

Global Update

AIDS: Panel Warns That Without New Direction, Epidemic Will Remain Out of Control at 50

By DONALD G. McNEIL Jr.

Unless there is a drastic change in approach, the AIDS epidemic will still be out of control on its 50th anniversary in 2031, a panel of AIDS experts predicted in an analysis being published Tuesday in the journal *Health Affairs*.

The lead author, Robert Hecht, an economist and former policymaker at the United Nations and the International AIDS Vaccine Initiative, predicted that by that time, poor countries would need \$35 billion a year - three times what is spent now - to treat AIDS patients, care for orphans and do prevention work.

Even under the best case foreseen by the panel, more than one million people would be newly infected each year. (About 2.3 million were infected in 2007.) Achieving that outcome would cost \$722 billion over 22 years, or nearly \$8,000 for each infection prevented. (Condoms are cheap, but the price includes drugs that lower viral levels and prevent mother-to-child transmission.)

Their economic models assumed that condoms, drugs and circumcision would become widespread but that a microbicide and a vaccine would not.

Rapidly developing countries like Brazil, China, India, Mexico and Russia should be able to pay for fighting their own relatively small epidemics, the authors said. Southern African countries will need only some help, despite having the world's highest AIDS rates. But much of Africa, and especially Kenya, Mozambique, Uganda and Zambia, will remain heavily dependent on donors.

Given the economic crisis, rich countries may come up with only 30 percent of what is needed; they come up with 43 percent now. "We're staring at the face of a huge crisis," Mr. Hecht said.

Really?

The Claim: A Person Can Pay Off a Sleep Debt by Sleeping Late on Weekends

By ANAHAD O'CONNOR

THE FACTS Chronic sleep deprivation is a given for most Americans. But paying off a sleep debt is not as simple as sleeping late on a Saturday.

In studies over the years, scientists have found that it can take a week or more for the cognitive and physiological consequences of poor sleep to wear off - even after increasing sleep.

In a study at the Walter Reed Army Institute of Research in 2003, for example, scientists examined the cognitive effects of a week of poor sleep, followed by three days of sleeping at least eight hours a night. The scientists found that the "recovery" sleep did not fully reverse declines in performance on a test of reaction times and other psychomotor tasks, especially for subjects who had been forced to sleep only three or five hours a night.

In a similar study in 2008, scientists at the Karolinska Institute in Stockholm found that when subjects slept four hours a night over five days, and then "recovered" with eight hours a night over the following week, they still showed slight residual cognitive impairments a week later, even though they reported no sleepiness.

But in another study, also at the Walter Reed Army Institute of Research, scientists found that people recovered much more quickly from a week of poor sleep when it was preceded by a "banking" week that included nights with 10 hours of shuteye. In other words, if you know you have a week of little sleep ahead of you, try loading up on sleep beforehand, not simply afterward.

THE BOTTOM LINE It takes more than a night of extra sleep to pay off a sleep debt.

Sleep apnea therapy improves golf game

Men find new motivation for using CPAP

Golfers who undergo treatment for sleep apnea may improve their golf game as well as their overall health, shows new research. A new study presented at CHEST 2009, the 75th annual international scientific assembly of the American College of Chest Physicians (ACCP), found that golfers with obstructive sleep apnea (OSA) who received nasal positive airway pressure (NPAP) for their disorder improved their daytime sleepiness scores and lowered their golf handicap by as much as three strokes. Researchers suggest that the possibility of improving your golf game may be a significant motivator to improve NPAP compliance rates among golfers.

"More so than many sports, golf has a strong intellectual component, with on-course strategizing, focus, and endurance being integral components to achieving good play," said Marc L. Benton, MD, FCCP, Atlantic Sleep and Pulmonary Associates, Madison, NJ. "OSAS can lead to daytime sleepiness, fatigue, and cognitive impairment, all side effects which can negatively impact a person's ability to golf to the best of one's ability."

Dr. Benton and colleague Neil S. Friedman, RN, RPSGT, from Morristown Memorial Hospital, Madison, NJ, evaluated the impact of NPAP on the golf handicap index (HI) of 12 golfers with diagnosed moderate to severe OSA. HI was recorded upon study entry, as was the Epworth sleepiness scale (ESS), a validated questionnaire

used to assess daytime sleepiness, and a sleep questionnaire (SQ) developed by the authors. After 20 rounds of golf while receiving NPAP treatment (approximately 3 to 5 months), the treatment group demonstrated a significant drop in average HI, 12.4 (+/- 3.5) to 11.0 (+/- 4.7). Patients in the study group also improved their ESS score, 11.8 (+/- 6.6) to 5.5 (+/- 3.6), and the SQ score, 14.3 (+/- 7.5), to 3.1 (+/- 3.1). A control group of 12 subjects demonstrated no change in HI, ESS score, or SQ score during this study.

"As any golfer knows, when your ability to think clearly or make good decisions is compromised, the likelihood of playing your best is greatly diminished," said Dr. Benton. "Through treatment with NPAP, we can improve many cognitive metrics, such as attention span, memory, decision-making abilities, and frustration management, which may, in turn, positively affect a person's golf game."

Results of the study also showed that the best golfers, defined as HI <12, had the biggest improvements in their game. Within this group, the average HI dropped from 9.2 (+/- 2.9) to 6.3 (+/- 3.0); the SQ score from 10.8 (+/- 1.9), to 2.8 (+/- 2.6).

"The biggest handicap improvements occurred in the lower handicap, often older golfers. This group typically would be expected to trend in the opposite direction due to age-related deterioration in strength and endurance," said Mr. Friedman. "The drop in handicap among the better golfers probably reflected that the major limiting factor was not golf skill but cognitive compromise that improved when the sleep apnea was treated."

Dr. Benton estimates that there are 1 to 3 million regular golfers (regular defined as 10 or more rounds per year) who have OSA, and most are undiagnosed or untreated. However, even when proper treatment is offered, it is only effective if it is used regularly. In men, studies have reported compliance rates as low as 40 percent. Patients cite many reasons for noncompliance with NPAP, including discomfort, inconvenience, cost, noise, or embarrassment. In the current study, nearly all patients in the treatment group had a compliance rate of above 90 percent.

"Providers typically attempt to maximize compliance with NPAP by promoting its medical benefits or warning patients of the risks involved in not being treated, but this approach does not always work," said Dr. Benton. "In the case of this study, the possibility of improving one's ability to play golf appears to have been a significant motivation to improve treatment compliance."

"Compliance with CPAP therapy is an ongoing issue in the treatment of patients with sleep apnea," said Kalpalatha Guntupalli, MD, FCCP, President of the American College of Chest Physicians. "Finding new and more effective ways to increase CPAP compliance based on individual motivations is definitely encouraged."

The entwined destinies of mankind and leprosy bacteria

For thousands of years an undesirable and persistent companion has been travelling with man wherever he goes. Mycobacterium leprae, the bacterium that causes leprosy, has only one known natural host - mankind. And because of man's many travels, this bacillus has colonized the entire earth. Its history is therefore intimately tied to our own, and it is this migratory relationship that Stewart Cole, EPFL professor of Microbial Pathogenesis, and his team have analyzed in a study to be published in Nature Genetics. Geneticists, microbiologists, and even archeologists have followed the bacteria's traces from their lab to the Silk Road and the tombs of Egyptian mummies.

The scientists started with the past history of the disease by investigating the remains of English, Croatian, and Bulgarian medieval cemeteries along with an ancient Egyptian burial site to find traces of the bacteria's DNA. "A person infected with the bacteria shows specific signs of bone deformations, like hands gripped closed in the form of a claw," explains Stewart Cole, "and these clues helped us determine if we were dealing with the bodies of people who died from the disease."

In the wake of commercial ships

Even though Egypt is geographically close to East Africa, where one of the four strains of leprosy comes from, DNA from a 4th century mummy shows traces of the European strain. Not necessarily surprising, for the Pharaonic Empire was economically and culturally tied to the old continent. With humans being the only possible vessel for the bacteria, it naturally navigated along with man throughout the trade routes of the seas.

The four strains of the leprosy bacilli that the scientific team found are: European, East African, West African and Indian. Their current distribution around the world echoes the history of population movements. Other examples in the study include Madagascar where, in spite of its geographic proximity to the African coast, the Indian strain is found on the island, where the majority of the inhabitants are of Indian origin. In Brazil, the West African strain is dominant, a probable consequence of the slave trade, but we also find the European strain - brought most likely from colonization.

"One of the most interesting surprises is the discovery that the bacteria found in China are of European origin," explains Stewart Cole, "and one would have naturally expected the Indian strain. The most probable explanation is that the strain was carried by traders along the Silk Road."

A stable DNA, more efficient treatments

There is little doubt that the bacillus originated in East Africa - Stewart Cole will examine this hypothesis in a future study - and then mutated into the four different strains. "The results of our analysis are surprising," says Cole, "the difference between the different strains is very small. It is one of the most stable organisms ever observed, even if half of its genome is dead." There are only around a hundred different variations between the DNA of two different strains, whereas with HIV or the flu there may be thousands of difference mutations.

In the case of HIV, mutations are so frequent that it is almost possible to say whether a person was infected in Geneva or in Lausanne," explains Stewart Cole, "but in the case of leprosy, the most we can do is place the infection on a continental scale." But this is not bad news. Frequent mutation by a bacterium often leads to disturbing resistances to antibiotic treatments, such as with tuberculosis. But a more stable bacillus responds more efficiently to treatment regardless of the strain. "Resistant cases are extremely rare for leprosy."

Yet the disease remains a persistent public health issue in certain regions in India and Brazil. Currently, more than 700,000 people are infected world-wide and the length of treatment of at least one year can complicate its application. We have not yet heard the last from *Mycobacterium leprae*, but public health politics, spurred on by work done by the likes of Stewart Cole and his scientific team, could put an end to the common history between leprosy and its unwilling human host.

Sneezing in times of a flu pandemic

The swine flu (H1N1) pandemic has received extensive media coverage this year. The World Health Organization, in addition to providing frequent updates about cases of infection and death tolls, recommends hyper vigilance in daily hygiene such as frequent hand washing or sneezing into the crook of our arms. News reports at all levels, from local school closures to airport screenings and global disease surveillance, continue to remind us of the high risk.

In times of heightened health concerns, everyday behaviors like sneezing can serve as a reminder to wash our hands or take our vitamins. But, what if we overreact to everyday sneezes and coughs and sniffles? Can these signals transform healthy discretion into an unreasonable fearfulness about germs and more?

New research, forthcoming in *Psychological Science*, a journal of the Association for Psychological Science, from University of Michigan psychologists, Spike Lee and Norbert Schwarz, tested whether a heightened perception of risk for a flu pandemic might unconsciously trigger fears of other, totally unrelated hazards.

To test this, the researchers stationed an experimenter in a busy campus building and instructed her to sneeze loudly as students passed. The researchers then administered a survey to some of the students asking them to indicate their perceived risk of an "average American" contracting a serious disease, having a heart attack before age 50, or dying from a crime or accident.

The researchers found that those who had just witnessed someone sneezing perceived a greater chance of falling ill. They also indicated an increased fear of dying of a heart attack before age 50, dying in an accident or as a result of a crime. The researchers suggest that the public sneeze triggered a broad fear of all health threats, even ones that couldn't possibly be linked to germs.

The researchers then asked the same people their views on the country's existing health care system. Those within hearing distance of the sneezing actor had far more negative views of health care in America.

This finding was so striking that the psychologists ran another version of the sneezing scenario at a mall. This time, the interviewer himself sneezed and coughed while conducting a survey on federal budget priorities (i.e., should the government spend money on vaccine production or on green jobs?).

Participants were more likely to favor federal spending of \$1.3 billion on the production of flu vaccines rather than the creation of green jobs when the experimenter sneezed. Thus, in times of a flu pandemic, "public sneezing has the power to shift policy preferences from other current priorities (i.e., green jobs) to the production of flu vaccines," says Schwarz.

Old drugs reveal surprising new tricks

* 10:24 02 November 2009 by **Bob Holmes**

USING a database of molecular interactions may help to prevent drugs' side effects by predicting how they will interact with the body's receptors. It might even suggest new target diseases for existing drugs.

Most drugs work by binding to a receptor or other molecule on cells, triggering a biochemical change. But many bind to other receptors too, producing side effects that only show up after tests in animals or people.

Thinking about how to predict these unintended targets, Brian Shoichet, a computational chemist at the University of California, San Francisco, and colleagues reasoned that if a drug's shape resembles that of another molecule known to bind to a certain target, then the drug may bind to that target too.

Potential targets

Using published databases of interactions between small molecules, or "ligands", and potential targets, they used software to search for similarities in chemical structure between ligands and 3665 drugs either in use or under development. This yielded a list of nearly 4000 previously unknown potential targets.

Some of these new targets might explain known side effects. The software predicted that the anti-nausea drug domperidone should also bind to a receptor that contributes to cardiac arrhythmia - one of the drug's side effects. Others point to new uses: the antihistamine mebhydrolin should block a receptor involved in Alzheimer's disease. Experiments are still needed to prove that these drugs really do bind to the predicted targets, and that this has a biological effect.

The approach provides a way to identify potential targets, and might help drug designers find drugs that hit several targets at once, says Andrew Hopkins, a pharmacologist at the University of Dundee, UK. "It is often by not being selective that drugs exert their effects." *Journal reference: Nature, DOI: 10.1038/nature08506*

Microbes' globe-trotting has made them less diverse

* 02 November 2009 by Linda Geddes

THERE are more microbes on Earth than there are stars in the universe. They occupy every ecological niche, from deep-sea vents to the human gut. So you'd expect them to be staggeringly diverse. But the latest studies suggest there may be far less variation than thought.

David Wilkinson of Liverpool John Moores University in the UK says the diversity of microbes depends on the ease with which they are transported across geographical boundaries. "One of the reasons why there are so many species of big things is because of geographical isolation," he says. "But if you have widespread dispersal, one would guess that there would be fewer species."

To see how widely microbes could be dispersed, Wilkinson's team used computer models designed for studying the dispersal of dust particles. They modified the particles to be more like microbes - which tend to be bigger but less dense - and looked at what would happen if such particles were released from the southern tip of South America.

To their surprise, they found that airborne microbes smaller than 20 micrometres in diameter could travel thousands of kilometres. Microbes less than 9 micrometres across went as far as Australia. These would include the majority of fungal spores and bacteria, and some amoebae. "Once airborne, microbes of 20 micrometres and below can easily get everywhere," says Wilkinson, who presented the findings at a recent meeting of the British Ecological Society in Hatfield, UK.

"This study has important implications for estimates of the total biodiversity of free-living micro-organisms," says Thierry Heger of the Swiss Federal Research Institute in Lausanne, Switzerland. The fact that microbes can travel huge distances makes it less likely that there are large numbers of endemic species, Heger says.

Heger's recent work supports this idea. He has been studying the biodiversity of amoebae on the remote Amsterdam Island in the Indian Ocean, which might be expected to harbour a host of unique microbe species, just as the Galapagos Islands support unique species of animals and birds. "Although Amsterdam Island is among the most remote islands in the world, there is no clear evidence for endemism [amongst amoebae]," he says (*Journal of Biogeography*, DOI: 10.1111/j.1365-2699.2009.02094).

Wilkinson's work may help us to understand how diseases spread. Most microbes carried by wind are likely to be harmless, but outbreaks of certain diseases, such as meningitis in the Sahel region of north Africa, and coral fan disease, have been linked to dust storms. Another recent study suggests that many more pathogens can be blown long distances with dust, which could protect them against UV radiation, desiccation and extreme heat.

Paraskevi Polymenakou of the Hellenic Centre for Marine Research-Crete in Heraklion, Greece, and her colleagues analysed the DNA content of air on Crete, in the eastern Mediterranean, during a Saharan dust storm. They found DNA from a broad range of bacteria associated with small dust particles that could easily be inhaled. These included relatives of human pathogens linked to pneumonia, meningitis, septic shock and inflammation of the heart (*Environmental Health Perspectives*, DOI: 10.1289/ehp.10684).

"Dust storms may be associated with more diseases than we once thought," says Polymenakou. They will also become more frequent, she adds, as climate change increases desertification.

'Ultra-primitive' particles found in comet dust

Washington, D.C. - Dust samples collected by high-flying aircraft in the upper atmosphere have yielded an unexpectedly rich trove of relicts from the ancient cosmos, report scientists from the Carnegie Institution. The stratospheric dust includes minute grains that likely formed inside stars that lived and died long before the birth of our sun, as well as material from molecular clouds in interstellar space. This "ultra-primitive" material likely wafted into the atmosphere after the Earth passed through the trail of an Earth-crossing comet in 2003, giving scientists a rare opportunity to study cometary dust in the laboratory.

At high altitudes, most dust in the atmosphere comes from space, rather than the Earth's surface. Thousands of tons of interplanetary dust particles (IDPs) enter the atmosphere each year. "We've known that many IDPs come from comets, but we've never been able to definitively tie a single IDP to a particular comet," says study coauthor Larry Nittler, of Carnegie's Department of Terrestrial Magnetism. "The only known cometary samples we've studied in the laboratory are those that were returned from comet 81P/Wild 2 by the Stardust mission." The Stardust mission used a NASA-launched spacecraft to collect samples of comet dust, returning to Earth in 2006.

Comets are thought to be repositories of primitive, unaltered matter left over from the formation of the solar system. Material held for eons in cometary ice has largely escaped the heating and chemical processing that has affected other bodies, such as the planets. However, the Wild 2 dust returned by the Stardust mission included more altered material than expected, indicating that not all cometary material is highly primitive.

The IDPs used in the current study were collected by NASA aircraft in April 2003, after the Earth passed through the dust trail of comet Gregg-Skjellerup. The research team, which included Carnegie scientists Nittler, Henner Busemann (now at the University of Manchester, U.K.), Ann Nguyen, George Cody, and seven other colleagues, analyzed a sub-sample of the dust to determine the chemical, isotopic and microstructural composition of its grains. The results are reported on-line in *Earth and Planetary Science Letters*.*

"What we found is that they are very different from typical IDPs" says Nittler. "They are more primitive, with higher abundances of material whose origin predates the formation of the solar system." The distinctiveness of the particles, plus the timing of their collection after the Earth's passing through the comet trail, point to their source being the Gregg-Skjellerup comet.

"This is exciting because it allows us to compare on a microscopic scale in the laboratory dust particles from different comets," says Nittler. "We can use them as tracers for different processes that occurred in the solar system four-and-a-half billion years ago."

The biggest surprise for the researchers was the abundance of so-called presolar grains in the dust sample. Presolar grains are tiny dust particles that formed in previous generations of stars and in supernova explosions before the formation of the solar system. Afterwards, they were trapped in our solar system as it was forming and are found today in meteorites and in IDPs. Presolar grains are identified by having extremely unusual isotopic compositions compared to anything else in the solar system. But presolar grains are generally extremely rare, with abundances of just a few parts per million in even the most primitive meteorites, and a few hundred parts per million in IDPs. "In the IDPs associated with comet Gregg-Skjellerup they are up to the percent level," says Nittler. "This is tens of times higher abundances than we see in other primitive materials."

Also surprising is the comparison with the samples from Wild 2 collected by the Stardust mission. "Our samples seem to be much more primitive, much less processed, than the samples from Wild 2," says Nittler, "which might indicate that there is a huge diversity in the degree of processing of materials in different comets."

This work was supported by NASA's Cosmochemistry (NNG004GF61G) and Origins of the Solar System (NNX07AJ71G) programs, the NASA Astrobiology Institute (NAI), the Office of Naval Research and the Office of Basic Energy Sciences of the U.S. Department of Energy under Contract No. DE-AC02-05CH11231. The NASA Astromaterials Acquisition and Curation Office provided the IDPs for the research.

**Busemann, H., et al., Ultra-primitive interplanetary dust particles from the comet 26P/Grigg - Skjellerup dust stream collection, *Earth Planet. Sci. Lett.* (2009), doi:10.1016/j.epsl.2009.09.007*

There's a speed limit to the pace of evolution, Penn biologists say

PHILADELPHIA - Researchers at the University of Pennsylvania have developed a theoretical model that informs the understanding of evolution and determines how quickly an organism will evolve using a catalogue of "evolutionary speed limits." The model provides quantitative predictions for the speed of evolution on various "fitness landscapes," the dynamic and varied conditions under which bacteria, viruses and even humans adapt.

A major conclusion of the work is that for some organisms, possibly including humans, continued evolution will not translate into ever-increasing fitness. Moreover, a population may accrue mutations at a constant rate - a pattern long considered the hallmark of "neutral" or non-Darwinian evolution - even when the mutations experience Darwinian selection.

While much is known about the qualitative aspects of evolutionary theory - that organisms mutate and these mutations are selected by the environment and are gradually absorbed by the entire population, very little is known about how, or how quickly, this is accomplished. Information on evolution between consecutive generations is hard to come by, and the lack of understanding has real-world implications. Public-health officials would have an easier time preparing targeted vaccinations, or combating drug resistance, if they understood the evolutionary speed limits on viruses and bacteria such as influenza and M. tuberculosis.

Penn researchers presented a theory of how the fitness of a population will increase over time, for a total of 14 types of underlying landscapes or "speed limits" that describe the consequences of available genetic mutations. These categories determine the speed and pattern of evolution, predicting how a population's overall fitness, and the number of accumulated beneficial mutations, are expected to increase over time.

Researchers compared the theory to the data from a two-decades study of *E. coli* to investigate how the bacterium evolves. Organisms of that simplicity and size reproduce more rapidly than larger species, providing 40,000 generations of data to study.

"We asked, quantitatively, how a population's fitness will increase over time as beneficial mutations accrue," said Joshua B. Plotkin, principal investigator and an assistant professor in the Department of Biology in Penn's School of Arts and Sciences. His research focuses on evolution at the molecular scale.

"This was an attempt to provide a theoretical framework for studying rates of molecular evolution," said first-author Sergey Kryazhimskiy, also of the Department of Biology. "We applied this theory to infer the underlying fitness landscape of bacteria, using data from a long-term bacterial experiment."

In some theoretically conceivable landscapes, fitness levels are expected to increase exponentially forever because of an inexhaustible supply of beneficial mutations. But in more realistic landscapes the rate of adaptive substitutions (mutations that improve an organism's fitness) eventually lose steam, resulting in sub-linear fitness growth. In some of these landscapes, the fitness eventually levels out and the organism ceases to adapt, even though mutations may continue to accrue.

E. coli, for example, has been observed to increase its rate of cellular division by roughly 40 percent during the course of 40,000 generations. Initially, the bacterial fitness increased rapidly, but eventually the fitness leveled out. These data have allowed the research team to infer that early mutations, while conferring large beneficial effects, also diminish the beneficial effects of subsequent mutations.

According to the study, a population's fitness and substitution trajectories - the mutations acquired to achieve higher fitness - depend not on the full distribution of fitness effects of available mutations but rather on the expected fixation probability and the expected fitness increment of mutations. This mathematical observation greatly simplifies the possible trajectories of evolution into 14 distinct categories.

Researchers demonstrated that linear substitution trajectories that signify a constant rate of accruing mutations, long considered the hallmark of neutral evolution, can arise even when mutations are strongly beneficial. The results provide a basis for understanding the dynamics of adaptation and for inferring properties of an organism's fitness landscape from long-term experimental data. Applying these methods to data from bacterial experiments allowed the researchers to characterize the evolutionary relationships among beneficial mutations in the *E. coli* genome.

The study, appearing in the current issue of the journal Proceedings of the National Academy of Sciences, was performed by Plotkin and Kryazhimskiy along with Gašper Tkacik of the Department of Physics and Astronomy at Penn.

The study was funded by the Burroughs Wellcome Fund, the David and Lucille Packard Foundation, the James S. McDonnell Foundation, the Alfred P. Sloan Foundation, a Defense Advanced Research Projects Agency grant and the National Science Foundation.

Humans are an acquired taste for lions

* 16:15 02 November 2009 **by Ewen Callaway**

When the food gets scarce, it's every lion for itself.

In 1898, according to numerous accounts and no fewer than three Hollywood movies, two male lions went on a nine-month killing spree around the Tsavo area of Kenya, devouring between 28 and 135 workers building the Kenya-Uganda railway.

Now an analysis of bone and hair samples from the notorious duo has backed the theory that scarcity drives dietary specialisation, and shows that food preferences can diverge within cooperating groups.

By comparing the isotopic ratios of nitrogen and carbon in the lions' remains with that of contemporary lions, humans and herbivore prey, Justin Yeakel of the University of California, Santa Cruz, estimates the lions ate around 35 people.

The study also made a surprise finding. "One lion was consuming a lot of humans, and one was not," Yeakel says. He attributes 24 deaths to one cat, or 30 per cent of its diet, and 11 deaths to the other, just 13 per cent of its food.

By the late 19th century, elephants in the area had been hunted away, causing grasslands to become overgrown woodlands and the number of ungulate prey to decline.

Most lions probably left the region, but two turned man-eaters, Yeakel speculates. "People are a dangerous food to go after," he says. "One lion was able to figure out how to do it and wasn't afraid, the other was not."

Journal reference: Proceedings of the National Academy of Sciences, DOI: 10.1073/pnas.0905309106

Researchers identify the three killer indicators that are even worse than high cholesterol

Researchers at the University of Warwick have identified a particular combination of health problems that can double the risk of heart attack and cause a three-fold increase in the risk of mortality.

The team, led by Assistant Clinical Professor of Public Health at Warwick Medical School Dr Oscar Franco, has discovered that simultaneously having obesity, high blood pressure and high blood sugar are the most dangerous combination of health factors when developing metabolic syndrome.

Metabolic syndrome is a combination of medical disorders that increase the risk of developing cardiovascular disease and diabetes.

The main five health problems normally associated with metabolic syndrome are abnormal levels of blood pressure, high cholesterol, high triglyceride levels (the chemical form in which fat exists in the body), too much sugar in the blood and central obesity (excess of fat around the waistline).

In his study, published in the American Heart Association journal *Circulation*, Dr Franco has identified the most dangerous combination of these conditions to be central obesity, high blood pressure and high blood sugar. People who have all three of these conditions are twice as likely to have a heart attack and three times more likely to die earlier than the general population.

His team looked at 3,078 people to track the prevalence and progress of Metabolic Syndrome as part of the Framingham Offspring Study.

He said: "Metabolic syndrome is a highly prevalent condition that is increasing dramatically and affects a large portion of the middle-age population. Not all individuals enter the syndrome with identical combination of factors. Certain combinations confer higher risks of incident cardiovascular disease and mortality."

Dr Franco said the combination of high blood pressure, central obesity and hyperglycemia (high blood sugar) showed a significantly higher risk compared to the others.

He added: "Intense efforts are needed to identify populations with these particular combinations and to provide them with adequate treatment at the early stages of disease."

Notes to editors The study, 'Trajectories of Entering the Metabolic Syndrome: the Framington Heart Study' is published online in *Circulation*. To speak to Dr Franco, please call him on 07545 003927. For more details, contact Kelly Parkes-Harrison, Communications Officer, University of Warwick, 02476 150483, 07824 540863, k.e.parkes@warwick.ac.uk

Atmospheric 'tides' trigger landslides at night

* 17:43 02 November 2009 by Shanta Barley

Tiny changes in atmospheric pressure between day and night can trigger landslides. The same phenomenon could be a final straw that sets off earthquakes and volcanic eruptions waiting to happen.

For the past four years, William Schulz at the United States Geological Survey in Denver, Colorado, and his colleagues have been studying the movement of an enormous ongoing landslide in south-west Colorado called Slumgullion - so called because the yellowish soil reminded early European settlers of the eponymous stew.

The landslide has been continually slipping for 700 years and contains over 20 million cubic metres of material. It is moving down the mountain at an average rate of 1 centimetre per day for most of the year.

Daily cycle

To investigate what is causing Slumgullion to slide, aside from gravity, Schulz's team measured its movement hour by hour with paired spools of wire that unwind when moved apart. They also mapped the daily cycle of atmospheric pressure "tides" over the landslide. Atmospheric tides are small variations in pressure that occur as air warms during the day.

Schulz found that the landslide's movement was not continuous but closely correlated with atmospheric tides. "The landslide mainly moves when the pressure drops [at night]," says Schulz.

Upward friction

Landslides are usually triggered by rain or snowmelt flowing into the base of a "slump" of loose rock and soil.

Schulz and his colleagues suspect that an atmospheric low tide releases a tiny amount of pressure on the air and water in the soil at the surface. As a result, fluids deeper in the soil move up towards this region of lower pressure. "This upward movement pulls the soil structure upward, thereby reducing the frictional strength along the base of the landslide, which is essentially a solid block sliding on a surface," says Schulz. "The reduced frictional strength is sufficient to trigger landslide movement."

"This is the first time that such an effect has been noted," says David Petley, who researches landslide mechanics and hazards at Durham University, UK.

The research suggests that certain storms may have unexpectedly dangerous effects, says Petley. The rapid pressure variations associated with fast-moving storm systems such as the typhoon crossing the Philippines right now may be triggering landslides, he says.

Last straws

Schulz says that atmospheric shifts could also trigger earthquakes and volcanic eruptions that are already about to go off, he says.

Previous research by Chi-Ching Liu of the Academia Sinica in Taipei, Taiwan, has linked the passage of typhoons with the triggering of "slow" earthquakes.

Slumgullion itself is unlikely to pose a threat. "There's a state highway around 100 metres below the landslide," says Schulz. "At the rate the landslide's moving it'll only reach it in 200 years."

Journal reference: Nature Geosciences, DOI: 10.1038/ngeo659

Premature Births Are Fueling Higher Rates of Infant Mortality in U.S., Report Says **By DENISE GRADY**

High rates of premature birth are the main reason the United States has higher infant mortality than do many other rich countries, government researchers reported Tuesday in their first detailed analysis of a longstanding problem.

In Sweden, for instance, 6.3 percent of births were premature, compared with 12.4 percent in the United States in 2005, the latest year for which international rankings are available. Infant mortality also differed markedly: for every 1,000 births in the United States, 6.9 infants died before they turned 1, compared with 2.4 in Sweden. Twenty-nine other countries also had lower rates.

If the United States could match Sweden's prematurity rate, the new report said, "nearly 8,000 infant deaths would be averted each year, and the U.S. infant mortality rate would be one-third lower."

The first author of the report, Marian F. MacDorman, a statistician at the National Center for Health Statistics, said in an interview that the strong role prematurity played came as a surprise to her.

Dr. Alan R. Fleischman, medical director for the March of Dimes, said the new report was "an indictment of the U.S. health care system" and the poor job it had done in taking care of women and children. The report, Dr. Fleischman added, "puts together two very important issues, both of which we knew about but hadn't linked tightly."

Infant mortality is widely used as a way to gauge the health of a nation, and the relatively high rates in the United States have long dismayed health officials. Most European countries - as well as Australia, Canada, Hong Kong, Israel, Japan, New Zealand and Singapore - have lower rates of infant death than the United States.

Premature infants in the United States are more likely to survive than those elsewhere. Yet they are still more likely to die than full-term babies, and the sheer numbers born prematurely in the United States - more than 540,000 per year - drive up infant mortality.

The high levels of prematurity in the United States have various causes.

Dr. Fleischman said the smallest, earliest and most fragile babies were often born to poor and minority women who lacked health care and social support. The highest rates of infant mortality occur in non-Hispanic black, American Indian, Alaska Native and Puerto Rican women. But other minorities have some of the lowest infant mortality rates in the United States: Asian and Pacific Islanders, Central and South Americans, Mexicans and Cubans.

When it comes to prematurity, infertility treatments - drugs that stimulate ovulation and procedures that implant more than one embryo in the uterus - also play a role by raising the odds of twins or higher multiples, which have an increased risk of being born too soon.

Professional groups for fertility doctors recommend limiting the number of embryos transferred to avoid multiple births, but ultimately doctors and patients make their own decisions. Dr. MacDorman said that because most insurance in the United States did not cover infertility treatments, some patients chose to transfer multiple eggs in hopes that doing so would increase the odds of pregnancy and reduce expensive procedures.

"In Europe, they may have been more successful in limiting the number of embryos transferred," Dr. MacDorman said, "because there is more national health insurance and people don't have to pay out of pocket."

Another factor in the United States, she said, is the increasing use of Caesarean sections and labor-inducing drugs to deliver babies early. The American College of Obstetricians and Gynecologists has guidelines stating that babies should not be delivered before 39 weeks without a medical reason, but doctors may be declaring a medical need more quickly than they did in the past.

"I don't think there are doctors doing preterm Caesarean sections or inductions without some indications," Dr. MacDorman said, "but there sort of has been this shift in the culture. Fifteen or 20 years ago, if a woman had high blood pressure or diabetes, she would be put in the hospital, and they would try to wait it out. It was called expectant management. "Now I think there's more of a tendency to take the baby out early if there's any question at all."

These births - called "late preterm," which occur after 34 to 37 weeks of pregnancy, instead of the normal 38 to 42 weeks - are the fastest-growing subgroup of premature births. A late preterm baby's risk of dying is about

three times that of a full-term infant. But late preterm babies are still far more likely to survive than very premature ones, and the very early babies account for much of the death rate, Dr. Fleischman said.

Taking care of women's illnesses and problems like drinking, drug use and smoking before and during pregnancy can help prevent prematurity, he said, adding that a state program in Kentucky to provide home visits by nurses to poor women during pregnancy had decreased preterm births.

Dr. MacDorman said prematurity was not the only factor behind infant mortality in the United States. She said full-term babies in this country also had higher death rates than those in Europe from sudden infant death syndrome, accidents, assaults and homicides.

Personal Health

A Breathing Technique Offers Help for People With Asthma

By JANE E. BRODY

I don't often write about alternative remedies for serious medical conditions. Most have little more than anecdotal support, and few have been found effective in well-designed clinical trials. Such trials randomly assign patients to one of two or more treatments and, wherever possible, assess the results without telling either the patients or evaluators who received which treatment.

Now, however, in describing an alternative treatment for asthma that does not yet have top clinical ratings in this country (although it is taught in Russian medical schools and covered by insurance in Australia), I am going beyond my usually stringent research criteria for three reasons:

¶ The treatment, a breathing technique discovered half a century ago, is harmless if practiced as directed with a well-trained therapist.

¶ It has the potential to improve the health and quality of life of many people with asthma, while saving health care dollars.

¶ I've seen it work miraculously well for a friend who had little choice but to stop using the steroid medications that were keeping him alive.

My friend, David Wiebe, 58, of Woodstock, N.Y., is a well-known maker of violins and cellos, with a 48-year history of severe asthma that was treated with bronchodilators and steroids for two decades. Ten years ago, Mr. Wiebe noticed gradually worsening vision problems, eventually diagnosed as a form of macular degeneration caused by the steroids. Two leading retina specialists told him to stop using the drugs if he wanted to preserve his sight.

He did, and endured several terrifying trips to the emergency room when asthma attacks raged out of control and forced him to resume steroids temporarily to stay alive.

Nothing else he tried seemed to work. "After having a really poor couple of years with significantly reduced quality of life and performance at work," he told me, "I was ready to give up my eyesight and go back on steroids just so I could breathe better."

Treatment From the '50s

Then, last spring, someone told him about the Buteyko method, a shallow-breathing technique developed in 1952 by a Russian doctor, Konstantin Buteyko. Mr. Wiebe watched a video demonstration on YouTube and mimicked the instructions shown.

"I could actually feel my airways relax and open," he recalled. "This was impressive. Two of the participants on the video were basically incapacitated by their asthma and on disability leave from their jobs. They each admitted that keeping up with the exercises was difficult but said they had been able to cut back on their medications by about 75 percent and their quality of life was gradually returning."

A further search uncovered the Buteyko Center USA in his hometown, newly established as the official North American representative of the Buteyko Clinic in Moscow.

"When I came to the center, I was without hope," Mr. Wiebe said. "I was using my rescue inhaler 20 or more times in a 24-hour period. If I was exposed to any kind of irritant or allergen, I could easily get a reaction that jeopardized my existence and forced me to go back on steroids to save my life. I was a mess."

But three months later, after a series of lessons and refresher sessions in shallow breathing, he said, "I am using less than one puff of the inhaler each day - no drugs, just breathing exercises."

Mr. Wiebe doesn't claim to be cured, though he believes this could eventually happen if he remains diligent about the exercises. But he said: "My quality of life has improved beyond my expectations. It's very exciting and amazing. More people should know about this."

Ordinarily, during an asthma attack, people panic and breathe quickly and as deeply as they can, blowing off more and more carbon dioxide. Breathing rate is controlled not by the amount of oxygen in the blood but by the amount of carbon dioxide, the gas that regulates the acid-base level of the blood.

Dr. Buteyko concluded that hyperventilation - breathing too fast and too deeply - could be the underlying cause of asthma, making it worse by lowering the level of carbon dioxide in the blood so much that the airways constrict to conserve it.

This technique may seem counterintuitive: when short of breath or overly stressed, instead of taking a deep breath, the Buteyko method instructs people to breathe shallowly and slowly through the nose, breaking the vicious cycle of rapid, gasping breaths, airway constriction and increased wheezing.

The shallow breathing aspect intrigued me because I had discovered its benefits during my daily lap swims. I noticed that swimmers who had to stop to catch their breath after a few lengths of the pool were taking deep breaths every other stroke, whereas I take in small puffs of air after several strokes and can go indefinitely without becoming winded.

The Buteyko practitioners in Woodstock, Sasha and Thomas Yakovlev-Fredricksen, were trained in Moscow by Dr. Andrey Novozhilov, a Buteyko disciple. Their treatment involves two courses of five sessions each: one in breathing technique and the other in lifestyle management. The breathing exercises gradually enable clients to lengthen the time between breaths. Mr. Wiebe, for example, can now take a breath after more than 10 seconds instead of just 2 while at rest.

Responses May Vary

His board-certified pulmonologist, Dr. Marie C. Lingat, told me: "Based on objective data, his breathing has improved since April even without steroids. The goal now is to make sure he maintains the improvement. The Buteyko method works for him, but that doesn't mean everyone who has asthma would respond in the same way."

In an interview, Mrs. Yakovlev-Fredricksen said: "People don't realize that too much air can be harmful to health. Almost every asthmatic breathes through his mouth and takes deep, forceful inhalations that trigger a bronchospasm," the hallmark of asthma.

"We teach them to inhale through the nose, even when they speak and when they sleep, so they don't lose too much carbon dioxide," she added.

At the Woodstock center, clients are also taught how to deal with stress and how to exercise without hyperventilating and to avoid foods that in some people can provoke an asthma attack.

The practitioners emphasize that Buteyko clients are never told to stop their medications, though in controlled clinical trials in Australia and elsewhere, most have been able to reduce their dependence on drugs significantly. The various trials, including a British study of 384 patients, have found that, on average, those who are diligent about practicing Buteyko breathing can expect a 90 percent reduction in the use of rescue inhalers and a 50 percent reduction in the need for steroids within three to six months.

The British Thoracic Society has given the technique a "B" rating, meaning that positive results of the trials are likely to have come from the Buteyko method and not some other factor. Now, perhaps, it is time for the pharmaceutically supported American medical community to explore this nondrug technique as well.

Statins may worsen symptoms in some cardiac patients

Although statins are widely used to prevent heart attacks, strokes, and other cardiovascular disorders, new research shows that the class of drugs may actually have negative effects on some cardiac patients. A new study presented at CHEST 2009, the 75th annual international scientific assembly of the American College of Chest Physicians (ACCP), found that statins have beneficial effects on patients with systolic heart failure (SHF), but those with diastolic heart failure (DHF) experienced the opposite effect, including increased dyspnea, fatigue, and decreased exercise tolerance.

"Systolic heart failure is most often due to coronary artery disease and appears to have more of an inflammatory component than diastolic heart failure," said Lawrence P. Cahalin, PhD, PT, Northeastern University, Boston, MA. "It is possible that statins would help patients with systolic heart failure more than patients with diastolic heart failure due to the cholesterol-lowering and antiinflammatory effects of statins."

Researchers from Northeastern University and Massachusetts General Hospital, Boston, MA, retrospectively reviewed the charts of 136 patients with heart failure in order to examine the effect of statins on pulmonary function (PF) and exercise tolerance (ET) in patients with DHF vs. SHF. A non-statin group (82 percent of patients had DHF) of 75 patients was compared with a statin group (72 percent of patients had DHF) of 61 patients. Atorvastatin was prescribed in 75 percent of the patients on statins.

Results of the analysis showed that overall PF and ET of patients in the statin group were significantly lower than patients in the non-statin group. Further subgroup analyses revealed that PF measures in the DHF statin group were 12 percent lower than PF measures in the DHF non-statin group. Furthermore, the amount of

exercise performed by patients with DHF who were on a statin was almost 50 percent less than patients with DHF not on a statin.

"Some patients with diastolic heart failure may be more prone to the adverse effect of statins on muscle. It may be that patients with particular preexisting factors will experience unfavorable results from statin therapy, including exercise intolerance, dyspnea, and fatigue," said Dr. Cahalin.

Although the PF and ET measures in the SHF statin group were not significantly greater than in the SHF non-statin group, the PF measures were 11 percent to 14 percent higher, and the peak ET measures were 2 percent to 7 percent higher than the PF and ET measures of the SHF non-statin group, suggesting that statins did benefit patients with SHF.

"Not all statins are alike and not all patients are alike. Some statins are stronger than others and are likely to act differently, given particular patient characteristics, and produce different degrees of wanted and unwanted effects," said Dr. Cahalin. "In our continuing study, we hope to identify patient characteristics that are associated with favorable and less than favorable results from statin therapy."

Although the new data suggest that statins may actually worsen symptoms in patients with DHF, researchers feel that the benefits of using statins in patients with SHF and DHF outweigh the risks.

"Due to beneficial effects on lipids and other cardiovascular factors, statins are becoming a standard treatment for many patients with or without systolic or diastolic heart failure. It is likely that the use of statins for these conditions will continue to increase," said Dr. Cahalin. "However, if patients taking a statin are short of breath, fatigued, and unable to exercise or perform functional tasks, then exams of muscle strength and endurance, as well as pulmonary function and exercise tolerance, are warranted."

"Statins provide significant benefits for patients with cardiovascular disease, said Kalpalatha Guntupalli, MD, FCCP, President of the American College of Chest Physicians. "However, as for any new medication prescribed, clinicians should closely monitor the effects that different types of statins have on individual patients."

Statins may prevent blood clots in patients with cardiovascular disease

Statins may provide potentially life-saving benefits for patients with cardiovascular disease by helping reduce the incidence of blood clots. New research presented at CHEST 2009, the 75th annual international scientific assembly of the American College of Chest Physicians (ACCP), shows that patients with atherosclerosis receiving statin therapy had a significantly reduced risk of developing venous thromboembolism (VTE) - a collective term for DVT (blood clot) and pulmonary embolism (PE) - than patients not on statin therapy. Furthermore, patients on a higher dose of statins had the least likelihood of developing VTE.

"Research has indicated an association between atherosclerosis and venous thrombosis," said lead author Danai Khemasuwan, MD, Albert Einstein Medical Center, Philadelphia, PA. "However, in our study, statin therapy demonstrated a protective effect on this group of patients, reducing their overall incidence of developing VTE."

To investigate the association between statin use and incidence of VTE, researchers from Albert Einstein Medical Center reviewed the cases of 593 patients (mean age, 67.8 years) who were admitted to the hospital for myocardial infarction or ischemic stroke. Of the patients, 73 percent (N=433) were receiving statins, and the overall incidence of VTE was 13 percent (N=77).

Results of the analysis showed that patients in the nonstatin group were three times as likely to develop VTE than patients receiving statins, 26.3 percent vs. 8.3 percent, respectively. Even after controlling for factors related to VTE (smoking, history of cancer, and immobilization), statins use was still associated with a low risk of developing VTE. Furthermore, patients receiving high-dose statins (greater than 40 mg/day) showed a lower occurrence of VTE compared with patients receiving standard dose statins, suggesting a dose-related response between statins and VTE.

VTE is a potentially life-threatening condition that occurs in more than 2 million Americans each year. Patients most at risk for VTE are those with cancer, those who have recently had surgery, and patients who have experience acute trauma. Although the current analysis only included patients with atherosclerosis, previous research by Dr. Khemasuwan showed that statins had a similar effect on patients with cancer. The authors caution that it is still too early to speculate the effect that statins may have on other high-risk groups, like surgical patients.

"Venous thromboembolism leads to significant morbidity, mortality, and hospital costs in Americans each year," said Kalpalatha Guntupalli, MD, FCCP, President of the American College of Chest Physicians. "Although more research is needed, statins may prove effective in helping to reduce the incidence of VTE in specific patient populations."

Chinese challenge to 'out of Africa' theory

* 00:01 03 November 2009 by Phil McKenna

The discovery of an early human fossil in southern China may challenge the commonly held idea that modern humans originated out of Africa.



Chinese paleontologists claim this 110,000-year-old jawbone is from a Homo sapiens (Image: Institute of Vertebrate Palaeontology and Palaeoanthropology, Chinese Academy of Sciences)

Jin Changzhu and colleagues of the Institute of Vertebrate Palaeontology and Palaeoanthropology in Beijing, announced to Chinese media last week that they have uncovered a 110,000-year-old putative Homo sapiens jawbone from a cave in southern China's Guangxi province.

The mandible has a protruding chin like that of Homo sapiens, but the thickness of the jaw is indicative of more primitive hominins, suggesting that the fossil could derive from interbreeding.

If confirmed, the finding would lend support to the "multiregional hypothesis". This says that modern humans descend from Homo sapiens coming out of Africa who then interbred with more primitive humans on other continents. In contrast, the prevailing "out of Africa" hypothesis holds that modern humans are the direct descendants of people who spread out of Africa to other continents around 100,000 years ago.

The study will appear in Chinese Science Bulletin later this month.

Out of China?

"[This paper] acts to reject the theory that modern humans are of uniquely African origin and supports the notion that emerging African populations mixed with natives they encountered," says Milford Wolpoff, a proponent of the multiregional hypothesis at the University of Michigan.

Others disagreed. Erik Trinkaus, an anthropologist at Washington University in St Louis, Missouri, questioned whether the find was a true Homo sapiens.

"You need to keep in mind that 'Homo sapiens' for most Chinese scholars is not limited to anatomically modern humans," he says. "For many of them, it is all 'post Homo erectus,' humans."

Chris Stringer of London's Natural History Museum said that it was too early to make far-reaching conclusions. "From the parts preserved, this fossil could just as likely be related to preceding archaic humans, or even to the Neanderthals, who at times seem to have extended their range towards China."

The present analysis of the mandible focused almost exclusively on determining the fossil's age. The researchers said a follow-up study would give a more complete treatment on what exactly the find represents.

Report on H1N1 cases in California shows hospitalization can occur at all ages, with many severe

In contrast with some common perceptions regarding 2009 influenza A(H1N1) infections, an examination of cases in California indicates that hospitalization and death can occur at all ages, and about 30 percent of hospitalized cases have been severe enough to require treatment in an intensive care unit, according to a study in the November 4 issue of JAMA.

"Since April 17, 2009, when the first 2 cases of pandemic influenza A(H1N1) virus infection were reported in California, the virus has rapidly spread throughout the world," the authors write. They add that preliminary comparisons with seasonal influenza suggest that this influenza infection disproportionately affects younger ages and causes generally mild disease.

Janice K. Louie, M.D., M.P.H., of the California Department of Public Health, Richmond, Calif., and colleagues examined the clinical and epidemiologic features of the first 1,088 hospitalized and fatal cases due to pandemic 2009 influenza A(H1N1) infection reported in California, between April 23 and August 11, 2009. On April 20 of this year the California Department of Public Health and 61 local health departments initiated enhanced surveillance for hospitalized and fatal cases of this infection.

The researchers found that of the 1,088 A(H1N1) cases, 344 (32 percent) were children younger than 18 years, with infants having the highest rate of hospitalization and persons age 50 years or older having the highest rate of death once hospitalized. The median (midpoint) age of all cases was 27 years. Fever, cough, and shortness of breath were the most common symptoms. Underlying conditions previously associated with severe influenza were reported in 68 percent of cases. Other underlying medical illnesses recorded included obesity, hypertension, hyperlipidemia and gastrointestinal disease. The median length of hospitalization among all cases was 4 days.

Three hundred forty cases (31 percent) were admitted to intensive care units, and of the 297 intensive care cases with available information, 65 percent required mechanical ventilation. Of the 884 cases with available information, 79 percent received antiviral treatment, including 496 patients (71 percent) with established risk factors for severe influenza. Of the 833 patients who had chest radiographs, 66 percent had infiltrates (evidence

of infection involving the lungs), suggestive of pneumonia or acute respiratory distress syndrome. Rapid antigen tests were falsely negative in 34 percent of cases evaluated.

"Overall fatality was 11 percent (118/1,088) and was highest (18 percent - 20 percent) in persons aged 50 years or older," the researchers write. "Of the deaths, 8 (7 percent) were children younger than 18 years. Among fatal cases, the median time from onset of symptoms to death was 12 days." The most common causes of death were viral pneumonia and acute respiratory distress syndrome.

"In the first 16 weeks of the current pandemic, 2009 influenza A(H1N1) appears to be notably different from seasonal influenza, with fewer hospitalizations and fatalities occurring in elderly persons. In contrast with the common perception that pandemic 2009 influenza A(H1N1) infection causes only mild disease, hospitalization and death occurred at all ages, and up to 30 percent of hospitalized cases were severely ill. Most hospitalized cases had identifiable established risk factors; obesity may be a newly identified risk factor for fatal pandemic 2009 influenza A(H1N1) infection and merits further study."

"Clinicians should maintain a high level of suspicion for pandemic 2009 influenza A(H1N1) infection in patients presenting currently with influenza-like illness who are older than 50 years or have known risk factors for influenza complications, regardless of rapid test results. Hospitalized infected cases should be carefully monitored and treated promptly with antiviral agents," the authors conclude.

(JAMA. 2009;302[17]:1896-1902. Available pre-embargo to the media at www.jamamedia.org)

Animated ink-blot images keep unwanted bots at bay

* 12:50 03 November 2009 **by Colin Barras**

Captchas, the scrambled images used to separate humans from software bots online, could become harder for bots to solve – and easier for humans to handle – by animating them.

That is the claim of computer scientist Niloy Mitra at the Indian Institute of Technology Delhi, who along with colleagues has devised a system that should separate the bots from the humans.

With some captcha systems close to being cracked, website owners are having to make them ever more fiendish to thwart bots. That comes at a cost, however: it makes them difficult for humans to read too, says Mitra.

Working with Daniel Cohen-Or and others at Tel Aviv University, Israel, and colleagues from Taiwan, Mitra thinks he has found a way round that problem.

Can you guess what it is? To reveal the unscrambled image [click here](#)



Ink-blot tests

The team's new system uses so-called "emerging images" – seemingly random assortments of blotches from which a coherent image emerges after a few seconds (see image, above).

To produce the emerging image, they have developed an algorithm that identifies key features within an original image and converts them into an array of ink blots or "splats". It then removes a number of the splats to make it harder for bots to reconstruct the original shape – while leaving enough information for a human brain to do so.

The number of splats and the noise in the background can be tweaked to make the emerging image easier or harder to spot. Tests with 310 volunteers showed that 98 per cent could recognise over 80 per cent of the emerging images at the easy setting, taking 6.4 seconds on average to do so.

Tough for bots

With the same images, three state-of-the-art software systems managed to identify whether an image contained a horse or a human between 51 and 60 per cent of the time - only slightly better than random guessing.

As the images generated moved towards the "hard" end of the scale, even humans began to struggle. The success rate fell to 74 per cent and users took on average 12.5 seconds to find the hidden image – making them as frustrating as some existing captcha systems.

Pass rates

That could be a problem, says Luis von Ahn at Carnegie Mellon University in Pittsburgh, Pennsylvania, co-creator of the written captchas found on the web today. His ReCaptcha update to the technology was recently bought by Google.

"For ReCaptcha, it takes approximately 10 seconds for users to do the test, and over 96 per cent of all attempts made by humans are correctly answered," von Ahn says. "It's hard to beat that."

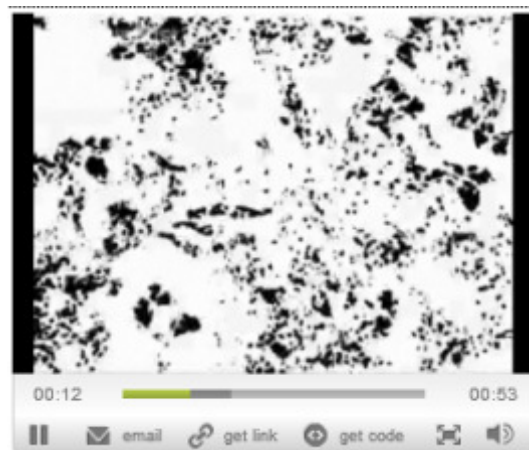
Adding a further element could make the emerging image system better yet, say Mitra and Cohen-Or. When they used their algorithm to convert 3D animations into emerging videos (see video above), they found that all

volunteers could spot the animated figure, even when the emergence setting was set to very hard. If shown a single frame from the video, under 10 per cent of volunteers could identify the image.

"When we add motion we win on two fronts," says Mitra. "Recognition becomes much easier for humans and much harder for bots." He says the team plans to analyse exactly how well the animations perform as a captcha system.

Picture perfect

Greg Mori at Simon Fraser University in Burnaby, British Columbia, Canada, sees Mitra and Cohen-Or's move towards animation as hugely promising. "Moving towards video-based captchas has a lot going for it," he says. "In fact, I am involved with a small start-up that is trying to do just that."



Video: [Animations stop bots](#)

Cohen-Or and Mitra will present their work at the SIGGRAPH Asia conference in Yokohama, Japan, in December.

Common Pain Relievers May Dilute Power of Flu Shots

With flu vaccination season in full swing, research from the University of Rochester Medical Center cautions that use of many common pain killers – Advil, Tylenol, aspirin – at the time of injection may blunt the effect of the shot and have a negative effect on the immune system.

Richard P. Phipps, Ph.D., professor of Environmental Medicine, Microbiology and Immunology, and of Pediatrics, has been studying this issue for years and recently presented his latest findings to an international conference on inflammatory diseases. (<http://bioactivelipidsconf.wayne.edu/>)

"What we've been saying all along, and continue to stress, is that it's probably not a good idea to take common, over-the-counter pain relievers for minor discomfort associated with vaccination," Phipps said. "We have studied this question using virus particles, live virus, and different kinds of pain relievers, in human blood samples and in mice - and all of our research shows that pain relievers interfere with the effect of the vaccine."

A study by researchers in the Czech Republic reported similar findings in the Oct. 17, 2009, edition of *The Lancet*. They found that giving acetaminophen, the active ingredient in Tylenol, to infants weakens the immune response to vaccines.

Phipps' research has tested whether production of antibodies using a cell culture system was blunted by over-the-counter pain relievers. He found that a variety of pain relievers – even though Tylenol and Advil have different ingredients - seemed to dilute the production of necessary antibodies to protect against illness.

Many of the pain relievers in question are classified as NSAIDs or nonsteroidal anti-inflammatory drugs, which act in part by blocking the cyclooxygenase-2 (cox-2) enzyme. Blocking the cox-2 enzyme is not a good idea in the context of vaccination, however, because the cox-2 enzyme is necessary for the optimal production of B-lymphocytes. Therefore, when a person takes a medication to reduce pain and fever, he or she might also inadvertently reduce the ability of B cells to make antibodies.

Phipps and colleagues also demonstrated that timing of the administration of pain relievers is important as well, according to the study published earlier this year in the journal *Cellular Immunology*

They exposed human cells and mice to ibuprofen, Tylenol, aspirin and naproxen (Aleve) in amounts comparable to doses commonly used by millions of Americans every day to prevent or treat pain and fever, or arthritis, or to prevent heart attack and stroke.

Treatment during the earliest stages of inflammation – or when the first signs of pain, swelling, redness or fever would occur – had the most detrimental effects on the immune system, the study noted.

The connection between NSAIDs and antibody production is still being actively pursued. Phipps said researchers believe ibuprofen, in particular, affects lymphocytes' ability to produce antibodies.

Meanwhile, until a full clinical trial provides a clearer picture, Phipps urges regular users of NSAIDs to be aware of the risks.

"NSAIDs are one of the most commonly used drugs; they are recommended for all age categories, are prescribed for relieving transient pain or in cases of serious inflammatory diseases," Phipps said. "By decreasing antibody synthesis, NSAIDs also have the ability to weaken the immune system which can have serious consequences for children, the elderly and the immune-compromised patients."

The U.S. Public Health Service has funded Phipps' studies.

URMC co-investigators on the study in Cellular Immunology include: David Topham, Ph.D., an expert in the immune response to influenza and a principal investigator in the David H. Smith Center for Vaccine Biology and Immunology, and Simona Bancos and Matthew P. Bernard, of the Department of Environmental Medicine, Lung Biology and Disease Program.

PMH finding may help some tonsil cancer patients avoid chemotherapy

Clinical researchers at Princess Margaret Hospital (PMH) have confirmed that patients with oropharyngeal squamous cell cancer ("tonsil cancer") harbour a common type of human papilloma virus (HPV16), but also that such cancers are very sensitive to radiation. For some patients, this may mean successful treatment with radiation alone and avoiding the side effects of chemotherapy.

"This represents the power of personalized medicine. By using a relatively simple molecular test to evaluate the tumour, we can customize the treatment plan, produce an excellent outcome, and maintain the patient's quality of life," says principal investigator Dr. Fei-Fei Liu, PMH radiation oncologist, Head of the Division of Applied Molecular Oncology, Ontario Cancer Institute, and Dr. Mariano Elia Chair in Head & Neck Cancer Research, University Health Network.

The findings were published on November 2 in the *Journal of Clinical Oncology* (JCO 231670).

Dr. Liu's team discovered that patients whose tumours tested positive for HPV16 had a much better survival, compared to patients whose tumours did not harbour HPV16. This HPV effect was independent of treatment (radiation alone, or radiation plus chemotherapy), suggesting that some HPV16 patients could be treated with radiation only. As a result, PMH now routinely tests tonsil-area tumours for HPV16 -- one of the first cancer programs to do so.

The study's finding is important because this particular type of cancer is increasing – up more than 10% in the past 20 years. The jump is likely attributed to the spread of HPV16 through sexual activity, compared with a 20% decline in other similar head-and-neck cancers over the same period because fewer people are now smoking.

Dr. Liu says the HPV vaccine currently available for teenagers targets the HPV16 strain. "Of course the goal is to prevent HPV infection in the first place, but for individuals who need treatment now, it's a major step to know that we could provide options so that some of our patients could be spared the often-difficult side effects of chemotherapy."

The research team analyzed tumour biopsies of 111 patients treated at PMH from 2003-2006, comparing clinical diagnosis, treatment plans, and outcomes. They found HPV16 in 60% of the samples, and determined that these patients experienced a much better survival, compared to the HPV-negative patients.

"We hope these findings will help other cancer programs manage their patients," says Dr. Brian O'Sullivan, Leader of the Head and Neck Program at Princess Margaret Hospital, Associate Director of the Radiation Medicine Program at PMH, and Bartley-Smith/Wharton Chair in Radiation Oncology.

This study was funded by the Ontario Institute for Cancer Research, Canadian Institutes of Health Research, and The Princess Margaret Hospital Foundation.

Fathers Gain Respect From Experts (and Mothers)

By LAURIE TARKAN

It used to irk Melissa Calapini when her 3-year-old daughter, Haley, hung around her father while he fixed his cars. Ms. Calapini thought there were more enriching things the little girl could be doing with her time.

But since the couple attended a parenting course - to save their relationship, which had become overwhelmed by arguments about rearing their children - Ms. Calapini has had a change of heart. Now she encourages the father-daughter car talk.

"Daddy's bonding time with his girls is working on cars," said Ms. Calapini, of Olivehurst, Calif. "He has his own way of communicating with them, and that's O.K."

As much as mothers want their partners to be involved with their children, experts say they often unintentionally discourage men from doing so. Because mothering is their realm, some women micromanage fathers and expect them to do things their way, said Marsha Kline Pruett, a professor at the Smith College School for Social Work at Smith College and a co-author of the new book "Partnership Parenting," with her husband, the child psychiatrist Dr. Kyle Pruett (Da Capo Press).

Yet a mother's support of the father turns out to be a critical factor in his involvement with their children, experts say - even when a couple is divorced.

"In the last 20 years, everyone's been talking about how important it is for fathers to be involved," said Sara S. McLanahan, a professor of sociology and public affairs at Princeton. "But now the idea is that the better the couple gets along, the better it is for the child."

Her research, part of a project based at Princeton and called the Fragile Families and Child Wellbeing Study, found that when couples scored high on positive relationship traits like willingness to compromise, expressing affection or love for their partner, encouraging or helping partners to do things that were important to them, and having an absence of insults and criticism, the father was significantly more likely to be engaged with his children.

Uninvolved fathers have long been accused of lacking motivation. But research shows that many societal obstacles conspire against them. Even as more fathers are changing diapers, dropping the children off at school and coaching soccer, they are often pushed aside in ways large and small.

“The walls in family resource centers are pink, there are women’s magazines in the waiting room, the mother’s name is on the files, and the home visitor asks for the mother if the father answers the door,” said Philip A. Cowan, an emeritus professor of psychology at the University of California, Berkeley, who along with his wife, Carolyn Pape Cowan, has conducted decades of research on families. “It’s like fathers are not there.”

In recent years, several fathers’ rights organizations have offered father-only parenting programs and groups, and studies have shown that these help men become more responsive and engaged with their children.

But a new randomized, controlled study conducted by the Pruetts and the Cowans found that the families did even better if mothers were brought into the picture.

In the study, low-income couples were randomly placed into a father-mother group, a father-only group and a control group of couples. The controls were given one information session; the other two groups met for 16 weeks at family resource centers in California, discussing various parental issues.

In both of those groups, the researchers found, the fathers not only spent more time with their children than the controls did but were also more active in the daily tasks of child-rearing. They became more emotionally involved with their children, and the children were much less aggressive, hyperactive, depressed or socially withdrawn than children of fathers in the control group.

But notably, the families in the couples group did best. They had less parental stress and more marital happiness than the other parents studied, suggesting that the critical difference was not greater involvement by the fathers in child-rearing but greater emotional support between couples.

“The study emphasizes the importance of couples’ figuring parenting out together and accepting the different ways of parenting,” Dr. Kline Pruett said. Fathers tend to do things differently, Dr. Kyle Pruett said, but not in ways that are worse for the children. Fathers do not mother, they father.

Dr. Kyle Pruett added: “Dads tend to discipline differently, use humor more and use play differently. Fathers want to show kids what’s going on outside their mother’s arms, to get their kids ready for the outside world.” To that end, he said, they tend to encourage risk-taking and problem-solving.

The study was financed by the California Office of Child Abuse Prevention, which is looking for ways to involve fathers more at the state’s many family resource centers. Experts say improving the way fathers are treated in many settings, public and private, is an important public health goal.

For example, they say, pictures of families on the walls of clinics and public agencies should have fathers in them. All correspondence should be addressed to both mother and father. Staff members should be welcoming to men. Steps like these promote early and lasting involvement by fathers.

“We want people to think about how positive father engagement in this co-parenting model would work in their foster care agency, local health clinic, pediatric office, adoption agency or school,” Dr. Kyle Pruett said. “That’s where an awful lot of the barriers are.”

At home, the experts recommend that couples keep talking about parenting issues and do their best to appreciate each other’s strengths. A recurring argument among couples is that each partner thinks he or she knows what is right; a mother may accuse the father of allowing too much television, while a father may tell a mother she isn’t strict enough with discipline.

“Instead, they should be saying, ‘How can each of us be the kind of parent that we are?’ ” Dr. Philip Cowan said. “I don’t think it’s abuse for a dad to sit with that little kid watching TV.”

These experts agree that parents should not focus solely on the children.

“Parents work all day, and feel as if they need to give every other minute to the kids,” Dr. Cowan said, “but if they don’t take care of the relationship between them, they’re not taking care of the whole story.”

Hydrogen Peroxide’s Link to Living Cells

By Carl Marziali on November 3, 2009 7:33 AM

If a circadian rhythm is like an orchestra - the united expression of the rhythms of millions of cells - a common chemical may serve as the conductor, or at least as the baton.

The chemical is hydrogen peroxide (H₂O₂), the active ingredient in color safe bleach. Produced in all animal cells, hydrogen peroxide may act as a signal for the active and resting phases of living things, new research by USC biologists suggests.

A study published in the journal PLoS ONE shows that hydrogen peroxide given to fruit flies has dramatic effects on their daily rhythms and activity levels. “H₂O₂ might be functioning as a systemic signal by which

rhythms are regulated within cells and between cells,” said lead author John Tower, associate professor in molecular and computational biology at USC College.

Most people are familiar with the concept of a circadian rhythm that governs sleeping and waking. But that is not the only circadian rhythm in the body. Many organs and tissues within the body have their own independent circadian rhythms, and they also interact to coordinate their rhythms.

Tower’s study suggests a link between metabolism - the production of energy by mitochondria, often described as the energy factories inside cells - and an animal’s daily rhythms. Mitochondria produce hydrogen peroxide as a by-product of oxygen combustion, making the chemical a candidate signal molecule.

“This is a logical way to connect rhythms to metabolism,” Tower said. “We know a lot about how circadian rhythms are regulated within certain cells. However, we have very little information on what signals coordinate circadian rhythms and how these rhythms are linked between metabolism and behavior.”

For the rhythms of even two cells to agree, some sort of signal has to pass between them.

Tower’s research group set out to find the signal by probing the action of an enzyme in mitochondria that converts toxic by-products of the body’s combustion process into hydrogen peroxide, itself a harmful but less toxic substance which other defenses later break down further.

Tower and his team had noticed that overexpression of the enzyme, known as superoxide dismutase (SOD), boosted the activity level of fruit flies and even increased the life span of certain genetically engineered strains.

Tower suspected that hydrogen peroxide was the key ingredient in SOD’s action.

“Hydrogen peroxide is a great candidate for a signaling molecule that would be involved in rhythms and behaviors. It’s the most stable and diffusible of the reactive oxygen species (by-products of combustion), but no one had demonstrated a role for it.”

As a test, Tower’s group administered hydrogen peroxide directly to fruit flies through feeding and injection.

The researchers observed similar effects from the direct administration of hydrogen peroxide and the over-expression of the SOD enzyme. Both strategies increased the activity levels of adult flies. Long-term direct treatment with hydrogen peroxide suppressed daily rhythms, while SOD over-expression altered those rhythms. Tower explained that he had not expected identical results from direct treatment versus genetic over-expression.

“I think it’s just a little too crude of an intervention, to feed them or inject them with the drug,” he said, because those effects will not be rhythmic, whereas production of hydrogen peroxide by the mitochondria and by SOD is expected to be rhythmic and to correspond to the rhythm of metabolism.

Still, the similarities in the flies’ reactions to direct treatment and to SOD over-expression suggested to the researchers that hydrogen peroxide is the crucial chemical.

“It’s a very exciting result for us that our data now start to point to hydrogen peroxide as perhaps being a relevant signaling molecule for coupling metabolism to behaviors and rhythms in the animal,” Tower said.

Hydrogen peroxide would govern rhythms inside each cell as well as between cells, Tower added.

Every cell alternates between a metabolic phase - in which it burns oxygen to make energy - and a detoxification phase in which the cell breaks down the harmful by-products of combustion.

Those rhythms must be coupled with the energy-producing activity of the mitochondria.

“Because hydrogen peroxide is produced by mitochondria as a product of metabolism, it’s a great candidate for a relevant signal that might be modulating these cellular rhythms,” Tower said.

Tower’s group was able to correlate fly activity and hydrogen peroxide concentration precisely through a unique three-dimensional movement tracking system developed by first author and doctoral student Dhruv Grover (<http://uscnews2.usc.edu/newstools/detail.php?recordnum=16087>).

Doctoral students Daniel Ford, Nicholas Hoe and Aysen Erdem and undergraduate Christopher Brown also contributed to the study. Simon Tavaré, professor of mathematics and molecular and computational biology at USC College, designed and supervised the statistical analyses.

Read the study at <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0007580>

Injected cells stop body from attacking self

* 18:24 03 November 2009 by **Jessica Hamzelou**

A virtually unlimited supply of rare cells can now be produced in the laboratory to fight diseases such as rheumatoid arthritis in mice. Crucially, these cells, which dampen down the body's immune response, have been engineered so that they target damaged tissue yet don't leave the rest of the body open to infection.

Vaccines have long harnessed the body's natural ability to fight disease. Therapies that boost our natural immune response to cancer are also in the works (see Autoimmune disease cells harnessed to fight cancer).

But in autoimmune disease – in which the immune system mistakenly attacks the body's own tissue – the opposite is needed. So immunologists have long eyed up the cells that dampen down the immune response,

known as regulatory T-cells or T-regs, for their potential to treat autoimmune disorders such as rheumatoid arthritis, diabetes and multiple sclerosis.

There have been two challenges: how to obtain large supplies of the rare T-regs, which make up less than 1 per cent of all immune cells, and how to neutralise dangerous immune cells without weakening the entire immune system, leaving people open to infection. Now Hans Stauss and his colleagues at University College London have made a stab at solving both.

Straight to the joint

The team starts by extracting ordinary T-cells – immune cells that are common in the blood – from mice and using a virus to insert two genes into these cells. One gene, FOXP3, transforms the ordinary T-cells into T-regs. The second gene codes for a receptor for a substance called ovalbumin.

Next the researchers injected ovalbumin into mice with rheumatoid arthritis, which is caused by normal T-cells attacking cartilage. Each mouse had two arthritic joints, but the researchers injected the ovalbumin into one only. Then they injected the lab-produced T-reg cells into the same mice.

The idea was that the ovalbumin would attract the cells, which would dampen down the arthritic inflammation that was attacking the joint's cartilage. The rest of the immune system, however, would remain intact.

Sure enough, the injected cells homed in on the ovalbumin-injected arthritic joints and reduced inflammation, while the other joints remained inflamed.

More targets

Stauss says that a similar T-reg therapy could be developed to target autoimmune diseases that strike other parts of the body, by adding genes for receptors specific to molecules found there.

Alexandre Corthay of the University of Oslo in Norway warns of the unpredictable nature of T-regs, which regularly turn back into normal T-cells in the body. Stauss admits that this is a risk but reckons that artificially produced T-reg cells are more stable than naturally occurring ones.

He also points out that because the T-regs are specific to a particular part of the body, even if they did revert, the damage they could do would be limited.

Journal reference: Proceedings of the National Academy of Sciences, DOI: 10.1073/pnas.0907396106

Findings

Can You Believe How Mean Office Gossip Can Be?

By JOHN TIERNEY

Could adults gossiping in the office be more devious than the teenagers in “Gossip Girl”?

If you have a hard time believing this, then you must have skipped the latest issue of the *Journal of Contemporary Ethnography*. Perhaps you saw “ethnography” and assumed it would just be quaint reports from the Amazon and the South Seas. But this time ethnographers have returned from the field with footage of a truly savage native ritual: teachers at an elementary school in the Midwest dishing about their principal behind her back.

These are rare records of “gossip episodes,” which have been the subject of a long-running theoretical debate among anthropologists and sociologists. One side, the functionalist school, sees gossip as a useful tool for enforcing social rules and maintaining group solidarity. The other school sees gossip more as a hostile endeavor by individuals selfishly trying to advance their own interests.

But both schools have spent more time theorizing than observing gossipers in their natural habitats. Until now, their flow charts of gossips’ conversations (where would social science be without flow charts?) have been largely based on studies in informal settings, like the casual conversations recorded in a German housing project and in the cafeteria of an American middle school.

The earlier studies found that once someone made a negative comment about a person who wasn’t there, the conversation would get meaner unless someone immediately defended the target. Otherwise, among both adults and teenagers, the insults would keep coming because there was so much social pressure to agree with the others.

Consider, for instance, the cascade of insults recorded in the earlier study of middle-school gossip by Donna Eder and Janet Lynne Enke of Indiana University. In this cafeteria conversation, a group of eighth-grade girls in the cafeteria were discussing an overweight classmate whose breasts they considered too large for her age:

Penny: In choir that girl was sitting in front of us and we kept going, “Moo.”

Karen: We were going, “Come here, cow; come here, cow.”

Bonnie: I know. She is one.

Penny: She looks like a big fat cow.

Julie: Who is that?

Bonnie: That girl on the basketball team.

Penny: That big red-headed cow.

Julie: Oh, yeah. I know. She is a cow.

The new study found that gossip in the workplace also tended to be overwhelmingly negative, but the insults were more subtle and the conversations less predictable, says Tim Hallett, a sociologist at Indiana University. Dr. Hallett conducted the study along with Dr. Eder and Brent Harger of Albright College.

“Office gossip can be a form of reputational warfare,” Dr. Hallett says. “It’s like informal gossip, but it’s richer and more elaborate. There are more layers to it because people practice indirectness and avoidance. People are more cautious because they know they can lose not just a friendship but a job.”

During his two years studying the group dynamics at a Midwestern elementary school, which allowed him access on condition of anonymity, Dr. Hallett found that the teachers became so comfortable with him and his camera that they would freely insult their bosses during one-on-one interviews. But at the teachers’ formal group meetings, where they knew that another teacher might report their insults to the principal, they were more discreet.

Instead of making direct criticisms, they sometimes offered obliquely sarcastic comments to test the waters. They used another indirect tactic categorized as praise the predecessor, as in the meeting when a teacher fondly recalled a previous administration: “It was so calm, and you could teach. No one was constantly looking over your shoulder.” The other teachers quickly agreed. No one explicitly called the current principal an authoritarian busybody, but that was the obvious implication.

Some teachers were especially adept at managing gossip. At one meeting, after someone complained about a student walking around with his hair shaped into horns (“Tell me, how is that part of the uniform dress code?”), the group began blaming the lapse in discipline on the assistant principal. The gossip seemed to be going down the same nasty track as the teenagers’ she’s-such-a-cow episode until another teacher, an ally of the assistant principal, smoothly intervened.

First, the teacher interrupted the attack by asking the name of the student with the horns. That deflected the group’s gossip on to the student’s academic difficulties and weird behavior (“He’s gotta frighten the little kids”). Then the teacher masterfully completed the rescue of the assistant principal by changing the topic entirely, reminding everyone of a different disciplinary issue that was the fault of a less popular administrator - the principal, who promptly became the new focus of the groups’ anger.

The teachers’ gossip never got as blatantly mean as the teenage girls’ - no one was ever called a cow - but in some ways the effects were more widely felt.

As teachers mocked the principal and complained about her being “stifling” and “hyper,” the atmosphere got more poisonous. The principal felt that her authority was being undermined by gossip and retaliated against teachers she suspected (correctly) of criticizing her. Teachers and administrators fled the school, and the students’ test scores declined.

“The gossip did serve to reinforce the teachers’ group solidarity, but in this case it was also a form of warfare that brought everyone down,” Dr. Hallett says. “It was reminiscent of the old saying that gossip is a three-pronged tongue: it can hurt the speaker and the listener, as well as the target.”

Some bosses have tried turning the office into a “no-gossip zone,” but Dr. Hallett says it is more realistic to try managing it. (If you have ideas for managing office gossip, you can suggest them at nytimes.com/tierneylab.)

If, say, an office rival seems poised to trash one of your absent allies, Dr. Hallett suggests you make a “pre-emptive positive evaluation.” A quick “Isn’t she doing a great job?” might be enough to stop the attack.

If your rival tries persisting with indirect sarcasm - “Oh, real great job” - you can force the issue by calmly asking what that means. That simple question, a dare made in a pleasant voice, often silenced the sarcastic gossips observed by Dr. Hallett.

And if that doesn’t work, Dr. Hallett suggests you try an even simpler tactic that was used successfully at the teachers’ meetings - and that is available in any workplace anytime. In fact, it’s one of the tactics that distinguishes office gossip from nonoffice gossip. When the going gets tough, when the gossip gets mean, you always have one reliable escape line: “Don’t we have some work to do here?”

Science chief backs cannabis view

By Pallab Ghosh Science correspondent, BBC News

The UK government's chief science adviser has told BBC News that he supports the former chief drugs adviser's scientific view on cannabis.

Professor John Beddington, the UK’s chief scientist, would not be drawn on whether the Home Secretary was wrong to sack Professor David Nutt. David Nutt was chair of the Advisory Council on the Misuse of Drugs.

He was fired after using a lecture to say cannabis was less harmful than alcohol and tobacco.

Asked whether he agreed with Professor Nutt's view that cannabis was less harmful than cigarettes and alcohol, Professor Beddington replied: "I think the scientific evidence is absolutely clear cut. I would agree with it."

Professor Beddington is the man ultimately responsible for scientific advice in government.

He said that he believed that the sacking had occurred because of a breakdown in trust between Professor Nutt and the Home Secretary Alan Johnson.

"I think it's very difficult - when clearly trust had broken down between the Home Secretary and Professor Nutt - to see how that could go on," he told BBC News.

He stressed the importance placed by government on obtaining clear-cut scientific advice from experts.

He added: "I think it's fair to say we need to make a distinction between scientific advice and evidence - which is the role of experts and scientific committees and the role of ministers - which is to make policy."

Inner workings

He said he did not believe that the incident revealed an underlying problem in the way government used scientific advice.

"There has been a lot of concern in the media that this is in some sense an undermining of the way in which government uses scientific advice. Let me put it in context: there are more than 75 scientific advisory committees," he said. "This is a single instance where there has been a problem. In my two years in government there has only been an instance with the ACMD."

Professor Beddington said that he would urgently consult with other heads of expert committees to see if they had experienced difficulties in their role.

However, some senior scientists who advise government feel that the Nutt affair is reflective of the inner workings of providing scientific advice in Whitehall.

Many of the advisers I spoke to felt that their committees produce reports whose conclusions are inadequately reported because the publicity is tightly controlled by government press officers. These advisers did not want to be quoted. Scientists are sometimes required to sign confidentiality agreements - a practise said to exist for commercial reasons. But critics claim the agreements can act as a legal gag on scientists who speak out on government initiatives.

"I'm going to be talking to the advisory committees, I'm going to get feedback from the chairmen. There are going to be cases where there has to be non-disclosure," Professor Beddington said.

"I want to know whether those cases are appropriate - if there is commercial confidentiality or there are sensitivities - or whether they are blanket."

He added: "If there was so many problems, we would not get the quality of scientific advice we get."

Scientists are first to 'unlock' the mystery of creating cultured pearls from the queen conch

Boca Raton, FL – For more than 25 years, all attempts at culturing pearls from the queen conch (*Strombus gigas*) have been unsuccessful—until now. For the first time, novel and proprietary seeding techniques to produce beaded (nucleated) and non-beaded cultured pearls from the queen conch have been developed by scientists from Florida Atlantic University's Harbor Branch Oceanographic Institute (HBOI). With less than two years of research and experimentation, Drs. Héctor Acosta-Salmón and Megan Davis, co-inventors, have produced more than 200 cultured pearls using the techniques they developed. Prior to this breakthrough, no high-quality queen conch pearl had been cultured. This discovery opens up a unique opportunity to introduce a new gem to the industry. This significant accomplishment is comparable to that of the Japanese in the 1920s when they commercially applied the original pearl culture techniques developed for pearl oysters.



Conch pearls are formed by concentric layers of fibrous crystals, and this layering often produces the desired flame structure, which is characteristic of conch pearls. The pearls have a porcelain finish and luster like the interior of the conch shell, and come in a wide variety and combination of colors including white, red, pink, orange, yellow and brown. Queen conch pearls are measured in carats like traditional gemstones. Credit: FAU's Harbor Branch

Oceanographic Institute

HBOI has been working with the Gemological Institute of America (GIA) to conduct extensive laboratory testing of the queen conch cultured pearls. In its independent analysis, GIA used techniques that included conventional gemological examination, chemical composition, spectroscopy, spectrometry and microscopy. HBOI and GIA plan to jointly publish the results of these trials in an upcoming issue of GIA's scientific journal, *Gems & Gemology*.

"This is a significant development for the pearl industry, and we were very excited to have the opportunity to closely examine these unique conch cultured pearls in our laboratory," said Tom Moses, senior vice president

of the GIA Laboratory and Research. "Several of the pearls we examined are truly top-quality gems. With the equipment and expertise available at the GIA Laboratory, identification criteria are being compiled to separate queen conch cultured pearls from their natural counterparts."

Previous efforts to culture queen conch pearls were unsuccessful, probably because of the animal's sensitivity to traditional pearl seeding techniques and its complex shell. The spiral shape of the shell makes it virtually impossible to reach the gonad, one of the pearl-forming portions in pearl oysters, without endangering the animal's life.

"Perhaps the most significant outcome from our research is that the technique we have developed does not require sacrificing the conch in the process," said Davis. "The 100 percent survival rate of queen conch after seeding and the fact that it will produce another pearl after the first pearl is harvested will make this culturing process more efficient and environmentally sustainable for commercial application."

Survival of the animal is critical because commercial fishing has depleted the once-abundant wild populations of queen conch, and they are now considered a commercially threatened species in Florida and throughout the Caribbean.

There are basically two types of cultured pearls: nucleated (beaded) and non-nucleated (non-beaded). Nucleated cultured pearls are produced by inserting a piece of mantle tissue from a donor mollusk and a nucleus, usually a spherical piece of shell, into the body of a recipient mollusk. Non-nucleated pearls are produced by grafting only a piece or pieces of mantle tissue, and no bead is inserted.

"We used two different seeding techniques to induce pearl formation in the queen conch," said Acosta-Salmón. "One was a modification of the conventional technique used to produce cultured pearls in freshwater mussels, and the other was a modification of the conventional technique used in marine pearl oysters."

Conch pearls are formed by concentric layers of fibrous crystals, and this layering often produces the desired flame structure, which is characteristic of conch pearls. The pearls have a porcelain finish and luster like the interior of the conch shell, and come in a wide variety and combination of colors including white, red, pink, orange, yellow and brown. Queen conch pearls are measured in carats like traditional gemstones.

The size of the cultured pearls produced by Acosta-Salmón and Davis is controlled by the size of the bead and the culture time. The researchers have experimented with culture times from six months to two years; longer culture times may produce larger pearls. The queen conch is farmed in aquaculture tanks, and the queen conch cultured pearls in the initial harvest were grown in an aquaculture facility at HBOI. Queen conch achieve full size at about three years and have a life span of up to 40 years.

The queen conch is the largest molluscan gastropod of the six conch species found in the shallow seagrass beds of Florida, the Bahamas, Bermuda, the Caribbean Islands, and the northern coasts of Central and South America.



The queen conch is the largest molluscan gastropod of the six conch species found in the shallow seagrass beds of Florida, the Bahamas, Bermuda, the Caribbean Islands and the northern coasts of Central and South America.

Credit: FAU's Harbor Branch Oceanographic Institute

To learn more about these queen conch cultured pearls, go to the G&G eBrief electronic newsletter at www.gia.edu/gandg. For additional information, contact Jan Petri at 772-465-2400, ext. 241 or petri@hboi.fau.edu. To view a brief video, go to http://pubweb.fau.edu:16080/Research/Conch_Pearl_Press.wmv.

Chart junk? How pictures may help make graphs better

Those oft-maligned, and highly embellished, graphs and charts in USA Today and other media outlets may actually help people understand data more effectively than traditional graphs, according to new research from North Carolina State University.

Newspapers and magazines often embellish charts or graphs to draw attention to them or to highlight information. Some experts describe these graphic embellishments as "chart junk," which they argue detracts from a graph or chart's effectiveness. So, can those graphics be too distracting, making it more difficult or time-consuming to read a graph accurately?

Researchers from NC State and the University of Idaho show that the answer is yes, and no.

When people look at charts or graphs, two things happen. In the first stage, a person quickly (and unconsciously) takes in all the elements of the image at the same time. In this stage any contrasting features "pop out" at the viewer, explains Dr. Doug Gillan, co-author of the study and professor and head of psychology at NC State. In the second stage, which is slower and requires some focused attention, the viewer examines each component of the graph or chart separately.

"Imagine a bar graph showing the number of ACC championships won by each school's basketball team," Gillan says. "In the second stage the viewer is examining each bar in the graph to see which team has won the most championships."

To determine whether design elements – such as background pictures – affect a viewer's ability to read a graph, the researchers ran an experiment using rectangular bar graphs. They tested how accurately people could read the bar graph when it was presented against three different backgrounds: a blank background, a background filled with rectangles, and a background filled with circles.

The researchers found that people were most accurate when reading the bar graph against a background filled with circles – the contrast between the rectangular bars and the circles made the graph pop out during that first stage. People performed worse when the background was blank, and worst when the bar graph was displayed against a background that contained rectangular shapes.

In other words, background images can actually enhance one's ability to read a chart or graph – as long as the images contrast with the chart or graph itself. If the background image is too similar, it can actually make it more difficult to read the chart or graph accurately.

Are you listening, USA Today?

The research, "Effects of Graph Backgrounds on Visual Search," was co-authored by Gillan and Dr. Douglas Sorenson of the University of Idaho. The work was presented Oct. 22 at the 53d Annual Meeting of the Human Factors and Ergonomics Society in San Antonio.

Poorer countries make drugs the rich world won't

IF YOU want to do something well, do it yourself. Newly industrialised countries of the "south" are developing cheap treatments for neglected tropical diseases, filling the void left by western drug firms, which focus on diseases of the rich.

The world's poorest people suffer from tropical diseases such as rabies, hookworm and river blindness. Yet few treatments have been developed by big pharma: of 1556 drugs approved between 1975 and 2004, only 21 were for such diseases.

Now the first inventory of drugs developed by small southern companies to tackle diseases of the poor reveals a further 62 treatments for tropical diseases, with 28 already on sale, including a cholera vaccine.

Many are only sold locally, and so could be exported, says Peter Singer of the McLaughlin-Rotman Centre for Global Health in Toronto, Canada, and co-author of the inventory in Health Affairs (DOI: 10.1377/hlthaff.28.6.1760). "It's a new vein of gold that hasn't been fully mined."

Singer admits that donated drugs from western companies may have helped tackle some neglected diseases, but only on an ad hoc basis. In contrast, southern companies are developing tailored and affordable products. To illustrate potential savings, Singer cites a hepatitis B vaccine developed in India, which though not strictly for a tropical disease, costs just 28 cents per shot compared with \$25 in the west.

Estrogen therapy likely must be given soon after menopause to provide stroke protection

Toni Baker - 2009 November 4

Augusta, Ga. – For estrogen replacement to provide stroke protection, it likely must be given soon after levels drop because of menopause or surgical removal of the ovaries, scientists report in the Journal of Neuroscience.

Animal studies indicate a "critical period" for estrogen replacement and that when therapy is delayed, estrogen receptors on brain cells are significantly diminished along with the neuroprotection estrogen typically conveys, according to scientists from the Medical College of Georgia, North China Coal Medical University and the University of Texas Health Sciences Center at San Antonio.

"We looked at the controversy over whether estrogen is going to be beneficial after long periods without it and found the answer appears to be 'no,'" says Dr. Darrell W. Brann, chief of MCG's Developmental Neurobiology Program and the study's corresponding author.

The controversy he's referencing resulted from the Women's Health Initiative, a 12-year study of 161,808 women ages 50-79 that examined the health benefits of hormone replacement therapy. Among the surprising findings was that estrogen and estrogen plus progesterone therapies, actually increased stroke risk rather than reduced it. Critics said one problem with the study was that many of the women had gone years without hormone replacement.

The animal studies indicate that they may be right, at least in terms of estrogen's ability to protect the brain. The studies focused on the hippocampus, a center of learning and memory, where scientists showed that estrogen was strongly protective against stroke in rats that got estrogen one week after surgical removal of their ovaries. When replacement therapy was delayed by 10 weeks after removal – equivalent to a couple of years of human life – estrogen was essentially useless.

A closer examination of the rats who went 10 weeks without estrogen showed alpha receptors, believed to mediate neuroprotective effects of estrogen, were decreased by 50 percent or more.

"That is why the receptors could not respond," says Dr. Brann, who also is associate director of MCG's Institute of Molecular Medicine and Genetics. "That seems to fit the data that there is something estrogen is doing that is necessary to maintain the receptor at the proper levels."

Interestingly estrogen receptors were still intact and receptive in the uterus, another important estrogen target. "We are trying to figure out why there is a tissue difference," Dr. Brann says.

But inside the brain, there were other signs of collateral damage from estrogen deficits. CA3, an area of the hippocampus that tends to be stroke resistant, became vulnerable to stroke in rats that went long term without estrogen. "Estrogen must be doing something that is very critical for the protection of CA3 and we think it's suppressing NADPH oxidase production," Dr. Brann says. NADPH oxidase, the enzyme which makes the free radical superoxide, is found in high levels in the nearby CA1 region, but in low levels in CA3. Both regions, he notes, are critical to learning and memory.

When a stroke happens, estrogen helps suppress free radical production in CA1, which can become deadly to cells at further increased levels. The studies showed CA1 and CA3 regions were equally vulnerable to stroke in animals that went long periods without estrogen.

"If this is also true in humans, just using surgical menopause as an example, most women would be fine unless they came upon a severe stress," Dr. Brann, noting that stress could be not just a stroke but even severe emotional stress or simple aging. It may also explain why women who undergo surgical menopause are at increased risk of cognitive loss and dementia. "That is what we are thinking based on this data," Dr. Brann says.

Next steps include studying the state of estrogen receptors in the brains of naturally older rats – equivalent to about age 70 in humans – to see what happens with normal age-related estrogen loss, waiting a while, then putting estrogen back to see if there is any benefit.

They also want to examine the neuroprotective benefits of estrogen made locally in the brain compared with that made by ovaries, the largest estrogen source. In the past decade, scientists have learned that neurons and the supportive glia cells in the brain locally produce estrogen via the enzyme aromatase. Both men and women have estrogen receptors in the brain and the scientific consensus is that men's brains also produce estrogen.

For more information visit: <http://www.the-aps.org/press/releases/09/45.htm>.

Hormone that affects finger length key to social behavior

The hormones, called androgens, are important in the development of masculine characteristics such as aggression and strength. It is also thought that prenatal androgens affect finger length during development in the womb. High levels of androgens, such as testosterone, increase the length of the fourth finger in comparison to the second finger. Scientists used finger ratios as an indicator of the levels of exposure to the hormone and compared this data with social behaviour in primate groups.

The team found that Old World monkeys, such as baboons and rhesus macaques, have a longer fourth finger in comparison to the second finger, which suggests that they have been exposed to high levels of prenatal androgens. These species tend to be highly competitive and promiscuous, which suggests that exposure to a lot of androgens before birth could be linked to the expression of this behaviour.

Other species, such as gibbons and many New World species, have digit ratios that suggest low levels of prenatal androgen exposure. These species were monogamous and less competitive than Old World monkeys.

The results show that Great Apes, such as orang-utans and chimpanzees, expressed a different finger ratio. The analysis suggests that early androgen exposure is lower in this groups compared to Old World monkeys. Lower androgen levels could help explain why Great Apes show high levels of male cooperation and tolerance.

Emma Nelson, from the University of Liverpool's School of Archaeology, Classics and Egyptology, explains: "It is thought that prenatal androgens affect the genes responsible for the development of fingers, toes and the reproductive system. High androgen levels from a foetus or mother during pregnancy, may alter gene function and lead to subtle changes in relative digit length and the functioning of the reproductive system. Finger ratios do not change very much after birth and appear to tell us something about how very early androgens affect adult behaviour, particularly behaviour linked to mating and reproduction."

Dr Susanne Shultz, from the Institute of Cognitive and Evolutionary Anthropology at the University of Oxford, said: "Humans are unique in that they live in large multi-male, multi-female groups, but maintain strong bonds and show high levels of group cooperation in both males and females. In most other species males are competitive rather than co-operative. Research from finger ratios may help us understand more clearly the development of human sociality and its evolutionary origins."

Major quakes could be aftershocks

Many recent earthquakes may have been the aftershocks of large quakes that occurred hundreds of years ago, according to scientists.

In the journal *Nature*, researchers described a new pattern in the frequency of aftershocks that could explain some major quakes. They found that, away from plate boundaries, echoes of past earthquakes can continue for several hundred years. Here, in the middle of a continent, the earth takes longer to recover.

"It's something we had never spotted before," said Seth Stein from Northwestern University in Illinois, US.

"Most big earthquakes happen at [plate] boundaries - like the San Andreas fault. There is a lot of movement there and aftershocks go on for about ten years after a big quake."

When the aftershocks have dissipated, scientists monitor regular movement of the earth to gauge the likelihood of a future quake.

But small earthquakes also occur where there is none of this regular movement, he explained. "So if the ground has not been storing up energy for future earthquakes, these must be aftershocks."

This, the scientists say, could explain the disastrous earthquake in 2008 in China's Sichuan province. The event shocked many scientists as this was an area where there had been hardly any earthquakes in the past few centuries. But these "aftershock quakes", the scientists say, get smaller over time.

"It even looks like we see small earthquakes today in the area along Canada's Saint Lawrence valley where a large earthquake occurred in 1663," Professor Stein said. "If you look at where they are - they're on the fault plane of the big earthquake."

He and his colleague, Mian Liu from the University of Missouri, found the same pattern repeated in seismic data from faults around the world.

Forecasting tremors

This discovery could help scientists to foresee the location of big earthquakes.

"Predicting big quakes based on small quakes is like the 'whack-a-mole' game," Professor Stein explained. "You wait for the mole to come up where it went down. "But we now know the big earthquakes can pop up somewhere else."

He recommended that, instead of just focusing on the regions where small, regular earthquakes happen, scientists should use methods like GPS satellites and computer modelling to look for places where the earth is "storing up energy for a large future earthquake".

Tom Parsons, a scientist from the US Geological Survey (USGS) in California was not involved in this study, but wrote an accompanying article in the same issue of *Nature*, explaining its significance.

He said that with a more comprehensive approach to studying earthquakes, researchers would eventually be able to "arrive at a practical solution" - balancing the available resources with the need to protect areas that were at risk.

Applause for the SmartHand

TAU's man/machine interface is essential link in groundbreaking prosthetic hand

In one sense, our hands define our humanity. Our opposable thumbs and our hands' unique structure allow us to write, paint, and play the piano. Those who lose their hands as a result of accident, conflict or disease often feel they've lost more than mere utility.

A new invention from Tel Aviv University researchers may change that.

Prof. Yosi Shacham-Diamand of TAU's Department of Engineering, working with a team of European Union scientists, has successfully wired a state-of-the-art artificial hand to existing nerve endings in the stump of a severed arm. The device, called "SmartHand," resembles - in function, sensitivity and appearance - a real hand.

Robin af Ekenstam of Sweden, the project's first human subject, has not only been able to complete extremely complicated tasks like eating and writing, he reports he is also able to "feel" his fingers once again.

In short, Prof. Shacham-Diamand and his team have seamlessly rewired Ekenstam's mind to his SmartHand.

Linking mind and machine

Prof. Shacham-Diamand's contribution to the project, on which TAU collaborated with Sweden's Lund University, is the interface between the body's nerves and the device's electronics. "Perfectly good nerve endings remain at the stem of a severed limb," the researcher says. "Our team is building the interface between the device and the nerves in the arm, connecting cognitive neuroscience with state-of-the-art information technologies."



Prof. Shacham-Diamand runs one of the top labs in the world for nano-bio-interfacing science: the Department of Electrical Engineering - Physical Electronics Lab under the Bernard L. Schwartz Chair for Nano-scale Information Technologies. "Our challenge," remarks Prof. Shacham-Diamand, "was to make an electrode that was not only flexible, but could be implanted in the human body and function properly for at least 20 years."

The artificial SmartHand, built by a team of top European Union scientists, will belong to Ekenstam, the test subject, as long as he wishes. "After only a few training sessions, he is operating the artificial hand as though it's his own," says Prof. Shacham-Diamand. "We've built in tactile sensors too, so the information transfer goes two ways. These allow Ekenstam to do difficult tasks like eating and writing."

Complexity of a challenging magnitude

Ekenstam told a television interviewer, "I am using muscles which I haven't used for years. I grab something hard, and then I can feel it in the fingertips, which is strange, as I don't have them anymore. It's amazing."

This particular multi-million dollar project focused on hands, but the TAU/EU team could also have built bionic legs to be wired to the brain. The team first chose to build a hand, however, because of its unique challenges. "The fingers in the hand are the most complex appendages we have," Prof. Shacham-Diamand observes. "The brain needs to synchronise the movement of each digit in a very complicated way."

With the help of the TAU team, the SmartHand project was able to integrate recent advances in today's "intelligent" prosthetic hands with all the basic features of a flesh-and-blood hand. Four electric motors and 40 sensors are activated when the SmartHand touches an object, not only replicating the movement of a human hand, but also providing the wearer with a sensation of feeling and touch.

While the prototype looks very "bionic" now, in the future SmartHand scientists plan to equip it with artificial skin that will give the brain even more tactile feedback. The researchers will also study amputees equipped with the SmartHand to understand how to improve the device over time.

The SmartHand project is funded by the E.U. Sixth Framework Programme. TAU's SmartHand partners include ARTS Lab, Scuola Superiore Sant'Anna (Italy), Aalborg University (Denmark), Tyndall Institute (Ireland), Össur (Iceland) and SciTech Link HB (Sweden).

Carbon atmosphere discovered on neutron star

Evidence for a thin veil of carbon has been found on the neutron star in the Cassiopeia A supernova remnant. This discovery, made with NASA's Chandra X-ray Observatory, resolves a ten-year mystery surrounding this object.

"The compact star at the center of this famous supernova remnant has been an enigma since its discovery," said Wynn Ho of the University of Southampton and lead author of a paper that appears in the latest issue of Nature. "Now we finally understand that it can be produced by a hot neutron star with a carbon atmosphere."

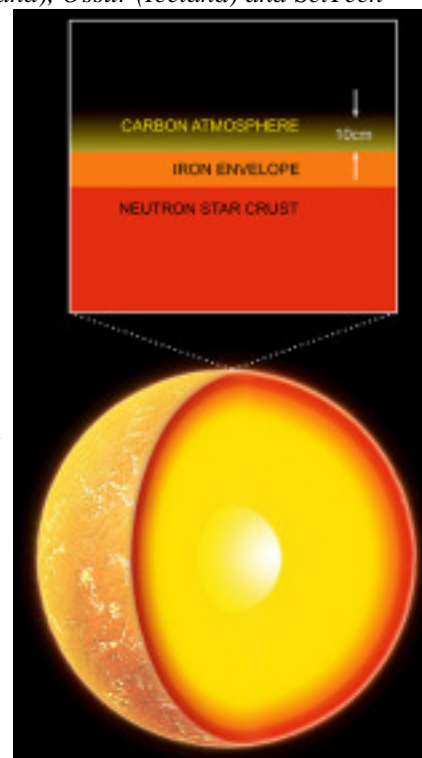
By analyzing Chandra's X-ray spectrum – akin to a fingerprint of energy – and applying it to theoretical models, Ho and his colleague Craig Heinke, from the University of Alberta, determined that the neutron star in Cassiopeia A, or Cas A for short, has an ultra-thin coating of carbon. This is the first time the composition of an atmosphere of an isolated neutron star has been confirmed.

The Chandra "First Light" image of Cas A in 1999 revealed a previously undetected point-like source of X-rays at the center. This object was presumed to be a neutron star, the typical remnant of an exploded star, but researchers were unable to understand its properties. Defying astronomers' expectations, this object did not show any X-ray or radio pulsations or any signs of radio pulsar activity.

Evidence for a thin carbon atmosphere on a neutron star at the center of Cas A has been found. The properties of the carbon atmosphere are remarkable. It is only about four inches thick, has a density similar to diamond and a pressure more than ten times that found at the center of the Earth. As with the Earth's atmosphere, the extent of an atmosphere on a neutron star is proportional to the atmospheric temperature and inversely proportional to the surface gravity. The temperature is estimated to be almost two million degrees, much hotter than the Earth's atmosphere. However, the surface gravity on Cas A is 100 billion times stronger than on Earth, resulting in an incredibly thin atmosphere.

Credit: NASA/CXC/M. Weiss

By applying a model of a neutron star with a carbon atmosphere to this object, Ho and Heinke found that the region emitting X-rays would uniformly cover a typical neutron star. This would explain the lack of X-ray pulsations because -- like a lightbulb that shines consistently in all directions -- this neutron star would be unlikely to display any changes in its intensity as it rotates.



Scientists previously have used a neutron star model with a hydrogen atmosphere giving a much smaller emission area, corresponding to a hot spot on a typical neutron star, which should produce X-ray pulsations as it rotates. Interpreting the hydrogen atmosphere model without pulsations would require a tiny size, consistent only with exotic stars made of strange quark matter.

"Our carbon veil solves one of the big questions about the neutron star in Cas A," said Craig Heinke. "People have been willing to consider some weird explanations, so it's a relief to discover a less peculiar solution."

Unlike most astronomical objects, neutron stars are small enough to understand on a human scale. For example, neutron stars typically have a diameter of about 14 miles, only slightly longer than a half-marathon. The atmosphere of a neutron star is on an even smaller scale. The researchers calculate that the carbon atmosphere is only about 4 inches thick, because it has been compressed by a surface gravity that is 100 billion times stronger than on Earth.

"For people who are used to hearing about immense sizes of things in space, it might be a surprise that we can study something so small," said Ho. "It's also funny to think that such a thin veil over this star played a key role in frustrating researchers."

In Earth's time frame, the estimated age of the neutron star in Cas A is only several hundred years, making it about ten times younger than other neutron stars with detected surface emission. Therefore, the Cas A neutron star gives a unique window into the early life of a cooling neutron star.

The carbon itself comes from a combination of material that has fallen back after the supernova, and nuclear reactions on the hot surface of the neutron star which convert hydrogen and helium into carbon.

The X-ray spectrum and lack of pulsar activity suggest that the magnetic field on the surface of this neutron star is relatively weak. Similarly low magnetic fields are implied for several other young neutron stars by study of their weak X-ray pulsations. It is not known whether these neutron stars will have low magnetic fields for their entire lives, and never become radio pulsars, or whether processes in their interior will lead to the development of stronger magnetic fields as they age.

Chemo-radiation before prostate removal may prevent cancer recurrence

OHSU Knight Cancer Institute findings prompt Phase II clinical trial for high-risk prostate cancer patients

PORTLAND, Ore. - Researchers in the Oregon Health & Science University Knight Cancer Institute and the Portland Veterans Affairs Medical Center have found a combination of radiation therapy and chemotherapy given before prostate removal is safe and may have the potential to reduce cancer recurrence and improve patient survival.

Their findings were presented this week at the 51st annual meeting of the American Society of Therapeutic Radiology and Oncology in Chicago.

"In men with aggressive prostate cancer, standard therapies such as radiation or surgery often fail to eliminate the cancer completely at the site of treatment. When these cancers recur, they are often fatal," said Mark Garzotto, M.D., principal investigator and Associate Professor of Urology and Radiation Medicine in the OHSU Knight Cancer Institute; and Chief of Urologic Oncology in the Portland Veterans Affairs Medical Center.

Previous clinical trials examining the effect of either hormonal therapy or chemotherapy prior to surgery have shown little if any benefit over prostate removal alone. "Novel approaches are needed if we are to make advances in this disease," added Dr. Garzotto.

The use of multimodality therapy - combined radiation, chemotherapy and surgery - has resulted in improved outcomes in a number of cancers, but has not yet been studied in prostate cancer.

This study looked at whether radiation therapy and chemotherapy (docetaxel) administered before surgery is possible, safe, and, ultimately, capable of preventing cancer recurrences. To answer these questions, Garzotto and colleagues developed a treatment regimen in which radiation and docetaxel were administered together before prostatectomy.

Twelve eligible participants were enrolled in the study between April 2006 and March 2008. The men were given intensity-modulated radiation therapy and increasing doses of docetaxel for five consecutive weeks, which was followed by surgical removal of the prostate gland.

The participants tolerated the treatment well and were able to undergo surgery without any major complications, which was a potential concern in this trial. Specifically there were no rectal or ureteral injuries or blood clots in the legs. Examination of the tumor tissue after surgery showed the cancer margins, evidence of complete removal of all of the cancer, to be clean in 75 percent of patients, which is higher than was expected. Also, the PSA, or prostate-specific antigen levels, a predictor of prostate cancer recurrence, were undetectable after treatment in all patients.

"Our study is the first-ever clinical trial in prostate cancer to combine radiation, chemotherapy and surgery given as a combination treatment before prostate surgery to potentially provide higher cure rates than traditional approaches with fewer side effects," said Arthur Hung, M.D., co-investigator and Assistant Professor of Radiation Medicine in the OHSU Knight Cancer Institute.

The researchers concluded this chemo-radiation combination is feasible and safe and potentially may reduce cancer recurrence rates in this high-risk population. Further, they say the development of this approach now opens the door to the study other drugs in combination with radiation.

The study was funded by sanofi-aventis U.S.

When should flu trigger a school shutdown?

Analysis of data from Japan suggests a protocol for schools to follow

Boston, Mass. -- As flu season approaches, parents around the country are starting to face school closures. But how bad should an influenza outbreak be for a school to shut down? A study led by epidemiologists John Brownstein, PhD, and Anne Gatewood Hoen, PhD of the Children's Hospital Boston Informatics Program, in collaboration Asami Sasaki of the University of Niigata Prefecture (Niigata, Japan), tapped a detailed set of Japanese data to help guide decision making by schools and government agencies. The analysis was published by the Centers for Disease Control and Prevention in the November issue of *Emerging Infectious Diseases*.

"Currently many U.S. schools don't have specific or consistent algorithms for deciding whether to shut down," says Brownstein. "They don't always use quantitative data, and it may be a political or fear-based decision rather than a data-based one."

Sasaki, Hoen and Brownstein analyzed flu absenteeism data from a Japanese school district with 54 elementary schools. Tracking four consecutive flu seasons (2004-2008), they asked what pattern of flu absenteeism was best for detecting a true school outbreak - balanced against the practical need to keep schools open if possible.

"You'd want get a school closed before an epidemic peaks, to prevent transmission of the virus, but you also don't want to close a school unnecessarily," explains Brownstein. "We also wanted an algorithm that's not too complex, that could be easily implemented by schools."

A school outbreak was defined as a daily flu absentee rate of more than 10 percent of students. After comparing more than two dozen possible scenarios for closing a school, the analysis suggested three optimal scenarios:

1. A single-day influenza-related absentee rate of 5 percent
2. Absenteeism of 4 percent or more on two consecutive days
3. Absenteeism of 3 percent or more on three consecutive days

The scenarios #2 and #3 performed similarly, with the greatest sensitivity and specificity for predicting a flu outbreak (i.e., the fewest missed predictions and the fewest "false positives.") Both gave better results than the single-day scenario (#1). The researchers suggest that scenario #2 (with a sensitivity of 0.84 and a specificity of 0.77) might be the preferred early warning trigger, balancing the need to prevent transmission with the need to minimize unnecessary closures.

"Our method would give school administrators or government agencies a basis for timely closure decisions, by allowing them to predict the escalation of an outbreak using past absenteeism data," says Hoen. "It could be used with data from schools in other communities to provide predictions. It would leave decision-making in the hands of local officials, but provide them with a data-driven basis for making those decisions."

Japan makes a good model for studying influenza in schools because it closely monitors school absenteeism due to flu, requires testing for the flu virus in students who become ill, and has a track record of instituting partial or complete school closures during outbreaks. However, Brownstein cautions that the scenarios might play out differently in the U.S. than they would in Japan, mainly because students here aren't required to be tested for influenza as they are in Japan, so it's less certain whether they actually have the flu. Also, the vaccination status of students in this study was unknown.

Last spring, during the early days of the H1N1 influenza pandemic, the CDC recommended first a 7-day school closure, then a 14-day closure after appearance of the first suspected case. Later, as more became known about the extent of community spread and disease severity, the CDC changed the recommendation to advise against school closure unless absentee rates interfered with school function. CDC's current guidelines (<http://www.cdc.gov/h1n1flu/schools/schoolguidance.htm>, 10/21/09) don't provide a specific algorithm, but state that "the decision to selectively dismiss a school should be made locally," in conjunction with local and state health officials, "and should balance the risks of keeping the students in school with the social disruption that school dismissal can cause." When the decision is made to dismiss students, CDC recommends doing so for 5 to 7 calendar days.

Researchers at the Harvard School of Public Health, the Boston University School of Public Health, and Niigata University were coauthors on the study. The study was funded by the Takemi Program, the Japan Foundation for the Promotion of International Medical Research Cooperation, the National Institute of Allergy and Infectious Disease, the National Institutes of Health Research and the Canadian Institutes of Health Research.

Citation: Sasaki A, et al. Evidenced-based tool for triggering school closures during influenza outbreaks, Japan. *Emerg Infect Dis* 2009 Nov. Available from <http://www.cdc.gov/EID/content/15/11/1841.htm>.

Babies' language learning starts from the womb

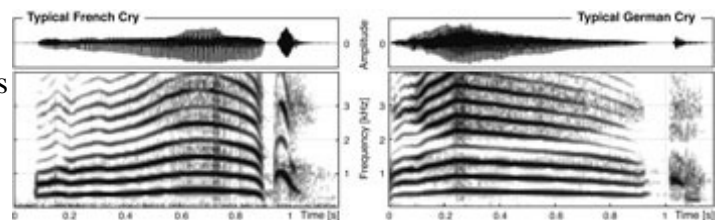
From their very first days, newborns' cries already bear the mark of the language their parents speak, reveals a new study published online on November 5th in *Current Biology*, a Cell Press publication. The findings suggest that infants begin picking up elements of what will be their first language in the womb, and certainly long before their first babble or coo.

"The dramatic finding of this study is that not only are human neonates capable of producing different cry melodies, but they prefer to produce those melody patterns that are typical for the ambient language they have heard during their fetal life, within the last trimester of gestation," said Kathleen Wermke of the University of Würzburg in Germany. "Contrary to orthodox interpretations, these data support the importance of human infants' crying for seeding language development."

Human fetuses are able to memorize sounds from the external world by the last trimester of pregnancy, with a particular sensitivity to melody contour in both music and language, earlier studies showed. Newborns prefer their mother's voice over other voices and perceive the emotional content of messages conveyed via intonation contours in maternal speech (a.k.a. "motherese"). Their perceptual preference for the surrounding language and their ability to distinguish between different languages and pitch changes are based primarily on melody.

Although prenatal exposure to native language was known to influence newborns' perception, scientists had thought that the surrounding language affected sound production much later, the researchers said. It now appears that isn't so.

Wermke's team recorded and analyzed the cries of 60 healthy newborns, 30 born into French-speaking families and 30 born into German-speaking families, when they were three to five days old. That analysis revealed clear differences in the shape of the newborns' cry melodies, based on their mother tongue.



The cry melody of french (left) and german (right) babies differs considerably with respect to the accentuation. Image: MPI für Kognitions- und Neurowissenschaften

Specifically, French newborns tend to cry with a rising melody contour, whereas German newborns seem to prefer a falling melody contour in their crying. Those patterns are consistent with characteristic differences between the two languages, Wermke said.

The new data show an extremely early impact of native language, the researchers say. Earlier studies of vocal imitation had shown that infants can match vowel sounds presented to them by adult speakers, but only from 12 weeks on. That skill depends on vocal control that just isn't physically possible much earlier, the researchers explain.

"Imitation of melody contour, in contrast, is merely predicated upon well-coordinated respiratory-laryngeal mechanisms and is not constrained by articulatory immaturity," they write. "Newborns are probably highly motivated to imitate their mother's behavior in order to attract her and hence to foster bonding. Because melody contour may be the only aspect of their mother's speech that newborns are able to imitate, this might explain why we found melody contour imitation at that early age."

The researchers include Birgit Mampe, University of Würzburg, Würzburg, Germany; Angela D. Friederici, Max-Planck-Institute for Human Cognitive and Brain Sciences, Leipzig, Germany; Anne Christophe, Ecole Normale Supérieure/CNRS, Paris, France; and Kathleen Wermke, University of Würzburg, Würzburg, Germany.

Mass extinction blamed on fiery fountains of coal

* 05 November 2009 by David Shiga

FOSSIL fuels have a new crime to live down. A frenzy of hydrocarbon burning at the end of the Permian period may have led to the most devastating mass extinction Earth has ever seen, as explosive encounters between magma and coal released more carbon dioxide in the course of a few years than in all of human history.

Around 250 million years ago, the so-called "Great Dying" saw 70 per cent of species wiped out on land and 95 per cent in the oceans. A clue to what may have triggered this disaster lies in solidified magma from this time, which is widespread in an area of Siberia where coal is also abundant.

One suggestion is that the heat of the magma could have baked many billions of tonnes of CO₂ out of the coal over a geologically brief period of a few thousand years (New Scientist, 8 December 2007, p 42). The

ensuing climate change and ocean acidification would account for the extinctions. Now Norman Sleep and Darcy Ogden, both of Stanford University in California, think the trigger for the Great Dying may have been even swifter and more terrifying.

Rather than causing gentle heating, magma encountering oil- and tar-soaked coal underground would melt it, producing a highly combustible material, they say. Crucially, this molten mixture would be light enough to rise quickly to the surface. There it would burn explosively on contact with oxygen in the air, blasting dust and ash into the stratosphere and releasing huge quantities of CO₂.

"You're basically going to have something like a fire fountain every few kilometres or so over this vast moonscape that's erupting, with flares going high into the air and columns of smoke and fly ash," says Sleep. The ground would be "covered with coal tar and coal fragments and pieces of basalt", he adds.

Dust injected into the stratosphere would cause drastic cooling. That would quickly switch to warming as the dust settled out of the atmosphere, leaving nothing to counteract the greenhouse effect of the increased CO₂. The climate might have swung between heating and cooling as new eruptions injected yet more dust into the stratosphere. "The climate is just going to go completely unstable," says Sleep, who presented the idea last month at a meeting of the Geological Society of America in Portland, Oregon.

Lee Kump of Pennsylvania State University in University Park agrees that a coal bed could be ignited by an intruding finger of magma in the way Sleep and Ogden envision. But he says their scenario would require many magma fingers to ignite many coal beds in the span of just a few years - whereas the solidified magma in Siberia more likely took thousands of years to intrude into rock. "[It's] possible, but seems improbable to me," he says.

If Sleep and Ogden are right, proof of their scenario may be hiding in Siberia's abundant volcanic deposits. In a burning mixture of coal and magma, the carbon in the coal would strip oxygen from iron oxide in the magma, leaving behind particles of iron.

"These things would get treated as a curiosity unless somebody was particularly looking for them," says Sleep. Part of the reason for presenting the theory at the meeting was "to get people to look at those rocks", he adds.

Does green tea prevent cancer? Evidence continues to brew, but questions remain

Philadelphia – Although scientists are reluctant to officially endorse green tea as a cancer prevention method, evidence continues to grow about its protective effects, including results of a new study published in *Cancer Prevention Research*, a journal of the American Association for Cancer Research, which suggests some reduction in oral cancer.

Vassiliki Papadimitrakopoulou, M.D., professor of medicine in the Department of Thoracic/Head and Neck Medical Oncology at the University of Texas M. D. Anderson Cancer Center, and colleagues tested green tea extract taken orally for three months at three doses among 41 patients: 500 mg/m², 750 mg/m² or 1,000 mg/m².

The researchers assessed clinical response in oral pre-malignant lesions and found 58.8 percent of patients at the highest doses displayed clinical response, compared with 18.2 percent among those taking placebo. They also observed a trend toward improved histology, and a trend towards improvement in a handful of biomarkers that may be important in predicting cancer development.

Patients were followed for 27.5 months and at the end of the study period, 15 developed oral cancer. Although there was no difference in oral cancer development overall between those who took green tea and those who did not, patients who presented with mild to moderate dysplasia had a longer time to develop oral cancer if they took green tea extract.

Although encouraged by the results, Papadimitrakopoulou cautioned against any recommendations that green tea could definitely prevent cancer. "This is a phase II study with a very limited number of patients who took what would be the equivalent of drinking eight to 10 cups of green tea every single day," said Papadimitrakopoulou. "We cannot with certainty claim prevention benefits from a trial this size."

Dong Shin, M.D., professor of hematology and medical oncology and Blomeyer Endowed Chair in Cancer Research at Emory School of Medicine, agreed, but said this trial is certainly a step in the right direction.

"A clinical trial with a natural compound is no easy task, and these researchers have accomplished that," said Shin, an editorial board member of *Cancer Prevention Research*. "The lack of toxicity is also important because often when you give supplements at higher doses than what would occur naturally, you induce nausea and vomiting. That did not happen in this trial."

Neither researchers had a reason why patients concerned about cancer should not drink green tea, but they cautioned against relying on the beverage to definitively reduce their risk of cancer.

"The goal of this kind of research is to determine whether or not these supplements have long-term prevention effects. More research including studies in which individuals at high risk are exposed to these supplements for longer time period is still needed to answer that sort of question," said Papadimitrakopoulou.

The study was funded by Ito En, the company that produced the green tea extract.

In addition to Papadimitrakopoulou and Tsao, other M. D. Anderson authors on the study include: Waun Ki Hong, M.D., professor and chair of the Division of Cancer Medicine; Jack Martin, D.D.S., professor in the Department of Dental Oncology; Li Mao, M.D., adjunct professor and Xi Ming Tang, M.D., Ph.D. research scientist, both of the Department of Thoracic/Head and Neck Medical Oncology; Adel El-Naggar, M.D., Ph.D., professor in the Department of Pathology; Iganacio Wistuba, M.D., professor in the Department of Pathology-Research; Kirk Culotta, Ph.D., Department of Pharmacy Pharmacology Research; Ann Gillenwater, M.D., professor in the Department of Head and Neck Surgery; J. Jack Lee, Ph.D., professor and Diane Liu, both of the Department of Biostatistics. Other authors include Yuko Sagesaka of Ito En, Ltd.

Gene therapy success in severe brain disorder applauded by the STOP ALD Foundation **Affected families achieve goal of saving children. Exciting results reported in Science**

Houston, TX - The Stop ALD Foundation today applauded the investigators who are reporting in the current issue of Science successful results from the pioneering use of gene therapy for adrenoleukodystrophy (ALD), a potentially crippling and fatal brain disorder in young boys.

"As an organization founded by families affected by ALD, we know too well the ravages that this disorder inflicts on its victims and the heartbreak it brings to those who love them," said Amber Salzman, president of The Stop ALD Foundation. "We are deeply thankful to Drs. Cartier and Aubourg and the many other scientists and physicians whose achievement is reported in Science, and we look forward to continuing to work with them to build on their success. Their pioneering work in gene therapy brings hope to those stricken not only by ALD but many other serious diseases as well."

The Stop ALD Foundation has been involved in this gene therapy initiative since 2001 by providing direct funding and by bringing together parties in the US and Europe who provided critical scientific and biomedical contributions. Given the encouraging results reported in Science, the foundation will continue to stay involved, assisting in driving forward a larger, international study including U.S. patients. It is anticipated that this next study may be open to a more diverse ALD population, including adult men who suffer from the same genetic disorder.

The promise of gene therapy in ALD is that it will enable each patient to serve as his own stem cell donor, obviating the need to find matching donors and avoiding the serious risks and sometimes lethal side effects of stem cell transplantation. The paper in Science details the cases of two boys who underwent gene therapy at Saint Vincent de Paul Hospital in Paris. The boys were born with a genetic mutation that by the time of their hospital admission had already resulted in early brain lesions. Their therapy began with removal of some of their own bone marrow stem cells. These genetically defective cells were then corrected via a laboratory procedure whereby functioning genes were inserted. Last, the treated cells were injected back into the young patients. This therapy arrested the progression of ALD, and over two years later the boys' conditions have stabilized. No adverse effects of the gene therapy have been noted to date.

"I know the urgency of boys stricken by ALD and the pain of their parents," said Eve Lapin, a founding member of The Stop ALD Foundation. One of her sons died of ALD, and another is confined to a wheelchair as a consequence of graft versus host disease following a stem cell transplant. "These gene therapy results are exciting, but they are just the beginning. Time is of the essence in finding the safest and most effective therapies. Every day more children become afflicted with ALD, and their chances of surviving depend on the success of trials such as this."

To see a video interview with Eve Lapin, a founding member of the Stop ALD Foundation, click here:

<http://www.youtube.com/watch?v=pnWDZJ7b7Xo&>

Small increases in phosphorus mean higher risk of heart disease

Higher phosphorus and lower kidney function linked to coronary artery calcifications

Higher levels of phosphorus in the blood are linked to increased calcification of the coronary arteries - a key marker of heart disease risk, according to a study in an upcoming issue of Clinical Journal of the American Society of Nephrology (CJASN). "This may help to explain why even early-stage chronic kidney disease (CKD) is associated with increased cardiovascular risk that is not otherwise explained by traditional risk factors," comments Katherine R. Tuttle, MD (Providence Medical Research Center, Spokane, WA).

The study looked at the relationship between phosphorus levels and coronary artery calcification (CAC) in nearly 900 healthy adults from the Spokane Heart Study, a long-term study of heart disease risk factors. Previous studies have linked CAC - an early sign of atherosclerosis ("hardening of the arteries") - to an increased risk of myocardial infarction (heart attack) and other cardiovascular events. At the start of the study, 28 percent of the participants had CAC. After six years' follow-up, another 33 percent of participants had developed CAC. For those who already had CAC, the level of CAC increased during follow-up.

The relationship between phosphorus levels and CAC remained significant even after adjustment for other factors. "Even small increases in the blood level of phosphorus predicted an increased risk of progressive CAC

in these apparently healthy adults," says Tuttle. The phosphorus-related increase in CAC was comparable to that seen with traditional heart disease risk factors like high blood pressure and high cholesterol.

In addition, participants with lower levels of kidney function - even if not below the normal range - were more likely to have progressive CAC. Recent studies have linked higher phosphorus levels to increased CAC in patients with CKD as well.

"Our results may help explain why even early-stage CKD is associated with increased cardiovascular risk that is not explained by traditional risk factors," says Tuttle. More research will be needed to see if treatments to lower phosphorus levels can reduce heart disease risk in people with early-stage CKD, or even those without CKD who have CAC."

The study had some important limitations, including the use of estimated kidney function levels. In addition, it did not address several factors that can affect phosphorus levels, such as parathyroid hormone and vitamin D. *Robert A. Short, PhD (also of Providence Medical Research Center) was co-author of the study. The authors reported no financial disclosures.*

The study, "Longitudinal Relationships among Coronary Artery Calcification, Serum Phosphorus, and Kidney Function," will appear in an upcoming issue of CJASN and online at <http://cjasn.asnjournals.org/> on November 5, doi 10.2215/CJN.01250209.

First use of antibody and stem cell transplantation to successfully treat advanced leukemia

SEATTLE – For the first time, researchers at Fred Hutchinson Cancer Research Center have reported the use of a radiolabeled antibody to deliver targeted doses of radiation, followed by a stem cell transplant, to successfully treat a group of leukemia and pre-leukemia patients for whom there previously had been no other curative treatment options.

All fifty-eight patients, with a median age of 63 and all with advanced acute myeloid leukemia or high-risk myelodysplastic syndrome – a pre-leukemic condition – saw their blood cancers go into remission using a novel combination of low-intensity chemotherapy, targeted radiation delivery by an antibody and a stem-cell transplant. Forty percent of the patients were alive a year after treatment and approximately 35 percent had survived three years, about the same rates as patients who received similar treatment but whose disease was already in remission and who had much more favorable risk for relapse when therapy began.

Results of the research appear online in the journal *Blood*. The principal investigator and corresponding author of the paper is John Pagel, M.D., Ph.D, a transplant oncologist and assistant member of the Hutchinson Center's Clinical Research Division.

The purpose of the study was to find the maximum dose of radiation that patients could tolerate with acceptable toxic side effects, not to assess how effective the novel treatment was, according to Pagel and colleagues. However, "the results appear to be very encouraging and warrant us to study it further for patients who really have no significant other curative options," Pagel said.

Older (over age 50) patients with active, advanced leukemia and myelodysplastic syndrome pose the most difficult treatment challenges because standard transplant therapy rarely works, according to Pagel. Both standard and low-dose therapies (a process sometimes known as a "mini transplant" and pioneered at the Hutchinson Center) used to kill leukemia cells in the bloodstream in preparation for a transplant usually require that patients be in remission.

The patients in this study, who came from all over the world to participate in the Phase 1 clinical trial, were in large part those with active relapsed disease that in many cases had failed to respond to standard therapies. Eighty-six percent of the 58 patients had active disease and only 10 percent were in remission when therapy was begun. Their cancers had failed previous treatment attempts. "These were people who had extremely advanced high-risk disease, they were typically older – most of them were in their 60s and some were in their 70s – and had few or no other options for a potential cure. In fact most, if not all, would not have been offered a stem cell transplant here or elsewhere. It is fair to say that these patients would likely have died without a transplant being performed if they had not been given the opportunity to participate in this study."

To find the optimal dose of radiation, researchers began at 12 Gy (Gray, a unit of measurement of absorbed radiation dose) and escalated the dosages in increments of 2 Gy up to a Gy of 26. At that dose, some toxicity to the heart and lungs was found so they concluded 24 Gy to be the maximum effective dosage. The 21 patients who received the maximum radiation dose have survived the longest, researchers reported.

The key to success in this study was use of a radiolabeled antibody that has therapeutic iodine 131 attached and is designed to target leukemic blood cells that carry a marker on the surface of the cell known as CD45. Its use in delivering targeted amounts of radiation was developed several years ago at the Hutchinson Center. Delivered intravenously, the radiation looks for the CD45 antigen receptor on the surface of blood cells. This approach results in a two- to four-fold increase in the amount of radiation that reaches cancerous cells as

compared to standard external beam radiation, which also radiates normal surrounding organs and tissue. The more radiation that can be applied, the more cancer cells will be killed in preparation for donor stem cells to take over the diseased immune system and kill off the remaining cancer cells.

Pagel said further research is needed to test more patients at the highest radiation dose both at the Hutchinson Center and at other transplant centers around the country.

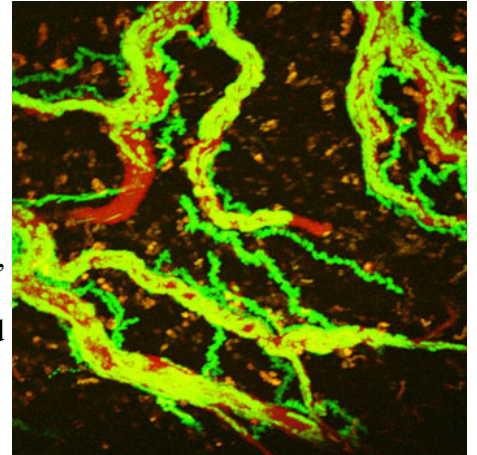
Joining Pagel in the study were colleagues from the Hutchinson Center, the Pacific Northwest Laboratory and the departments of Medicine, Pediatrics and Nuclear Medicine at the University of Washington School of Medicine.

Grants from the National Institutes of Health, the Leukemia and Lymphoma Society of America, the Damon Runyon Cancer Research Foundation, the Edson Foundation and the Frederick Kullman Memorial Fund supported this research.

Crossing the line: how aggressive cells invade the brain

Real-time observation sheds new light on multiple sclerosis

In diseases such as multiple sclerosis, cells of the immune system infiltrate the brain tissue, where they cause immense damage. For many years, it was an enigma as to how these cells can escape from the bloodstream. This is no trivial feat, given that specialized blood vessels act as a barrier between the nervous system and the bloodstream. Until now, tissue sections provided the sole evidence that the immune cells really do manage to reach the nerve cells. Now, a team of scientists from the Max Planck Institute of Neurobiology, the University Medical Center Göttingen, and other institutes, has witnessed the movements of these cells "live" under the microscope for the very first time. In the process, they discovered several new behavioural traits of the immune cells. The consolidated findings mark a significant step forward in our understanding of this complex disease. (Nature, 14 October 2009)



The picture shows the movement of crawling T-cells (green) inside blood vessels (red) over a period of about 20 minutes. It clearly shows that some T-cells leave the blood vessels - the long exposure lets them leave a green trail as the cells make their way through the brain tissue. Image: Max Planck Institute of Neurobiology / Bartholomäus

The brain and the spinal cord monitor and control the functions of all body parts and co-ordinate the whole organism's movements, senses and behaviour. Adequate protection of the brain and spinal cord are therefore of the utmost importance. Physical influences and injuries are warded off by the cranial bone and the vertebral column. Dangers lurking within the body, such as viruses circulating in the bloodstream, are kept at bay by highly specialized blood vessels. The vessels' walls form a barrier that cannot be penetrated by the cells or various other small particles, thus serving to protect the delicate nerve cells.

There are, however, exceptions to the rule. In diseases such as multiple sclerosis (MS), aggressive cells in the immune system manage to break through the blood vessels' barrier. Having invaded the brain tissue, these cells wreak havoc by triggering off inflammatory reactions and attacking nerve cells. In Germany alone, the resulting adverse effects afflict over 120,000 MS-patients.

Tracking down the culprits

Since there is normally a clear division between the blood circulatory system and the central nervous system (i.e. brain plus spinal cord), scientists were baffled as to how immune cells manage to cross the blood-brain-barrier. This knowledge may aid in understanding the origins of multiple sclerosis. In the 1980s, scientists were able to prove conclusively that, under certain conditions, so called T-cells can recognize and attack components of the body's own brain cells. Thanks to tissue sections performed over the last few decades, scientists now have much better knowledge of the migration of these cells from their point of origin to their point of penetration into the brain and the damage that they cause. However, actual observations of such movements long remained impossible

Observing aggressive cells in action

Scientists at the Max Planck Institute of Neurobiology, the University Medical Center Göttingen and their colleagues have now overcome this impossibility. Using a two-photon microscope, the researchers succeeded in tracing the movements of aggressive T-cells labelled with the green fluorescent protein (GFP) in the living tissue of rats. The systematic observation of these cells during the course of the disease provided amazing new insights into the cell's behaviour.

The scientists discovered that the aggressive T-cells overcome the barrier between blood and nerve tissue in a number of steps. Outside the nervous system, the labelled cells moved just as we would expect them to; most cells were floating along with the flow of the bloodstream. Only now and again did a cell attach itself briefly onto the vascular wall. Here they rolled in the direction of the blood stream or were being carried off again by

the current. Yet, once the cells reached the blood vessels of the nervous system, they began to act in a completely different manner. The scientists observed here far more cells clinging to the vascular walls. "Things got really exciting when we observed that the cells can actually crawl, a behaviour so far unheard of for T-cells", Ingo Bartholomäus relates his observations. Here, "crawling" describes an active cell movement, usually against the flow of the bloodstream. The scientists watched T-cells as they took anything between a few minutes and several hours to crawl along the vessels' walls. At the end of such a search movement, the cells were either swept away again by the bloodstream or they managed to squeeze through the vascular wall.

Ominous encounters

Having successfully penetrated the blood-brain-barrier, the cells continued their search in the vicinity of the blood vessels. It was thus only a question of time before the T-cells encountered one of the phagocytic cells abundant on the outer linings of blood vessels and on the surface of the nerve tissue. When a mobile T-cell came across such a phagocyte, the two cells formed a closely connected pair. Some of these pairs remained inseparable for several minutes.

Although the scientists already knew that T-cells must make contact with phagocytes in order to become immune-activated, they were now able to observe these interactions right where they happened, i.e. at the blood-brain-barrier. And indeed, the T-cells did not launch their attack on the nervous system by releasing their inflammatory neurotransmitters until they had bonded with the phagocytes. As a result of the T-cells' activation, more and more T-cells passed through the vascular walls. "The activation of T-cells at the border to the nerve tissue appears to be a decisive signal for the invasion of the immune cells", concludes Alexander Flügel, supervisor of the study and director of the Department of Experimental and Clinical Neuroimmunology at the University Medical Center Göttingen and Head of the MS Hertie-Institute.

Light bulb moments

Thanks to their sophisticated observation methods, the scientists also established that some of the antibodies already being used in MS-therapy cause the crawling cells to disappear. As Ingo Bartholomäus explains "Up to now, it was only known that these antibodies prevented the T-cells' escaping from the blood vessels, but as our observations now show, they actually prevent them from crawling".

Thanks to the scientists' observations, we now have a much clearer picture of how the immune cells move and obtain access to the nervous system. This knowledge is likely to also increase our knowledge of the immune system's security system functions in healthy tissue. However, as is often the case, new insights and information also give rise to many new questions. How do the immune cells manage to cling to the lining of the blood vessels and how do they recognize the weak spots, where they can slip through the barrier between the bloodstream and the nervous system? What governs the cells once they have surmounted the blood-brain-barrier? These are some of the questions the scientists will be addressing next. The long-term goal will be to develop new forms of therapy and medication for multiple sclerosis and other diseases. [SM]

Related links:

[\[1\] The film shows in real time how the green labelled T-cells crawl along the inside walls of blood vessels before single cells force their way through the vessels' walls and penetrate the nerve tissue. \(click right to download\).](#)

[\[2\] Tracking down the causes of multiple sclerosis \(MPS press release, June 10, 2009\)](#)

Original work: Ingo Bartholomäus, Naoto Kawakami*, Francesca Odoardi, Christian Schläger, Djordje Miljkovic, Joachim W. Ellwart, Wolfgang EF Klinkert, Cassandra Flügel-Koch, Thomas B. Issekutz, Hartmut Wekerle, Alexander Flügel [*equal contribution]*

Effector T cell interactions with meningeal vascular structures in nascent autoimmune CNS lesions Nature, October 14, 2009
[PDF \(204 KB\)](#)

1930s drug slows tumor growth

Drugs sometimes have beneficial side effects. A glaucoma treatment causes luscious eyelashes. A blood pressure drug also aids those with a rare genetic disease. The newest surprise discovered by researchers at the Johns Hopkins University School of Medicine is a gonorrhea medication that might help battle cancer.

"Often times we are surprised that a drug known to do something else has another hidden property," says Jun Liu, Ph.D., a professor of pharmacology and molecular sciences at Johns Hopkins and author on the study published Oct. 1 in the Proceedings of the National Academy of Sciences.

In this case, the surprise is a big one. The drug, acriflavine, used in the 1930s for treating gonorrhea, has turned out to have the previously unknown ability to halt the growth of new blood vessels. Preliminary tests showed that mice engineered to develop cancer had no tumor growth if treated with daily injections of acriflavine.

"As cancer cells rapidly divide, they consume considerable amounts of oxygen," says Gregg Semenza, M.D., Ph.D., the C. Michael Armstrong Professor of Pediatrics and director of the vascular program at the Johns

Hopkins Institute for Cell Engineering. "To continue growing, a tumor must create new blood vessels to deliver oxygen to the tumor cells."

Acridflavine stops blood vessel growth by inhibiting the function of the protein hypoxia-inducible factor (HIF)-1, which was discovered by Semenza's team in 1992. When HIF-1 senses that the surrounding environment is low in oxygen, it turns on genes necessary for building new vessels. Though essential for normal tissue growth and wound healing, HIF-1 is also turned on by cancers to obtain the oxygen they need to survive. Most importantly, in order for HIF-1 to work, two subunits must bind together like puzzle pieces.

Most drugs are unable to prevent protein binding because the drug molecules can be much smaller than the proteins they interact with. A medicine must hit just the right spot, a critical domain or pocket on the surface of one protein to stop it from binding to another protein. Even though drugs that stop binding are uncommon, they are such an effective means to stop protein function that Semenza decided to look for one that might block HIF-1. To do that, he turned to the Johns Hopkins Drug Library, a collection of FDA- and internationally approved compounds in that was assembled by Liu.

To visualize protein binding, scientists engineered a cell line so that when the HIF-1 subunits came together, they would cause the cell to light up like a firefly. They then tested each of the more than 3,000 drugs in the drug library in hopes of finding one that would turn out the light. Acridflavine did, and further studies confirmed that it was binding directly to HIF-1.

"Mechanistically, this is the first drug of its kind," says Liu. "It is acting in a way that is never seen for this family of proteins." Liu hopes that acridflavine can one day be incorporated into chemotherapy cocktails, one drug among many that help fight cancer.

Hopkins is seeking even more new uses for old drugs. So far, drugs in the library have been screened for use against malaria, tuberculosis, HIV and the Ebola virus. In the future, Liu expects even more researchers to take advantage of the library, which is continuing to grow as more drugs are added to the collection.

"In the public domain, Hopkins has the largest drug library," says Liu. "The more drugs you have, the more possibilities, the higher the chance you rediscover something that will help."

This study was funded by the Johns Hopkins Institute for Cell Engineering and the Foundation for Advanced Research in the Medical Sciences. Authors on the paper are KangAe Lee, now of Princeton University, Huafeng Zhang, David Z. Qian, Sergio Rey, Liu and Semenza, all of Johns Hopkins.

Blood test identifies women at risk from Alzheimer's

Middle-aged women with high levels of a specific amino acid in their blood are twice as likely to suffer from Alzheimer's many years later, reveals a thesis from the Sahlgrenska Academy at the University of Gothenburg, Sweden. This discovery could lead to a new and simple way of determining who is at risk long before there are any signs of the illness.

The thesis is based on the Prospective Population Study of Women in Gothenburg, which was started at the end of the 1960s when almost 1,500 women between the ages of 38 and 60 were examined, asked questions about their health and had blood samples taken. Nearly all of the samples have now been analysed and compared with information on who went on to suffer from Alzheimer's and dementia much later.

"Alzheimer's disease was more than twice as common among the women with the highest levels of homocysteine than among those with the lowest, and the risk for any kind of dementia was 70 per cent higher," says doctor Dimitri Zylberstein, author of the thesis.

Homocysteine is an amino acid that is important for the body's metabolism. It is known that high levels of homocysteine can damage the blood vessels and increase the risk of blood clots. Previous longitudinal studies linking homocysteine and dementia had 8 years of follow-up at most. The present study is by far the longest one with follow-up time of 35 years. The study is also the first to show association between homocysteine levels in middle aged women and dementia development several decades later. The researchers do not yet know whether it is the homocysteine itself that damages the brain, or whether there is some other underlying factor that both increases levels of the homocysteine and causes dementia.

Historically elevated homocysteine levels were related to certain vitamin deficiencies (B12 and folate). Today we know that high homocysteine levels might be present even with perfectly normal vitamin status. "These days we in our clinical practice use homocysteine analyses mainly for assessment of vitamin status. However, our results mean that we could use the very same analysis for assessment of individual's risk profile for dementia development. This opens the possibility for future preventive treatment at a very early stage", says Zylberstein.

The thesis also looks at a gene which, in some variants, appears to offer protection against dementia. This gene variant reduces the risk of dementia by no less than 65 percent when present doubled (homozygous) which

occurs in just one in ten Swedes and by 40 percent when present in mixed form (heterozygous) in additional four of ten Swedes.

"We have only been able to carry out a genetic analysis on just over 550 of the blood samples from the Prospective Population Study of Women, and want to undertake bigger studies before we can say for sure that the gene really does protect against dementia," says professor Lauren Lissner who supervised the thesis. "We hope to be able to perform the same analysis on more samples from the study."

The work was carried out in conjunction with the Neuropsychiatric Epidemiology Research Unit as part of EpiLife, the Sahlgrenska Academy's major research project.

Was life founded on cyanide from space crashes?

* 15:55 06 November 2009 **by David Shiga**

Life may have been built on a foundation of cyanide formed in the fiery wakes of asteroids plunging through Earth's atmosphere, high-speed impact experiments suggest.

Earth was probably not born with much in the way of organic material – the complex molecules containing carbon that life requires. It formed too close to the sun for such compounds to condense from the swirling primordial disc of gas and dust.

One possibility is that organic matter formed on Earth after the planet coalesced, for example in chemical reactions induced by lightning arcing through the atmosphere, as experiments by Stanley Miller at the University of Chicago in the 1950s suggested. But the chemical reactions in this process could happen only in an early atmosphere full of methane and hydrogen, and later studies of the ancient geological record have suggested that was unlikely.

Others have suggested the building blocks came from comets and asteroids that struck Earth, because these objects are known to contain high concentrations of organic material. But the tremendous heat of impact would have burned up much of that material, converting it into simpler molecules like carbon dioxide.

Third way

Now another way for organic material to appear on Earth has been demonstrated. New experiments show that although impacts destroy the original organic molecules in comets and asteroids, they may help create new ones at the same time.

"The idea in the past has been, 'Any of this stuff coming through the atmosphere would be heated to the point where it would get wasted,'" says Peter Schultz of Brown University in Providence, Rhode Island, one of the experimenters. "What this new work did was to show that we might actually revive these compounds."

With Seiji Sugita of the University of Tokyo, Japan, Schultz simulated asteroid and comet impacts by firing projectiles made of polycarbonate plastic, an organic material, as fast as 6 kilometres per second at metal targets in a laboratory at the NASA Ames Research Center in Moffett Field, California. The projectiles were vaporised in a flash of light, just as an asteroid or comet would be on impact with Earth's surface.

Life-giving poison

Analysis of the spectrum of the flashes revealed abundant cyanide – a compound consisting of a carbon atom bound to a nitrogen atom – formed by chemical reactions between the projectile's carbon and nitrogen in the air.

Cyanide compounds are very reactive, so further reactions involving them on early Earth could have led to more complex carbon-containing molecules important to life, Sugita and Schultz argue.

The nitrogen in the cyanide compounds could have been especially important, since it is an ingredient of amino acids – key building blocks for life – but is relatively scarce in the raw organic material of asteroids.

Donald Brownlee of the University of Washington in Seattle, who was not involved in the study, says some of early Earth's organic material undoubtedly formed this way. But he adds that there were probably other sources too, including organic-rich particles of interplanetary dust, which fall to Earth more gently than asteroids and comets. "It gets warmed but it doesn't get extremely hot," he says.

Journal reference: Geophysical Research Letters, DOI: 10.1029/2009gl040252

SNM applauds House action to build medical isotopes reactor in the US

American Medical Isotopes Production Act of 2009 will ensure reliable medical isotope supply

Reston, Va.—SNM applauds the U.S. House of Representatives for its passage of H.R. 3276 - the American Medical Isotopes Production Act of 2009. "The worldwide isotope shortage has long been adversely affecting patients in the U.S.," said Michael M. Graham, Ph.D., M.D., president of SNM. "This important legislation will bring us one step closer to solving this chronic problem."

The American Medical Isotopes Production Act of 2009 was introduced by Congressman Edward J. Markey (D-MA) in July. "Congressman Markey has worked closely with the medical community, members of industry and other stakeholders to ensure that this important legislation comes to fruition," said Robert W. Atcher, Ph.D.,

M.B.A., chair of SNM's Domestic Isotope Availability Taskforce. "The time is now to make sure that the U.S. has long-term access to medical isotopes - without having to rely on foreign producers."

Molybdenum-99 (Mo-99) is a critical medical isotope. Technetium-99m - the decay product of Mo-99 - is used in more than 16 million diagnostic medical tests annually in the U.S. for the early detection and effective management of cancer, heart disease, thyroid disease and other serious conditions.

There are currently only six foreign producers of Mo-99 approved by the U.S. Food and Drug Administration to import the product into the U.S. - and no domestic facilities exist which are dedicated to the production of Mo-99 for medical uses. These aging foreign reactors regularly experience significant ongoing maintenance issues—frequently causing these reactors to go off-line. These continuing problems were exacerbated with reactors shutting down in Canada and the Netherlands earlier this year. Subsequently, the Canadian government announced that it will no longer produce medical isotopes as of 2016.

"To date, it has not been a pretty picture - and that is why SNM is so supportive of the House's approval of this bill," added Graham.

Most reactors in the world that produce Mo-99 utilize highly enriched uranium (HEU), which can also be used in the construction of nuclear weapons. Under this legislation, nuclear reactors that produce Mo-99 would have to stop using HEU and make the transition to low enriched uranium (LEU) as a replacement.

The American Medical Isotopes Production Act of 2009 now heads to the U.S. Senate for approval. If enacted, this legislation would create a stable and reliable supply of medical isotopes in the U.S.

"This is landmark legislation for patients and all Americans," said Graham.

Less than 1 in 3 Toronto bystanders who witness a cardiac arrest try to help: Study Unregistered defibrillators mean 911 dispatchers are unaware and devices are not used

TORONTO, On –Researchers at St. Michael's Hospital working in conjunction with EMS services, paramedics and fire services across Ontario found that a bystander who attempts cardiopulmonary resuscitation (CPR) can quadruple the survival rate to over 50 per cent. But Dr. Laurie Morrison and the research team at Rescu (www.rescu.ca) have found only 30 per cent of bystanders in Toronto are willing to help, one of the lowest rates of bystanders helping others in the developed world.

"Over the last four years, we have been working hard with paramedics and firefighters in Southern Ontario to increase the survival rate of people who experience cardiac arrest outside of the hospital," says Dr. Morrison. "Since 2004, our efforts have managed to triple the survival rate in the Toronto area but it is still less than 10 per cent."

Compared to other cities during the same time frame, Toronto has much lower rates of bystander CPR and survival. The research team wants to encourage all Canadians to learn the basics of CPR. Home is one of the most common places for cardiac arrests so learning CPR could mean saving a family member's life.

"Even if you perform hands-only CPR, and focus on compressing the chest, you can give a victim of cardiac arrest as much as a 1 in 2 chance of surviving," says Dr. Marco Di Buono, Director of Research at the Heart and Stroke Foundation of Ontario, "on the contrary, doing nothing virtually guarantees the victim will not survive at all."

Dr. Morrison's research group, Rescu (www.rescu.ca), is based out of St. Michael's and dedicated to out of hospital resuscitation. It is a collaborative network of EMS and fire services, paramedics and firefighters and over 40 hospitals in Southern Ontario. Rescu is the largest research program of its kind in Canada and the US, and is world renowned for their clinical trials in out of hospital treatment of cardiac arrest and life threatening emergencies.

The study looked at the impact of bystanders using Automated External Defibrillators (AEDs). An AED is a portable electronic device that treats life threatening cardiac rhythms through electrical therapy, allowing the heart to reestablish an effective rhythm. The researchers found that AEDs used in casinos and airports demonstrated an unprecedented survival rate of 50 per cent or greater. The study found that the use of AEDs in Toronto to be very low. Only one per cent of cardiac arrest victims had an AED applied to their chest.

Although more than an estimated 1,800 AEDs are in public places in Toronto and adjacent cities, the study found only 750 of the devices were registered with Toronto EMS. This is problematic when a 911 dispatcher cannot alert a bystander or EMS person that an AED is close by. In times of an emergency the dispatcher can be an effective coach for bystanders to help others.

Even with a 911 dispatcher talking them through the process, many bystanders do not feel comfortable doing CPR or using an AED. Minimal training is required and people can learn CPR or how to use an AED in an emergency by listening to the dispatcher's coaching until paramedics and fire fighters arrive.

"You can learn CPR in 20 minutes with a personal learning kit available through the Heart and Stroke Foundation website (www.heartandstroke.ca/restart) or by simply watching a video on Youtube," explains Dr.

Morrison. "I believe that we should be teaching CPR and AED use in all schools so that helping someone in cardiac arrest is a learned behaviour. You may never need to use your training but if you are a witness, you will be more likely to jump in and help. If you do nothing, very few will survive." Under Ontario's Good Samaritan Act of 2001, bystanders who assist others with all good intentions are not liable.

The trial included Peel EMS, Peel Fire Brampton, Peel Fire Mississauga, Muskoka EMS, Toronto EMS, Toronto Fire, Durham (Ajax Fire, Brock Fire, Clarington Fire, Oshawa Fire, Pickering Fire, Scugog Fire, Uxbridge Fire and Whitby Fire) and Halton.

2012: Six End-of-the-World Myths Debunked

Brian Handwerk for National Geographic News

The end of the world is near - December 21, 2012, to be exact - according to theories based on a purported ancient Maya prediction and fanned by the marketing machine behind the soon-to-be-released 2012 movie.

But could humankind really meet its end in 2012 - drowned in apocalyptic floods, walloped by a secret planet, seared by an angry sun, or thrown overboard by speeding continents?

And did the ancient Maya - whose empire peaked between A.D. 250 and 900 in what is now Mexico and Central America - really predict the end of the world in 2012?

At least one aspect of the 2012, end-of-the-world hype is, for some people, all too real: the fear. NASA's Ask an Astrobiologist Web site, for example, has received thousands of questions regarding the 2012 doomsday predictions - some of them disturbing, according to David Morrison, senior scientist with the NASA Astrobiology Institute. "A lot of [the submitters] are people who are genuinely frightened," Morrison said.

"I've had two teenagers who were considering killing themselves, because they didn't want to be around when the world ends," he said. "Two women in the last two weeks said they were contemplating killing their children and themselves so they wouldn't have to suffer through the end of the world."

Fortunately, with the help of scientists like Morrison, most of the predicted 2012 cataclysms are easily explained away.

2012 MYTH 1 Maya Predicted End of the World in 2012

The Maya calendar doesn't end in 2012, as some have said, and the ancients never viewed that year as the time of the end of the world, archaeologists say.

But December 21, 2012, (give or take a day) was nonetheless momentous to the Maya.

"It's the time when the largest grand cycle in the Mayan calendar - 1,872,000 days or 5,125.37 years - overturns and a new cycle begins," said Anthony Aveni, a Maya expert and archaeoastronomer at Colgate University in Hamilton, New York.

The Maya kept time on a scale few other cultures have considered.

During the empire's heyday, the Maya invented the Long Count - a lengthy circular calendar that "transplanted the roots of Maya culture all the way back to creation itself," Aveni said.

During the 2012 winter solstice, time runs out on the current era of the Long Count calendar, which began at what the Maya saw as the dawn of the last creation period: August 11, 3114 B.C. The Maya wrote that date, which preceded their civilization by thousands of years, as Day Zero, or 13.0.0.0.

In December 2012 the lengthy era ends and the complicated, cyclical calendar will roll over again to Day Zero, beginning another enormous cycle.

"The idea is that time gets renewed, that the world gets renewed all over again—often after a period of stress—the same way we renew time on New Year's Day or even on Monday morning," said Aveni, author of *The End of Time: The Maya Mystery of 2012*.

2012 MYTH 2 Breakaway Continents Will Destroy Civilization

In some 2012 doomsday prophecies, the Earth becomes a deathtrap as it undergoes a "pole shift."

The planet's crust and mantle will suddenly shift, spinning around Earth's liquid-iron outer core like an orange's peel spinning around its fleshy fruit. (See what Einstein had to say about pole shifts.)

2012, the movie, envisions a Maya-predicted pole shift, triggered by an extreme gravitational pull on the planet - courtesy of a rare "galactic alignment" - and by massive solar radiation destabilizing the inner Earth by heating it.

Breakaway oceans and continents dump cities into the sea, thrust palm trees to the poles, and spawn earthquakes, tsunamis, volcanic eruptions, and other disasters. (Interactive: pole shift theories illustrated.)

Scientists dismiss such drastic scenarios, but some researchers have speculated that a subtler shift could occur—for example, if the distribution of mass on or inside the planet changed radically, due to, say, the melting of ice caps.

Princeton University geologist Adam Maloof has extensively studied pole shifts, and tackles this 2012 myth in 2012: Countdown to Armageddon, a National Geographic Channel documentary airing Sunday, November 8. (*The National Geographic Society owns National Geographic News and part-owns the National Geographic Channel.*)

Maloof says magnetic evidence in rocks confirm that continents have undergone such drastic rearrangement, but the process took millions of years - slow enough that humanity wouldn't have felt the motion (quick guide to plate tectonics).

2012 MYTH 3 Galactic Alignment Spells Doom

Some sky-watchers believe 2012 will close with a "galactic alignment," which will occur for the first time in 26,000 years.

In this scenario, the path of the sun in the sky would appear to cross through what, from Earth, looks to be the midpoint of our galaxy, the Milky Way, which in good viewing conditions appears as a cloudy stripe across the night sky.

Some fear that the lineup will somehow expose Earth to powerful unknown galactic forces that will hasten its doom - perhaps through a "pole shift" (see above) or the stirring of the supermassive black hole at our galaxy's heart.

Others see the purported event in a positive light, as heralding the dawn of a new era in human consciousness.

NASA's Morrison has a different view.

"There is no 'galactic alignment' in 2012," he said, "or at least nothing out of the ordinary."

He explained that a type of "alignment" occurs during every winter solstice, when the sun, as seen from Earth, appears in the sky near what looks to be the midpoint of the Milky Way.

Horoscope writers may be excited by alignments, Morrison said. But "the reality is that alignments are of no interest to science. They mean nothing," he said. They create no changes in gravitational pull, solar radiation, planetary orbits, or anything else that would impact life on Earth.

The speculation over alignments isn't surprising, though, he said. "Ordinary astronomical phenomena are imbued with a sense of threat by people who already think the world is going to end."

Regarding galactic alignments, University of Texas Maya expert David Stuart writes on his blog that "no ancient Maya text or artwork makes reference to anything of the kind."

Even so, the end date of the current Long Count cycle - winter solstice 2012 - may be evidence of Maya astronomical skill, said Aveni, the archaeoastronomer.

"I don't rule out the likelihood that astronomy played a role" in the selection of 2012 as the cycle's terminus, he said.

Maya astronomers built observatories and, by observing the night skies and using mathematics, learned to accurately predict eclipses and other celestial phenomena. Aveni notes that the start date of the current cycle was likely tied to a solar zenith passage, when the sun crosses directly overhead, and its terminal date will fall on a December solstice, perhaps by design.

These choices, he said, may indicate that the Maya calendar is tied to seasonal agricultural cycles central to ancient survival.

2012 MYTH 4 Planet X Is on a Collision Course With Earth

Some say it's out there: a mysterious Planet X, aka Nibiru, on a collision course with Earth—or at least a disruptive flyby.

A direct hit would obliterate Earth, it's said. Even a near miss, some fear, could shower Earth with deadly asteroid impacts hurled our way by the planet's gravitational wake.

Could such an unknown planet really be headed our way in 2012, even just a little bit?

Well, no. "There is no object out there," NASA astrobiologist Morrison said. "That's probably the most straightforward thing to say."

The origins of this theory actually predate widespread interest in 2012. Popularized in part by a woman who claims to receive messages from extraterrestrials, the Nibiru doomsday was originally predicted for 2003.

"If there were a planet or a brown dwarf or whatever that was going to be in the inner solar system three years from now, astronomers would have been studying it for the past decade and it would be visible to the naked eye by now," Morrison said. "It's not there."

2012 MYTH 5 Solar Storms to Savage Earth

In some 2012 disaster scenarios, our own sun is the enemy.

Our friendly neighborhood star, it's rumored, will produce lethal eruptions of solar flares, turning up the heat on Earthlings.

Solar activity waxes and wanes according to approximately 11-year cycles. Big flares can indeed damage communications and other Earthly systems, but scientists have no indications the sun, at least in the short term, will unleash storms strong enough to fry the planet.

"As it turns out the sun isn't on schedule anyway," NASA astronomer Morrison said. "We expect that this cycle probably won't peak in 2012 but a year or two later."

2012 MYTH 6 Maya Had Clear Predictions for 2012

If the Maya didn't expect the end of time in 2012, what exactly did they predict for that year?

Many scholars who've pored over the scattered evidence on Maya monuments say the empire didn't leave a clear record predicting that anything specific would happen in 2012.

The Maya did pass down a graphic - though undated - end-of-the-world scenario, described on the final page of a circa-1100 text known as the Dresden Codex. The document describes a world destroyed by flood, a scenario imagined in many cultures and probably experienced, on a less apocalyptic scale, by ancient peoples (more on the Dresden Codex).

Aveni, the archaeoastronomer, said the scenario is not meant to be read literally - but as a lesson about human behavior. He likens the cycles to our own New Year period, when the closing of an era is accompanied by frenetic activities and stress, followed by a rebirth period, when many people take stock and resolve to begin living better. In fact, Aveni says, the Maya weren't much for predictions.

"The whole timekeeping scale is very past directed, not future directed," he said. "What you read on these monuments of the Long Count are events that connected Maya rulers with ancestors and the divine.

"The farther back you can plant your roots in deep time the better argument you can make that you're legit," Aveni said. "And I think that's why these Maya rulers were using Long Count time.

"It's not about a fixed prediction about what's going to happen."

License to Wonder

In the wake of my column last week about how the faces you make when speaking different languages might affect your mood, several people wrote and accused me of speculating. I admit it! Indeed, I said as much in the piece.

One of my favorite things to do is to take a set of facts and use them to imagine how the world might work. In writing about some of these ideas, my aim is not to be correct - how can I be, when the answer isn't known? - but to be thought-provoking, to ask questions, to make people wonder.

I mention this because science is usually presented as a body of knowledge - facts to be memorized, equations to be solved, concepts to be understood, discoveries to be applauded. But this approach can give students two misleading impressions.

One is that science is about what we know. One colleague told me that when he was studying science at school, the relentless focus on the known gave him the impression that almost everything had already been discovered. But in fact, science - as the physicist Richard Feynman once wrote - creates an "expanding frontier of ignorance," where most discoveries lead to more questions. (This frontier - this peering into the unknown - is what I especially like to write about.) Moreover, insofar as science is a body of knowledge, that body is provisional: much of what we thought we knew in the past has turned out to be incomplete, or plain wrong.

The second misconception that comes from this "facts, facts, facts" method of teaching science is the impression that scientific discovery progresses as an orderly, logical "creep"; that each new discovery points more or less unambiguously to the next. But in reality, while some scientific work does involve the plodding, brick-by-brick accumulation of evidence, much of it requires leaps of imagination and daring speculation. (This raises the interesting question of when speculation is more likely to generate productive lines of enquiry than deductive creep. I don't know the answer - I'd have to speculate.)

There are plenty of (probably) apocryphal tales about what inspired a great discovery, from Archimedes in his bathtub, to Newton and his apple. But there are also many well-documented accounts of inspiration - or lack of it - in the history of science. Among the most famous is the story of Rosalind Franklin and her non-discovery of the structure of DNA.

Franklin was an expert at getting x-ray diagrams from crystals of molecules. The idea is that the array of spots in the diagram will reveal how the atoms in the crystal are arranged. When Franklin started working on DNA, she obtained superb x-ray diagrams; one of her contemporaries described them as among the most beautiful of any substance ever taken. Indeed, it was from one of her diagrams that James Watson and Francis Crick deduced what the correct structure of DNA must be. (The picture was shown to Watson without Franklin's knowledge.)

She had the data. Why didn't she reach the solution? There are several answers to this; but one is that she had a fixed idea about how the problem should be solved. Namely, she wanted to work out the structure using

the methods she had been taught. These methods are intricate, abstract, and mathematical, and difficult to use on a molecule as complex as DNA. Watson and Crick, meanwhile, were building physical models of what the diagram suggested the structure should be like - an approach that Franklin scorned. What's more, their first model was ludicrously wrong, something that Franklin spotted immediately. But they were willing to play; she wasn't. In other words, she wouldn't, or couldn't, adopt a more intuitive, speculative approach.

Our ability to make scientific discoveries is limited in a number of fundamental ways. One is time: it's hard to do good experiments that last for more than a few weeks. Experiments that run for years are rare; as a result, we know relatively little about long, slow processes. Another constraint is money (no surprise there); a third is ethics (some experiments that would be interesting to do are ethically impossible). Some questions remain uninvestigated because no one stands to profit from the answers. Still others are neglected because they have no obvious bearing on human health or welfare, the areas of research are unfashionable, or the appropriate tools haven't been invented yet. Some problems are just overwhelmingly complex.

But there's one way in which we should not be limited: imagination. As Einstein put it, "Imagination is more important than knowledge. Knowledge is limited. Imagination encircles the world."