

Look ma, no mercury in fillings!

Tooth enamel is hardest material in the human body because it's made almost entirely of minerals. As tough as it may be, however, enamel can be broken down by bacteria, forming cavities and eventually destroying the tooth. That's why dentists repair cavities by filling them with a material to replace the lost enamel. The most common such restorative is a material invented in the 19th-century known as amalgam - the classic silver-black fillings many people have.

Amalgam works well because it is very durable, easy to use, and cheap. The dark fillings are sometimes unsightly, however, and they contain mercury. Because of the mercury, amalgam has raised health and environmental questions - though according to the American Dental Association, the scientific consensus is that the material poses no health hazards. Dentists would love to have a perfectly white material that mimics natural enamel for repairing cavities in teeth, but for the most part, they still use amalgam. Other filling materials have been developed in recent years, but they often have problems with shrinkage or durability.

Kent Coulter and his colleagues at Southwest Research Institute in San Antonio have developed a new proof-of-concept dental restorative material under a program funded by the National Institutes of Health that seeks to replace amalgam with other materials. They will describe the material on November 9 at a meeting of the scientific society AVS in San Jose. The new fillings are made with a plastic-like material containing zirconia nanoplatelets - tiny crystals made of the same sort of material used to make fake diamonds and gem stones. Unlike their costume jewelry cousins, the zirconia nanoplatelets super hard because of a difference in the particular arrangements of the atoms in the material.

Coulter and his colleagues designed a way to make a roll of this material under vacuum. They envision that this material would be lifted from the roll and packed in a dental cavity and then cured - using an ultraviolet lamp or some other means - so that it hardens in place without shrinking. In San Jose, they will describe how they have been developing and testing the performance of these materials in the laboratory. Its use is still several years away from the dentist's chair, however, and the next steps will be first to see if the new material performs as hoped for people with cavities.

The talk "Zirconia Nanoplatelets for use in Dental Restoratives" is at 8:20 a.m. on Monday, November 9, 2009. Abstract: <http://www.avssymposium.org>

Failing the sniff test: Researchers find new way to spot fraud

Companies that commit fraud can find innovative ways to fudge the numbers, making it hard to tell something is wrong by just looking at their financial statements. But research from North Carolina State University unveils a new warning system that sees through accounting tricks by evaluating things that are easily verifiable, such as the number of employees or the square footage that a company owns. If a company says that its profits are up, but these nonfinancial measures (NFM) are down, that's a sign something is probably wrong.

"Some companies commit financial statement fraud, and a good portion of those overstate their revenue," says Dr. Joe Brazel, an assistant professor of accounting at NC State and co-author of the research. "They're able to do that because they can manipulate the accounting. But there are NFMs that can't be manipulated as easily." These NFMs include the number of employees, as well as industry-specific measures, such as the square footage of facilities in the manufacturing sector, the number of retail outlets in the retail sector or the number of hospital visits in the hospital industry.

Brazel explains that companies may fraudulently claim inflated revenues in order to meet market expectations and maintain, or improve, their stock price - as well as protecting company management from criticism.

But, Brazel says, "when these firms commit fraud, we found a huge gap between their reported revenue growth and related NFMs - their revenue was up, but the NFMs were either flat or declining. And when you looked at their competitors, you see revenue growth and NFMs closely correlated. So when you see that gap, it's a red flag - you need to take a closer look."

For example, Brazel says that researchers found a difference of approximately 4 percent between revenue growth and employee growth in companies that did not commit fraud. The difference between revenue growth and employee growth in fraudulent companies was 20 percent. "It's pretty obvious, when you look at it," Brazel says.

Furthermore, the NFM data are easy to find. Brazel explains that each company's NFMs and revenue numbers are disclosed in the same financial filings, which the company is required to submit each year to the U.S. Securities and Exchange Commission.

The researchers evaluated 220 companies when evaluating employee growth versus revenue growth - 110 companies that were known to have committed fraud between 1994 and 2002, and 110 that had not. Similarly, they looked at 100 companies when evaluating other NFMs, 50 fraudulent and 50 that had not committed fraud.

The researchers are now in the process of developing an online tool that will perform the NFM analysis, as well as conducting experimental studies with auditors to help detect fraud and with investors to help make wise investment decisions.

The paper, "Using Nonfinancial Measures to Assess Fraud Risk," was co-authored by Brazel, Dr. Keith Jones of George Mason University and Dr. Mark Zimbelman of Brigham Young University. The work was funded by the Institute of Internal Auditors Research Foundation and the Financial Industry Regulatory Authority Investor Education Foundation, and will be published in the Journal of Accounting Research later this year.

Words, gestures are translated by same brain regions, says new research **Findings may further our understanding of how language evolved**

Your ability to make sense of Groucho's words and Harpo's pantomimes in an old Marx Brothers movie takes place in the same regions of your brain, says new research funded by the National Institute on Deafness and Other Communication Disorders (NIDCD), one of the National Institutes of Health.

In a study published in this week's Early Edition of Proceedings of the National Academy of Sciences (PNAS), researchers have shown that the brain regions that have long been recognized as a center in which spoken or written words are decoded are also important in interpreting wordless gestures. The findings suggest that these brain regions may play a much broader role in the interpretation of symbols than researchers have thought and, for this reason, could be the evolutionary starting point from which language originated.

"In babies, the ability to communicate through gestures precedes spoken language, and you can predict a child's language skills based on the repertoire of his or her gestures during those early months," said James F. Battey, Jr., M.D., Ph.D., director of the NIDCD. "These findings not only provide compelling evidence regarding where language may have come from, they help explain the interplay that exists between language and gesture as children develop their language skills."

Scientists have known that sign language is largely processed in the same regions of the brain as spoken language. These regions include the inferior frontal gyrus, or Broca's area, in the front left side of the brain, and the posterior temporal region, commonly referred to as Wernicke's area, toward the back left side of the brain. It isn't surprising that signed and spoken language activate the same brain regions, because sign language operates in the same way as spoken language does—with its own vocabulary and rules of grammar.

In this study, NIDCD researchers, in collaboration with scientists from Hofstra University School of Medicine, Hempstead, N.Y., and San Diego State University, wanted to find out if non-language-related gestures—the hand and body movements we use that convey meaning on their own, without having to be translated into specific words or phrases—are processed in the same regions of the brain as language is. Two types of gestures were considered for the study: pantomimes, which mimic objects or actions, such as unscrewing a jar or juggling balls, and emblems, which are commonly used in social interactions and which signify abstract, usually more emotionally charged concepts than pantomimes. Examples include a hand sweeping across the forehead to indicate "it's hot in here!" or a finger to the lips to signify "be quiet." While inside a functional MRI machine, 20 healthy, English-speaking volunteers - nine males and 11 females - watched video clips of a person either acting out one of the two gesture types or voicing the phrases that the gestures represent. As controls, volunteers also watched clips of the person using meaningless gestures or speaking pseudowords that had been chopped up and randomly reorganized so the brain would not interpret them as language. Volunteers watched 60 video clips for each of the six stimuli, with the clips presented in 45-second time blocks at a rate of 15 clips per block. A mirror attached to the head enabled the volunteer to watch the video projected on the scanner room wall. The scientists then measured brain activity for each of the stimuli and looked for similarities and differences as well as any communication occurring between individual parts of the brain.

The researchers found that for the gesture and spoken language stimuli, the brain was highly activated in the inferior frontal and posterior temporal areas, the long-recognized language regions of the brain.

"If gesture and language were not processed by the same system, you'd have spoken language activating the inferior frontal and posterior temporal areas, and gestures activating other parts of the brain," said Allen Braun, M.D., senior author on the paper, "But in fact we found virtual overlap."

Current thinking in the study of language is that, like a smart search engine that pops up the most suitable Web site at the top of its search results, the posterior temporal region serves as a storehouse of words from which the inferior frontal gyrus selects the most appropriate match. The researchers suggest that, rather than being limited to deciphering words alone, these regions may be able to apply meaning to any incoming symbols, be they words, gestures, images, sounds, or objects. According to Dr. Braun, these regions also may present a clue into how language evolved.

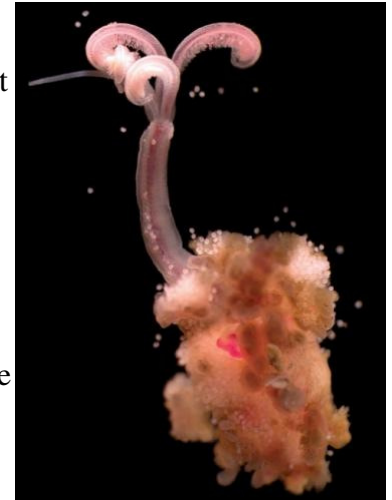
"Our results fit a longstanding theory which says that the common ancestor of humans and apes communicated through meaningful gestures and, over time, the brain regions that processed gestures became adapted for using words," he said. "If the theory is correct, our language areas may actually be the remnant of this ancient communication system, one that continues to process gesture as well as language in the human brain."

Dr. Braun adds that developing a better understanding of the brain systems that support gestures and words may help in the treatment of some patients with aphasia, a disorder that hinders a person's ability to produce or understand language.

The bizarre lives of bone-eating worms

The females of the recently discovered *Osedax* marine worms feast on submerged bones via a complex relationship with symbiotic bacteria, and they are turning out to be far more diverse and widespread than scientists expected. Californian researchers investigating the genetic history of *Osedax* worms have found that up to twelve further distinct evolutionary lineages exist beyond the five species already described. The new findings about these beautiful sea creatures with unusual sexual and digestive habits are published today in the online open access journal *BMC Biology*.

Geneticists placed the new *Osedax* genus in the polychaete annelid family Siboglinidae when it was first discovered on whalebones in Monterey Bay, California in 2004. Siboglinidae or 'beard worms' are among the few known animals that, as adults, completely lack a mouth, gut and anus, and rely entirely on endosymbiotic bacteria for their nutrition. Found to date in the eastern and western Pacific and the north Atlantic, *Osedax* are unique because they penetrate and digest bones using bacteria housed in a complex branching "root" system. Sexual inequality is also part of daily life for *Osedax*: harems of dwarf males live inside the tubes of the much larger female.



Osedax mucofloris

Robert Vrijenhoek and Shannon Johnson from Monterey Bay Aquarium Research Institute, together with Greg Rouse from Scripps Institution of Oceanography, both in California, US looked at two mitochondrial genes and three nuclear genes from Monterey Bay *Osedax* worms. Their study revealed 17 distinct evolutionary lineages, clustered into five clades (groups including a single common ancestor and all its descendants). The researchers could tell these clades apart based on the anatomy of the worms as well as their genetics.

Precisely when these *Osedax* boneworms split from their other beard worm relatives depends whether researchers pick a 'molecular clock' calibrated for shallow or deep-sea invertebrates (*Osedax* have been found at depths ranging from 30 to 3000 metres). Based on the shallow invertebrate scenario *Osedax* probably branched off about 45 million years ago when archeocete cetaceans first appeared and then diversified during the late Oligocene and early Miocene when toothed and baleen whales arrived. Using the slower, deep-sea invertebrate clock model *Osedax* evolved during the Cretaceous and began to diversify during the Early Paleocene, at least 20 million years before the origin of large marine mammals.

Research to settle the evolutionary age of *Osedax* might examine fossil bones from Cretaceous marine reptiles and late Oligocene cetaceans to find possible trace fossils left by *Osedax* roots, suggest the authors. "Regardless, the present molecular evidence suggests that the undescribed *Osedax* lineages comprise evolutionarily significant units that have been separate from one another for many millions of years, and provide a solid foundation for their future descriptions as new species," concludes Vrijenhoek.

*Notes to Editors: After the embargo, article available at journal website: <http://www.biomedcentral.com/bmcbiol/>
1. A remarkable diversity of bone-eating worms (*Osedax*; Siboglinidae; Annelida) Robert C Vrijenhoek, Shannon B Johnson and Greg W Rouse *BMC Biology* (in press)*

CSHL study shows that some malignant tumors can be shut down after all Aggressive tumors lacking p53 protein stop dead in their tracks when p53's sister protein -- TAp63 -- steps in

Cold Spring Harbor, N.Y. – Oncologists have had their hands tied because more than half of all human cancers have mutations that disable a protein called p53. As a critical anti-cancer watchdog, p53 masterminds several cancer-fighting operations within cells. When cells lose p53, tumors grow aggressively and often cannot be treated.

These tumors might be tough, but they're not invincible, suggests a new study from Cold Spring Harbor Laboratory (CSHL). The chink in the tumors' armor, according to CSHL Associate Professor Alea Mills, Ph.D., is a protein called TAp63, an older sibling of p53 that's usually intact and not mutated in most cancers.

Mills and her team have succeeded in shutting off the growth of tumors in which p53 is missing by turning up the production of TAp63 proteins, which make up one class of proteins produced by the p63 gene. TAp63

completely blocked tumor initiation, the team found, by inducing senescence, a state of growth arrest in which tumor cells are still metabolically alive but fail to divide. More importantly, turning up the levels of TAp63 in cells that did not have p53 blocked the progression of established tumors in mice.

"We were very excited to see that TAp63 shuts down cancer completely independently of p53," says Mills. "This means that we now have a way of attacking cancers that have damaged p53, which are very difficult to treat in the clinic." The study, funded by a Research Scholar Award from the American Cancer Society, appears online ahead of print on November 8th in *Nature Cell Biology*.

TAp63 protects from cancer

"p53 is a double-edged sword," says Mills, who discovered it when she was a postdoctoral researcher almost a decade ago. Of the six different proteins that are produced from the p63 gene, three promote activities that could lead to cancer. The remaining three, which are TAp63 versions, do the opposite: prevent cancer by triggering senescence—a process that shuts down the tumor.

Using a genetic maneuver called chromosome engineering, the CSHL team has found that TAp63 staves off cancer via senescence. The maneuver enabled them to specifically wipe out the TAp63 proteins while leaving the other p63 proteins intact. When exposed to the cancer-causing protein Ras, normal cells underwent senescence and could not form tumors. But cells without TAp63 failed to undergo senescence and developed into massive tumors.

When p53 and TAp63 were both missing, Ras caused extremely rapid and aggressive tumors. This tumor growth was much more severe than in tumors lacking either TAp63 or p53, suggesting that the two related proteins, working together, pack a stronger anti-cancer punch than either one alone.

A future anti-cancer strategy?

The team found that TAp63 could also substitute for p53 in its ability to halt tumor growth. When TAp63 was turned on in Ras-producing cells that were missing p53, tumors never started. "This suggests that TAp63 overrides cancer-promoting signals and prevents cancer from even forming," explains Mills.

The team went a step further and showed that in addition to blocking the initiation of tumors, TAp63 could also shut down tumors that were already established. With help from Professor Scott Lowe, Ph.D., another researcher at CSHL, Mills' team genetically tricked tumors into producing TAp63 when they were exposed to a compound called doxycycline.

Now being able to turn on TAp63 at will, the team transplanted these cells (which lack p53 and overproduce Ras) into mice and monitored for tumors. Once the tumors formed, a "mouse clinic" was set up: half of the "patients" were treated with doxycycline to induce TAp63 production, whereas the other half received a placebo. Tumor growth continued in the placebo group, with the tumors becoming five times larger within a week. In contrast, the tumors in the mice exposed to doxycycline were abruptly shut down, and the tumors even shrank in size. Mills speculates that the tumor cells disappear because the newly senescent cells might attract the attention of the immune system, which have the ability to destroy them.

Mills proposes that robustly activating TAp63 might be a viable anti-cancer strategy in the future. Alternatively, finding ways to stabilize the TAp63 that is already being made in cells or blocking pathways that combat TAp63 activities might also work, she speculates.

"TAp63 induces senescence and suppresses tumorigenesis in vivo," was published online ahead of print on November 8th in Nature Cell Biology. The full citation is: Xuecui Guo, William M. Keyes, Cristian Papazoglu, Johannes Zuber, Wangzhi Li, Scott W. Lowe, Hannes Vogel and Alea A. Mills.

UCI embryonic stem cell therapy restores walking ability in rats with neck injuries

Study supports expansion of first human trial to include those with cervical spinal cord damage

Irvine, Calif. - The first human embryonic stem cell treatment approved by the FDA for human testing has been shown to restore limb function in rats with neck spinal cord injuries - a finding that could expand the clinical trial to include people with cervical damage.

In January, the U.S. Food & Drug Administration gave Geron Corp. of Menlo Park, Calif., permission to test the UC Irvine treatment in individuals with thoracic spinal cord injuries, which occur below the neck. However, trying it in those with cervical damage wasn't approved because preclinical testing with rats hadn't been completed.

Results of the cervical study currently appear online in the journal *Stem Cells*. UCI scientist Hans Keirstead hopes the data will prompt the FDA to authorize clinical testing of the treatment in people with both types of spinal cord damage. About 52 percent of spinal cord injuries are cervical and 48 percent thoracic.

"People with cervical damage often have lost or impaired limb movement and bowel, bladder or sexual function, and currently there's no effective treatment. It's a challenging existence," said Keirstead, a primary

author of the study. "What our therapy did to injured rodents is phenomenal. If we see even a fraction of that benefit in humans, it will be nothing short of a home run."

A week after test rats with 100 percent walking ability suffered neck spinal cord injuries, some received the stem cell treatment. The walking ability of those that didn't degraded to 38 percent. Treated rats' ability, however, was restored to 97 percent.

UCI's therapy utilizes human embryonic stem cells destined to become spinal cord cells called oligodendrocytes. These are the building blocks of myelin, the biological insulation for nerve fibers that's critical to proper functioning of the central nervous system. When myelin is stripped away through injury or disease, paralysis can occur.

Lead author and doctoral student Jason Sharp, Keirstead and colleagues discovered that the stem cells not only rebuilt myelin but prevented tissue death and triggered nerve fiber regrowth. They also suppressed the immune response, causing an increase in anti-inflammatory molecules.

"The transplant created a healing environment in the spinal cord," said Keirstead, who is co-director of the Sue & Bill Gross Stem Cell Research Center and on the faculty of the Reeve-Irvine Research Center - named for late actor Christopher Reeve, who became a quadriplegic after a cervical spinal cord injury.

In addition to Keirstead and Sharp, Jennifer Frame, Monica Siegenthaler and Dr. Gabriel Nistor of UCI worked on the study, which was supported by Geron Corp., a University of California Discovery Grant, the Roman Reed Spinal Cord Injury Research Fund of California, Research for Cure, and individual donations to the Reeve-Irvine Research Center.

Vanished Persian Army Said Found in Desert

Bones, jewelry and weapons found in Egyptian desert may be the remains of Cambyses' army that vanished 2,500 years ago.

By Rossella Lorenzi

The remains of a mighty Persian army said to have drowned in the sands of the western Egyptian desert 2,500 years ago might have been finally located, solving one of archaeology's biggest outstanding mysteries, according to Italian researchers.

Bronze weapons, a silver bracelet, an earring and hundreds of human bones found in the vast desolate wilderness of the Sahara desert have raised hopes of finally finding the lost army of Persian King Cambyses II. The 50,000 warriors were said to be buried by a cataclysmic sandstorm in 525 B.C.

[**WATCH VIDEO: Take a closer look at a valley of bones that researchers think may belong to the fabled lost army of Cambyses II.**](#)

[**VIEW A SLIDE SHOW: See some of the remains found in the Sahara Desert.**](#)

"We have found the first archaeological evidence of a story reported by the Greek historian Herodotus," Dario Del Bufalo, a member of the expedition from the University of Lecce, told Discovery News.

According to Herodotus (484-425 B.C.), Cambyses, the son of Cyrus the Great, sent 50,000 soldiers from Thebes to attack the Oasis of Siwa and destroy the oracle at the Temple of Amun after the priests there refused to legitimize his claim to Egypt. After walking for seven days in the desert, the army got to an "oasis," which historians believe was El-Kharga. After they left, they were never seen again.

"A wind arose from the south, strong and deadly, bringing with it vast columns of whirling sand, which entirely covered up the troops and caused them wholly to disappear," wrote Herodotus.

A century after Herodotus wrote his account, Alexander the Great made his own pilgrimage to the oracle of Amun, and in 332 B.C. he won the oracle's confirmation that he was the divine son of Zeus, the Greek god equated with Amun.

The tale of Cambyses' lost army, however, faded into antiquity. As no trace of the hapless warriors was ever found, scholars began to dismiss the story as a fanciful tale.

Now, two top Italian archaeologists claim to have found striking evidence that the Persian army was indeed swallowed in a sandstorm. Twin brothers Angelo and Alfredo Castiglioni are already famous for their discovery 20 years ago of the ancient Egyptian "city of gold" Berenike Panchrysos.

Presented recently at the archaeological film festival of Rovereto, the discovery is the result of 13 years of research and five expeditions to the desert.

"It all started in 1996, during an expedition aimed at investigating the presence of iron meteorites near Bahrin, one small oasis not far from Siwa," Alfredo Castiglioni, director of the Eastern Desert Research Center (CeRDO) in Varese, told Discovery News. While working in the area, the researchers noticed a half-buried pot and some human remains. Then the brothers spotted something really intriguing - what could have been a natural shelter. It was a rock about 35 meters (114.8 feet) long, 1.8 meters (5.9 feet) in height and 3 meters (9.8 feet) deep. Such natural formations occur in the desert, but this large rock was the only one in a large area.

"Its size and shape made it the perfect refuge in a sandstorm," Castiglioni said.

Right there, the metal detector of Egyptian geologist Aly Barakat of Cairo University located relics of ancient warfare: a bronze dagger and several arrow tips.

"We are talking of small items, but they are extremely important as they are the first Achaemenid objects, thus dating to Cambyses' time, which have emerged from the desert sands in a location quite close to Siwa," Castiglioni said.

About a quarter mile from the natural shelter, the Castiglioni team found a silver bracelet, an earring and few spheres which were likely part of a necklace.

"An analysis of the earring, based on photographs, indicate that it certainly dates to the Achaemenid period. Both the earring and the spheres appear to be made of silver. Indeed a very similar earring, dating to the fifth century B.C., has been found in a dig in Turkey," Andrea Cagnetti, a leading expert of ancient jewelry, told Discovery News.

In the following years, the Castiglioni brothers studied ancient maps and came to the conclusion that Cambyses' army did not take the widely believed caravan route via the Dakhla Oasis and Farafra Oasis.

"Since the 19th century, many archaeologists and explorers have searched for the lost army along that route. They found nothing. We hypothesized a different itinerary, coming from south. Indeed we found that such a route already existed in the 18th Dynasty," Castiglioni said.

According to Castiglioni, from El Kargha the army took a westerly route to Gilf El Kebir, passing through the Wadi Abd el Melik, then headed north toward Siwa. "This route had the advantage of taking the enemy aback. Moreover, the army could march undisturbed. On the contrary, since the oasis on the other route were controlled by the Egyptians, the army would have had to fight at each oasis," Castiglioni said.

To test their hypothesis, the Castiglioni brothers did geological surveys along that alternative route. They found desiccated water sources and artificial wells made of hundreds of water pots buried in the sand. Such water sources could have made a march in the desert possible.

"Termoluminescence has dated the pottery to 2,500 years ago, which is in line with Cambyses' time," Castiglioni said.

In their last expedition in 2002, the Castiglioni brothers returned the location of their initial discovery. Right there, some 100 km (62 miles) south of Siwa, ancient maps had erroneously located the temple of Amun.

The soldiers believed they had reached their destination, but instead they found the khamsin - the hot, strong, unpredictable southeasterly wind that blows from the Sahara desert over Egypt.

"Some soldiers found refuge under that natural shelter, other dispersed in various directions. Some might have reached the lake of Sitra, thus surviving," Castiglioni said.



Hundreds of bleached bones and skulls found in the desolate wilderness of the Sahara desert may be the remains of the long lost Cambyses' army, according to Italian researchers.

Alfredo and Angelo Castiglioni

At the end of their expedition, the team decided to investigate Bedouin stories about thousands of white bones that would have emerged decades ago during particular wind conditions in a nearby area.

Indeed, they found a mass grave with hundreds of bleached bones and skulls.

"We learned that the remains had been exposed by tomb robbers and that a beautiful sword which was found among the bones was sold to American tourists," Castiglioni said.

Among the bones, a number of Persian arrow heads and a horse bit, identical to one appearing in a depiction of an ancient Persian horse, emerged. "In the desolate wilderness of the desert, we have found the most precise location where the tragedy occurred," Del Bufalo said.

The team communicated their finding to the Geological Survey of Egypt and gave the recovered objects to the Egyptian authorities. "We never heard back. I'm sure that the lost army is buried somewhere around the area we surveyed, perhaps under five meters (16.4 feet) of sand."

Mosalam Shaltout, professor of solar physics at the National Research Institute of Astronomy and Geophysics, Helwan, Cairo, believes it is very likely that the army took an alternative western route to reach Siwa.

"I think it depended on their bad planning for sufficient water and meals during the long desert route and most of all by the occurrence of an eruptive Kamassen sandy winds for more than one day," Shaltout told Discovery News.

Piero Pruneti, editor of Archeologia Viva, Italy's most important archaeology magazine, is also impressed by the team's work. "Judging from their documentary, the Castiglioni's have made a very promising finding,"

Pruneti told Discovery News. "Indeed, their expeditions are all based on a careful study of the landscape...An in-depth exploration of the area is certainly needed!"

Long-term statin use associated with decreased risk of gallstones requiring surgery

Use of the cholesterol-lowering drugs statins for more than a year is associated with a reduced risk of having gallstones requiring surgery, according to a study in the November 11 issue of JAMA.

In developed countries, approximately 10 percent to 20 percent of white adults have gallstones, which can cause pain and complications. Gallstone disease is a leading cause of gastrointestinal tract illness and inpatient admission in western countries and represents a serious burden for health care systems worldwide. More than 700,000 cholecystectomies (removal of the gallbladder) are performed annually in the United States, according to background information in the article.

Gallstones are classified as either cholesterol (80 percent-90 percent) or pigment stones (10 percent-20 percent), with cholesterol stones formed on the basis of cholesterol-supersaturated bile. "Statins decrease hepatic [liver] cholesterol biosynthesis and may therefore lower the risk of cholesterol gallstones by reducing the cholesterol concentration in the bile. Data on this association in humans are scarce," the authors write.

Michael Bodmer, M.D., M.Sc., of University Hospital, Basel, Switzerland, and colleagues conducted a large long-term observational study to examine the association between statin use and the risk of developing gallstone disease followed by cholecystectomy. The study included data from between 1994 and 2008 from the UK-based General Practice Research Database. A total of 27,035 patients with cholecystectomy and 106,531 matched controls were identified, including 2,396 patients and 8,868 controls who had statin use.

The researchers found that compared with nonuse, current statin use (last prescription recorded within 90 days before the first-time diagnosis of the disease) was 1.0 percent for patients and 0.8 percent for controls for 1 to 4 prescriptions; 2.6 percent vs. 2.4 percent for 5 to 19 prescriptions, and 3.2 percent vs. 3.7 percent for 20 or more prescriptions.

"This large observational study provides evidence that patients with long-term statin use have a reduced risk of gallstone disease followed by cholecystectomy compared with patients without statin use. However, the odds ratio was not decreased for patients with short-term statin use but started to decrease after 5 prescriptions, reflecting approximately 1 to 1.5 years of treatment. The risk estimate was consistent across age and sex groups. Adjustment for important risk factors for gallstone disease did not materially alter the results," the researchers write.

The authors add that the observed risk reduction suggests a class effect for all statins, and that there was a tendency toward a lower risk of gallstone disease for high-dose statin use compared with low-dose exposure. A substantially increased gallstone risk with cholecystectomy was found for patients with high body mass indexes and for patients with estrogen use. "Our findings may be of clinical relevance given that gallstone disease represents a major burden for health care systems," the researchers conclude.

(JAMA. 2009;302[18]:2001-2007. Available pre-embargo to the media at www.jamamedia.org)

Warm-blooded dinosaurs worked up a sweat

Were dinosaurs endothermic (warm-blooded) like present-day mammals and birds or ectothermic (cold-blooded) like present-day lizards? Reporting in PLoS ONE, Herman Pontzer at Washington University in St Louis and colleagues sought to answer this simple-sounding yet important question by determining whether a variety of dinosaurs and closely-related extinct animals were ectothermic or endothermic and when, where, and how often in the dinosaur family tree this important trait may have evolved, using a combination of simple measurements, rigorous computer modelling techniques and their knowledge of physiology in present-day animals.

The question of whether dinosaurs were endothermic or ectothermic has important implications: if dinosaurs were endothermic, they would have had the potential for athletic abilities rivalling those of present day birds and mammals. They could have survived in colder habitats that would kill ectotherms, such as high mountain ranges and the polar regions, allowing them to cover the entire Mesozoic landscape. These advantages come at a price, however; endothermic animals require much more food than their ectothermic counterparts because their rapid metabolisms fatally malfunction if they cool down too much, and so a constant supply of fuel is required.

Studies of present-day animals have shown that endothermic animals can sustain much higher rates of energy use (that is, they have a higher "VO₂max") than ectothermic animals. Following this observation, Pontzer and colleagues Vivian Allen and John Hutchinson at The Royal Veterinary College, UK, reasoned that if the energy cost of walking and running could be estimated in dinosaurs, the results might show whether they were warm- or cold-blooded. If walking and running burned more energy than a cold-blooded physiology can supply, these dinosaurs were probably warm-blooded.

But metabolism and energy use are complex biological processes, and all that remains of extinct dinosaurs are their bones. A recent work of Pontzer's showed that the energy cost of walking and running is strongly associated with leg length – so much so that hip height (the distance from the hip joint to the ground) can predict the observed cost of locomotion with 98% accuracy for a wide variety of land animals. As hip height can be simply estimated from the length of fossilized leg bones, Pontzer and colleagues were able to use this to obtain simple but reliable estimates of locomotor cost for dinosaurs.

To back up these estimates, the researchers also used a more complex method, which estimates the actual volume of leg muscle dinosaurs would have had to activate in order to move. Working this out in extinct animals involved using basic principles of locomotion: determining how large the forces required from the legs would have to be to move the animal and how much muscle would be needed to supply these forces.

The team then applied these principles to examine recent anatomical models of 14 extinct dinosaur species, using detailed measurements of the fossilised bony levers that limb muscles attached to. From this, the authors were able to reconstruct the mechanical advantage of the limb muscles and calculate the active muscle volume required for each dinosaur to walk or run at different speeds. The cost of activating this muscle was then compared to similar costs in present-day endothermic and ectothermic animals.

The results of both methods suggest that based on the energy they consumed when moving, many dinosaurs were probably endothermic, athletic animals because their energy requirements during walking and running were too high for cold-blooded animals to produce.

Interestingly, when the results for each dinosaur were arranged into an evolutionary family tree, the authors found that endothermy might be the ancestral condition for all dinosaurs. This pushes the evolution of endothermy further back into the ancient past than many researchers expected, suggesting that dinosaurs were athletic, endothermic animals throughout the Mesozoic era. This early adoption of high metabolic rates may be one of the key factors in the massive evolutionary success that dinosaurs enjoyed during the Triassic, Jurassic and Cretaceous periods, and continue to enjoy now in feathery, flying form.

The debate over dinosaur physiology will no doubt continue to evolve, and while the physiology of long-extinct species will always remain somewhat speculative, the authors hope that the methods developed in this study will provide a new tool for researchers in the field.

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Citation: Pontzer H, Allen V, Hutchinson JR (2009) Biomechanics of Running Indicates Endothermy in Bipedal Dinosaurs. *PLoS ONE* 4(11): e7783.

Foreign Subtitles Improve Speech Perception

Do you speak English as a second language well, but still have trouble understanding movies with unfamiliar accents, such as Brad Pitt's southern accent in Quentin Tarantino's *Inglourious Basterds*? In a new study, published in the open-access journal *PLoS One*, Holger Mitterer (Max Planck Institute for Psycholinguistics) and James McQueen (MPI and Radboud University Nijmegen) show how you can improve your second-language listening ability by watching the movie with subtitles - as long as these subtitles are in the same language as the film. Subtitles in one's native language, the default in some European countries, may actually be counter-productive to learning to understand foreign speech.

Mitterer and McQueen show that listeners can tune in to an unfamiliar regional accent in a foreign language. Dutch students showed improvements in their ability to recognise Scottish or Australian English after only 25 minutes of exposure to video material. English subtitling during exposure enhanced this learning effect; Dutch subtitling reduced it.

In the study, Dutch students who were unfamiliar with Scottish and Australian English watched either an episode of the Australian sitcom *Kath & Kim* or a shortened version of *Trainspotting*, which depicts a Scottish drug addict, Renton, and his friends - with English subtitles, Dutch subtitles or no subtitles. After this exposure, participants were asked to repeat back as many words as they could from 80 audio excerpts taken from each source spoken by the main characters (*Kath* from *Kath & Kim*; *Renton* from *Trainspotting*), half of which had already been heard by the participants in the extracts and half were new to the participants (from a different *Kath & Kim* episode or from a part of *Trainspotting* that was edited out).

The researchers found that English subtitles were associated with the best performance on both previously heard and new material but although Dutch subtitles also enhanced performance on the old items, they led to a worse performance on the new materials. The participants seemed to be using the semantic (meaning-based) information in the Dutch subtitles when listening to the English speech and so the Dutch subtitles appear to

have helped the participants to decipher which English words had been uttered, as seen in the improved recognition of previously heard materials. This did not, however, allow participants to retune their phonetic categories so as to improve their understanding of new utterances from the same speaker.

Listeners can use their knowledge about how words normally sound to adjust the way they perceive speech that is spoken in an unfamiliar way. This seems to happen with subtitles too. If an English word was spoken with a Scottish accent, English subtitles usually told the perceiver what that word was, and hence what its sounds were. This made it easier for the students to tune in to the accent. In contrast, the Dutch subtitles did not provide this teaching function, and, because they told the viewer what the characters in the film meant to say, the Dutch subtitles may have drawn the students' attention away from the unfamiliar speech.

These findings also have educational implications. Since foreign subtitles seem to help with adaptation to foreign speech in adults, they should perhaps be used whenever available (e.g. on a DVD) to boost listening skills during second-language learning. Moreover, since native-language subtitles interfere with this kind of learning, such subtitles in television programmes should be made optional for the viewer.

This work was funded by the Max-Planck-Gesellschaft zur Förderung der Wissenschaften.

Men leave: Separation and divorce far more common when the wife is the patient

SEATTLE – A woman is six times more likely to be separated or divorced soon after a diagnosis of cancer or multiple sclerosis than if a man in the relationship is the patient, according to a study that examined the role gender played in so-called "partner abandonment." The study also found that the longer the marriage the more likely it would remain intact.

The study confirmed earlier research that put the overall divorce or separation rate among cancer patients at 11.6 percent, similar to the population as a whole. However, researchers were surprised by the difference in separation and divorce rates by gender. The rate when the woman was the patient was 20.8 percent compared to 2.9 percent when the man was the patient.

"Female gender was the strongest predictor of separation or divorce in each of the patient groups we studied," said Marc Chamberlain, M.D., a co-corresponding author and director of the neuro-oncology program at the Seattle Cancer Care Alliance (SCCA). Chamberlain is also a professor of neurology and neurosurgery at the University of Washington School of Medicine.

The study, "Gender Disparity in the Rate of Partner Abandonment in Patients with Serious Medical Illness," was published in the Nov. 15 issue of the journal *Cancer*. The other corresponding author is Michael Glanz, M.D., of the Huntsman Cancer Institute at the University of Utah School of Medicine.

Why men leave a sick spouse can be partly explained by their lack of ability, compared to women, to make more rapid commitments to being caregivers to a sick partner and women's better ability to assume the burdens of maintaining a home and family, the study authors said.

Researchers at three medical centers - the SCCA, Huntsman and Stanford University School of Medicine -- enrolled a total of 515 patients in 2001 and 2002 and followed them until February 2006. The men and women were in three diagnostic groups: those with a malignant primary brain tumor (214 patients), those with a solid tumor with no central nervous system involvement (193 patients) and those with multiple sclerosis (108 patients). Almost half of the patients were women.

Chamberlain said the study was initiated because doctors noticed that in their neuro-oncology practices, divorce occurred almost exclusively when the wife was the patient. The researchers enrolled groups of patients with other cancers and with multiple sclerosis to separate the impact of oncologic versus neurological disease.

The results showed a stronger gender disparity for divorce when the wife was the patient in the general oncology and multiple sclerosis groups (93 percent and 96 percent respectively, compared to 78 percent for the primary brain tumor group).

The study also found correlations between age and length of marriage and the likelihood of divorce or separation. The older the woman was the more likely her partnership would end. However, longer marriages remained more stable.

Researchers also measured some health and quality of life outcomes among the patients who separated or divorced. They found that patients used more antidepressants, participated less in clinical trials, had more frequent hospitalizations, were less likely to complete radiation therapy and more likely not to die at home, according to the study.

"We believe that our findings apply generally to patients with life-altering medical illness," the authors wrote. "We recommend that medical providers be especially sensitive to early suggestions of marital discord in couples affected by the occurrence of a serious medical illness, especially when the woman is the affected spouse and it occurs early in the marriage. Early identification and psychosocial intervention might reduce the frequency of divorce and separation, and in turn improve quality of life and quality of care."

Will probe's upcoming fly-by unlock exotic physics?

* 18:17 10 November 2009 by David Shiga

What's causing spacecraft to mysteriously accelerate? The Rosetta comet chaser's fly-by of Earth on 13 November is a perfect opportunity to get to the bottom of it.

The anomaly emerged in 1990, when NASA's Galileo spacecraft whizzed by Earth to get a boost from our planet's gravity and gained 3.9 millimetres per second more than expected. And the European Space Agency's Rosetta spacecraft had an unexpected increase of about 1.8 millimetres per second during a previous fly-by of Earth in 2005.

Scientists have ruled out various mundane explanations like atmospheric drag or the effect of deviations in Earth's shape. This has led some to propose that exotic new physics is involved, such as modifications of Einstein's general relativity, the currently accepted theory of gravity.

Comet-chaser clue

All eyes are now on Rosetta, which is set to swing by Earth again at 0745 GMT on 13 November. It is en route to a comet, and will travel around 2500 kilometres above our planet's surface at over 13 kilometres per second. If it gains an extra 1.1 millimetres per second relative to Earth, it would vindicate a formula that reproduces the anomalies seen so far.

The formula, published in 2008 by ex-NASA scientist John Anderson and his team, hints that Earth's rotation may be distorting space-time more than expected and thus influencing nearby spacecraft, though no one can explain how. General relativity predicts that spinning bodies distort the fabric of surrounding space, but the expected amount is far too small to explain the observed anomalies.

"I am definitely looking forward to this one," says Anderson, who is working with members of the Rosetta team to watch for an anomaly.

However, any anomaly will not be immediately obvious because the expected change is tiny. "I anticipate a few days or weeks before we know if an anomaly occurred," he says.

Curiously, Rosetta's 2007 flyby of Earth produced no anomaly. That might be because of its much higher altitude, about 5300 kilometres above Earth's surface, Anderson says. He suggests the effect may get weaker with distance from Earth: "There is most likely some dependence on distance – we just do not know what it is."

Ancient penguin DNA raises doubts about accuracy of genetic dating techniques

Corvallis, Ore. - Penguins that died 44,000 years ago in Antarctica have provided extraordinary frozen DNA samples that challenge the accuracy of traditional genetic aging measurements, and suggest those approaches have been routinely underestimating the age of many specimens by 200 to 600 percent.

In other words, a biological specimen determined by traditional DNA testing to be 100,000 years old may actually be 200,000 to 600,000 years old, researchers suggest in a new report in *Trends in Genetics*, a professional journal. The findings raise doubts about the accuracy of many evolutionary rates based on conventional types of genetic analysis.

"Some earlier work based on small amounts of DNA indicated this same problem, but now we have more conclusive evidence based on the study of almost an entire mitochondrial genome," said Dee Denver, an evolutionary biologist with the Center for Genome Research and Biocomputing at Oregon State University.

"The observations in this report appear to be fundamental and should extend to most animal species," he added. "We believe that traditional DNA dating techniques are fundamentally flawed, and that the rates of evolution are in fact much faster than conventional technologies have led us to believe."

The findings, researchers say, are primarily a challenge to the techniques used to determine the age of a sample by genetic analysis alone, rather than by other observations about fossils. In particular, they may force a widespread re-examination of determinations about when one species split off from another, if that determination was based largely on genetic evidence.

For years, researchers have been using their understanding of the rates of genetic mutations in cells to help date ancient biological samples, and in what's called "phylogenetic comparison," used that information along with fossil evidence to determine the dates of fossils and the history of evolution. The rates of molecular evolution "underpin much of modern evolutionary biology," the researchers noted in their report.

"For the genetic analysis to be accurate, however, you must have the right molecular clock rate," Denver said. "We now think that many genetic changes were happening that conventional DNA analysis did not capture. They were fairly easy to use and apply but also too indirect, and inaccurate as a result."

This conclusion, researchers said, was forced by the study of many penguin bones that were well preserved by sub-freezing temperatures in Antarctica. These penguins live in massive rookeries, have inhabited the same areas for thousands of years, and it was comparatively simple to identify bones of different ages just by digging deeper in areas where they died and their bones piled up.

For their study, the scientists used a range of mitochondrial DNA found in bones ranging from 250 years to about 44,000 years old. “In a temperate zone when an animal dies and falls to the ground, their DNA might degrade within a year,” Denver said. “In Antarctica the same remains are well-preserved for tens of thousands of years. It’s a remarkable scientific resource.”

A precise study of this ancient DNA was compared to the known ages of the bones, and produced results that were far different than conventional analysis would have suggested. Researchers also determined that different types of DNA sequences changed at different rates.

Aside from raising doubts about the accuracy of many specimens dated with conventional approaches, the study may give researchers tools to improve their future dating estimates, Denver said.

Collaborators on the research included scientists from OSU, Griffith University in Australia, the University of Auckland in New Zealand, Massey University in New Zealand, University of North Carolina in Wilmington, the Scripps Research Institute, and Università di Pisa in Italy.

The studies were supported by the National Science Foundation, National Geographic Society, and other agencies.

Controversial new climate change results

New data show that the balance between the airborne and the absorbed fraction of carbon dioxide has stayed approximately constant since 1850, despite emissions of carbon dioxide having risen from about 2 billion tons a year in 1850 to 35 billion tons a year now. This suggests that terrestrial ecosystems and the oceans have a much greater capacity to absorb CO₂ than had been previously expected.

The results run contrary to a significant body of recent research which expects that the capacity of terrestrial ecosystems and the oceans to absorb CO₂ should start to diminish as CO₂ emissions increase, letting greenhouse gas levels skyrocket. Dr Wolfgang Knorr at the University of Bristol found that in fact the trend in the airborne fraction since 1850 has only been $0.7 \pm 1.4\%$ per decade, which is essentially zero.

The strength of the new study, published online in Geophysical Research Letters, is that it rests solely on measurements and statistical data, including historical records extracted from Antarctic ice, and does not rely on computations with complex climate models.

This work is extremely important for climate change policy, because emission targets to be negotiated at the United Nations Climate Change Conference in Copenhagen early next month have been based on projections that have a carbon free sink of already factored in. Some researchers have cautioned against this approach, pointing at evidence that suggests the sink has already started to decrease.

So is this good news for climate negotiations in Copenhagen? “Not necessarily”, says Knorr. “Like all studies of this kind, there are uncertainties in the data, so rather than relying on Nature to provide a free service, soaking up our waste carbon, we need to ascertain why the proportion being absorbed has not changed”.

Another result of the study is that emissions from deforestation might have been overestimated by between 18 and 75 per cent. This would agree with results published last week in Nature Geoscience by a team led by Guido van der Werf from VU University Amsterdam. They re-visited deforestation data and concluded that emissions have been overestimated by at least a factor of two.

Please contact Cherry Lewis for further information.

Further information: *The paper: Is the airborne fraction of anthropogenic CO₂ emissions increasing? by Wolfgang Knorr. Geophysical Research Letters, VOL. 36, L21710, doi:10.1029/2009GL040613, 2009.*

People with less education could be more susceptible to the flu

ANN ARBOR, Mich.—People who did not earn a high school diploma could be more likely to get H1N1 and the vaccine might be less effective in them compared to those who earned a diploma, new research shows.

The University of Michigan study looked at a latent virus called CMV in young people, and the body’s ability to control the virus. Previous studies have shown that elderly people with less education are less successful at fighting off CMV, but this is the first known study to make that connection in younger adults as well, said study co-author Jennifer Dowd, who began the work while in the Health and Society Scholars program at the U-M School of Public Health.

Previous studies have shown that high levels of CMV antibodies make it tougher for the elderly to fight new infections like H1N1, and hampers the body’s immune response to the flu vaccine. The U-M findings suggest that lower socioeconomic status may make it tougher even for adults of all ages to fight new infections and may make the flu vaccine less effective.

“We’re showing that the ability to keep CMV under control varies by income and education even at much younger ages, and this could have implications for the ability to fight new infections like H1N1 for all ages, not just the elderly,” said Dowd, now an assistant professor of epidemiology and biostatistics at Hunter College. Allison Aiello, assistant professor of epidemiology at University of Michigan SPH, is co-author.

"We looked at CMV because it is an infection that is not cleared from the body but rather persists in a latent state with periodic reactivations in generally healthy individuals," Aiello said. "Immune response to CMV may serve as a marker of general immune alterations and is therefore an important indicator of health risks."

CMV is a latent virus in the herpes family. Infection is common but the majority of people aren't symptomatic because the immune system keeps the virus under control. People of lower income and education lose immune control more easily, Dowd said. Their weakened immune systems, which may be due to increased levels of stress, make them more susceptible to other infections as well. "What is going on with the dramatic (downturn) in the economy could actually translate into people's susceptibility to these diseases," Dowd said.

CMV is thought to be a prime culprit in breaking down the immune system as we age, and CMV is also associated with chronic conditions like heart disease. In the study, a person with less than a high school education had the same level of immune control as someone 15-20 years older with more than a high school education, Dowd said.

"When you listen to the current news about H1N1, it's interesting because everyone feels that this is a random threat, that we all have an equal chance of getting it," Dowd said. "This study points out that certain groups are potentially more susceptible and it's not just people with existing chronic illness."

The study, "Socioeconomic Differentials in Immune Response," will appear in an upcoming issue of the journal Epidemiology.

Device enables world's first voluntary gorilla blood pressure reading

Veterinary leap forward through collaboration with Zoo Atlanta, Georgia Tech, Emory University and a 300-pound great ape

Zoo Atlanta recently became the first zoological institution in the world to obtain voluntary blood pressure readings from a gorilla. This groundbreaking stride was made possible by the Gorilla Tough Cuff, a blood pressure reading system devised through partnership with the Wallace H. Coulter Department of Biomedical Engineering at Georgia Tech and Emory University.

Created as a senior design project by biomedical engineering undergraduates David Sotto, Nisha Bhatia, Stephanie Drewicz and Scott Seaman, the prototype has now been successfully tested on one of Zoo Atlanta's 22 western lowland gorillas. The students also had guidance from Hanjoong Jo, the Ada Lee and Pete Correll Professor in Biomedical Engineering and the Division of Cardiology; and Professor Franklin Bost, the Coulter Department director of design instruction.

"Zoo Atlanta is home to the nation's largest collection of gorillas, so there is an ongoing responsibility to contribute to the zoological community's understanding of their care," said Dennis Kelly, President and CEO. "We are proud to have spearheaded an effort that will ultimately benefit gorillas living in captive settings around the world."

The Gorilla Tough Cuff operates in the same manner as the mechanism familiar to humans, with the patient slipping an arm into a cuff. As the cuff inflates, the blood pressure reading is measured and displayed on a monitor. The student design team's biggest set of challenges, however, was constructing a durable, comfortable cuff large enough to fit an adult male gorilla weighing upwards of 300 pounds.

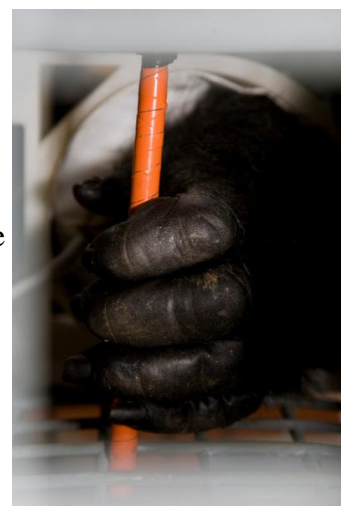
The prototype system was comprised of a blood pressure cuff bolted to a casing made of acrylonitrile butadiene styrene (ABS) plastic. The casing was zip-tied to a rectangular mesh trap and the trap was temporarily attached to the gorilla cage. The pressure cuff tubing was connected to an off-the-shelf veterinary blood pressure monitor located outside of the gorilla cage.

"We also built a safety mechanism into the device so that the gorillas would not be injured if they became alarmed or frightened and tried to remove their arm from the cuff," said Sotto, who is currently a graduate student at Georgia Tech.

Once the prototype was complete, the Tough Cuff had its first tester: Ozzie, a 48-year-old male western lowland gorilla. Gorillas aren't typically keen on the idea of inserting their arms into inflatable cuffs: Ozzie's accomplishment is the result of months of patience and diligent voluntary positive reinforcement training on the part of Zoo Atlanta's Primate Team.

Ozzie slides his arm into the durable, yet comfortable, Gorilla Tough Cuff. As the cuff inflates, Ozzie's blood pressure is measured and displayed on a monitor. Credit: Zoo Atlanta

One of four geriatric gorillas living at the Zoo (the others are Shamba, 50; Choomba, 48; and Ivan, 47), Ozzie is at an age where he may be subject to health concerns similar to those experienced by mature humans. Cardiac disease is the leading cause of mortality in adult male gorillas living in captive settings, and the new system will enable veterinarians to more effectively monitor precursory signs such as high blood pressure.



"This is a great step forward in the medical management and care of captive gorillas," said Dr. Sam Rivera, Associate Veterinarian at Zoo Atlanta. "Our Veterinary and Primate Teams are extremely fortunate to have the biomedical engineering department at Georgia Tech and Emory University as a resource."

The Gorilla Tough Cuff has already been demonstrated for veterinarians and animal care professionals from numerous other accredited zoos. The device could ultimately prove invaluable to the more than 100 institutions around the world currently housing the species.

Vital Signs

Nutrition: Chocolate Milk May Reduce Inflammation

By RONI CARYN RABIN

Move over, red wine. Make room for chocolate milk. A new study suggests that regular consumption of skim milk with flavonoid-rich cocoa may reduce inflammation, potentially slowing or preventing development of atherosclerosis. Researchers noted, however, that the effect was not as pronounced as that seen with red wine.

Scientists in Barcelona, Spain, recruited 47 volunteers ages 55 and older who were at risk for heart disease. Half were given 20-gram sachets of soluble cocoa powder to drink with skim milk twice a day, while the rest drank plain skim milk. After one month, the groups were switched.

Blood tests found that after participants drank chocolate milk twice a day for four weeks, they had significantly lower levels of several inflammatory biomarkers, though some markers of cellular inflammation remained unchanged.

Participants also had significantly higher levels of good HDL cholesterol after completing the chocolate milk regimen, according to the study, which appears in the November issue of *The American Journal of Clinical Nutrition* and is already online.

"Since atherosclerosis is a low-grade inflammatory disease of the arteries, regular cocoa intake seems to prevent or reduce" it, said Dr. Ramón Estruch of the University of Barcelona, the paper's senior author, adding that more studies were needed.

Web Link: [Effect of cocoa powder on the modulation of inflammatory biomarkers in patients at high risk of cardiovascular disease \(American Journal of Clinical Nutrition\)](#)

Vital Signs

Risks: 5 Pathogens Linked to Risk for Stroke

By RONI CARYN RABIN

Many strokes cannot be explained by known risk factors like high blood pressure and smoking, and scientists have speculated that infection could play a role.

Now a new study is linking cumulative exposure to five common pathogens with an increased risk for stroke.

The infections in order of significance are *Chlamydia pneumoniae*, *Helicobacter pylori*, cytomegalovirus and herpes simplex viruses 1 and 2, according to the study, published online on Nov. 9 in *The Archives of Neurology*. The report will appear in the print edition of the journal in January.

"Each of these common pathogens may persist after an acute infection and contribute to perpetuating a state of chronic low-level infection," said the paper's lead author, Dr. Mitchell S. V. Elkind, an associate professor of neurology at Columbia University Medical Center.

Dr. Elkind said the low-level infection and inflammation in the vessel walls might be leading to disease.

The researchers followed an ethnically diverse group of 1,625 residents from northern Manhattan whose average age was 68 and who had been stroke-free at the beginning of the study. After almost 8 years, 67 of the participants had suffered strokes.

Blood samples from all participants were tested for antibodies to the five pathogens, an indicator of previous exposure, and a weighted-composite index of exposure was developed.

Dr. Elkind noted that the study did not prove a cause-and-effect relationship between common infections and stroke, only an association, and that the evidence was circumstantial.

Turtles are 'right-flipped'

By Matt Walker Editor, Earth News

Leatherback turtles tend to be the reptilian equivalent of "right-handed".

Across a population studied by scientists, more turtles preferred to use their right rear flipper rather than their left when laying eggs.

The result, published in the journal *Behavioural Brain Research*, is the first time a species of turtle has found to prefer one limb over another. The discovery adds to growing evidence that even lower vertebrates prefer to use one side of the body more often.

Such preference is known by scientists as a "lateralised functional behaviour", and it usually indicates that an animal's brain function is also lateralised, with one side of the brain dominating control of certain tasks.

Studies on relatively small numbers of reptiles have shown that some species display lateralised behaviour. For example, cottonmouth snakes (*Agkistrodon piscivorus*) tend to prefer to coil one way more than the other, while upturned Mediterranean tortoises (*Testudo hermanni*) prefer to right their bodies to one side.

But a team of US-based researchers led by Annette Sieg of Drexel University in Philadelphia, Pennsylvania investigated whether such a similar preference occurs across a large wild population of leatherback turtles (*Dermodochelys coriacea*).

When female leatherbacks come ashore to lay their eggs, they clear out an chamber for the eggs using repeated movements of their rear flippers.

Then as they lay their eggs, they move one rear flipper back over the opening from which the eggs emerge, called the cloaca, obscuring it, perhaps to prevent the eggs being spotted by predators. The turtles do this spontaneously, and it is the only time when leatherbacks use a single flipper to perform a particular task.



Right or leftie?

Population bias

Dr Sieg and her colleagues observed flipper use among 361 females laying at the Playa Grande rookery on the northern Pacific Coast of Costa Rica.

Over five years, they watched as these females laid eggs on 1889 occasions.

Overall, the turtles preferred to use their right hind flippers 54% of the time.

Although the preference is subtle, it is statistically significant, revealing a bias in flipper use at the population level. It also compares with the proportion of people or apes that are right or left-handed. For example, 54% of people across different cultures who have yet to learn how to write spontaneously prefer to use their right hands. In chimpanzees, 53.8% prefer to use one limb over the other.

"We call this asymmetry in the use of the leatherback's flipper "flipperedness" because "handedness" is used in primates, "footedness" in birds and "pawedness" in rodents, other mammals and several amphibian species," the researchers write in the journal.

The study is the first to show a limb preference among Testudinata, the group that comprises turtles and tortoises, and is the largest multi-year study of any spontaneous behaviour in a lower vertebrate.

Why the turtles prefer to use one flipper more than the other remains a mystery.

While researchers have recently found differences in brain structure between left- and right-handed primates, with the left and right brain hemispheres having slight structural differences, there is no evidence as yet that the left and right sides of a turtle's brain are different.

| LEATHERBACK FACTS |
|---|
| <i>The turtles can grow up to 2.7m (8.8ft)</i> |
| <i>Due to their size, adults have few natural predators</i> |
| <i>The species is endangered</i> |
| <i>They are accidentally trapped in tuna and swordfish nets</i> |
| <i>They can weigh up to a tonne</i> |

The deep-sea crab that eats trees

By Matt Walker Editor, Earth News

Deep under the ocean, there is a species of crab that eats trees. The crab survives by eating wood that has sunk to the ocean floor, comprising trunks and leaves swept into the sea, as well as the odd shipwreck.

Inside the stomach of the crab, also called a squat lobster, are bacteria and fungi that help digest the wood.

The discovery, published in the journal *Marine Biology*, adds to evidence that these so-called 'wood falls' help support special underwater communities.



M. andamanica, a wood-muncher

"At first sight, it seems improbable," says PhD student Caroline Hoyoux of the University of Liège, Belgium.

"Munidopsis andamanica is a species only found in the deep sea and yet it eats 'terrestrial food'," she says. Ms Hoyoux and colleagues based at the University of Liege and at the Natural History Museum and Pierre and Marie Curie University in Paris, France made the discovery while studying which animals colonise wood falls.

Among worms, bivalves and a host of crustacean species they found *Munidopsis andamanica*, a species known as a galatheid crab, or squat lobster.

Further investigation of the crabs mouthparts and gut contents revealed they feed exclusively on wood.

"We were surprised, because crustaceans are often regarded as predators or scavengers. The fact I found *M. andamanica* consistently feeding on vegetal remains, especially wood, instead of eating molluscs or [worms] breaks with the general a priori about the diet of squat lobsters," says Ms Hoyoux.

Sunken treasure

The importance of wood falls and the communities they host are only just being appreciated.

Although first discovered in the late 19th century, it was not until the late 1970s that scientists began to study the animals that colonise them. Until this century, these were mainly thought to be wood-boring molluscs.

"However, crustaceans are the second most important group, according to the number of species and individuals," says Ms Hoyoux.

She is studying wood fall crustaceans for her PhD thesis and as part of the international DiWOOD project, which seeks to learn more about animals colonising deep-sea wood.

"The wood falls that we study are principally natural tree debris that have sunk and reached the deep sea floor. They consist of real wood as well as plant fragments like leaves, seagrass, coconuts etc."

To collect the animals, Ms Hoyoux and colleagues mimic real wood falls by immersing mesh boxes baited with wood. The mesh is wide enough to allow crustacean larvae to colonise the wood, but too small to allow the animals to escape as they grow. After a year, these boxes are brought to the surface and the animals collected.

Animal riches

Among those found are 15 species of decapod, one species of isopod and one amphipod, including hermit crabs, shrimp and galatheid crabs of the genus *Munidopsis* and *Munida*.

The squat lobster is thought to bite off small splinters of wood which it then passes through a 'gastric-mill' of strong teeth used to grind the wood down.

The crab's gut then contains bacteria and fungi that produce enzymes that help digest the cellulose in the wood.

The ecological importance of wood falls rivals that of whale falls, where highly specialised communities of deep-sea animals colonise the bodies of dead whales and dolphins that drift to the sea bed.

"Although they are not as quantifiable as whale falls, they could be more important," says Ms Hoyoux.

"It is strongly assumed that these vegetable debris constitute an important and significant contribution of food to the deep-sea fauna."

They could even be important stepping stones in the colonisation of more extreme deep-sea environments such as hydrothermal vents, say the researchers.

Backward star ain't from around here

* 12:51 11 November 2009 by Ken Crowell

Here's an apple that landed far from the tree. A dim star just 13 light years from Earth was born in a cluster 17,000 light years away.

Discovered in 1897, Kapteyn's Star is the 25th nearest star system to our sun, but it is not local, says Elizabeth Wylie-de Boer of Mount Stromlo Observatory in Canberra.

The cool star's composition is tricky to study, but astronomers can look at 16 other stars in the same "moving group", all of which orbit the galaxy backwards and are very old. The odd motion marks them as members of the Milky Way's ancient population of halo stars.

Kapteyn's Star is part of a 'Moving group' in the constellation of Pictor (Image: ESO Online Digitized Sky Survey)

Of the stars, 14 had the same abundance of elements – such as sodium, magnesium, zirconium, barium – as Omega Centauri, the galaxy's most luminous globular cluster. The cluster emits a million times more light than the sun.

"It's long been thought that Omega Centauri is the left-over nucleus of a dwarf galaxy that merged with the Milky Way," says Wylie-de Boer, whose paper will appear in the *Astronomical Journal*. "During the merger, the outer regions of this dwarf galaxy were stripped."

Some of the cast-off stars ended up near the Sun, with one landing a mere 13 light years from Earth.

Earth's early ocean cooled more than a billion years earlier than thought: Stanford study

The scalding-hot sea that supposedly covered the early Earth may in fact never have existed, according to a new study by Stanford University researchers who analyzed isotope ratios in 3.4 billion-year-old ocean floor rocks. Their findings suggest that the early ocean was much more temperate and that, as a result, life likely diversified and spread across the globe much sooner in Earth's history than has been generally theorized.

It also means that the chemical composition of the ancient ocean was significantly different from today's ocean, which in turn may change interpretations of how the early atmosphere evolved, said Page Chamberlain, professor of environmental earth system science.

When rocks form on the ocean floor, they form in chemical equilibrium with the ocean water, incorporating similar proportions of different isotopes into the rock as are in the water. Isotopes are atoms of the same element that have different numbers of neutrons in the nucleus, giving them different masses. However,



because the exact proportion of different isotopes that go into the rock is partly temperature dependent, the ratios in the rock provide critical clues into how warm the ocean was when the rock formed.

Previous studies of similarly aged rocks had looked only at oxygen isotope ratios, which suggested that in the Archean era (about 3.5 billion years ago), the ocean temperature was at least 55 degrees Celsius and may have been as high as 85 C, or 185 F. At a water temperature so perilously close to the boiling point, the only organisms that could have thrived would have been extremophiles – life forms adapted to extreme environments – such as the microbes that live in the intense heat of deep-sea hydrothermal vents or in hot springs such as at Yellowstone National Park.

But isotope ratios recorded in rocks on the ocean floor are also dependent on the chemical composition of the seawater in which those rocks formed, and the past studies assumed the composition of the ancient ocean was essentially what it is today, which the Stanford study did not.

Using a relatively new approach, Michael Hren and Mike Tice, both Stanford graduate students at the time, analyzed hydrogen isotopes as well as oxygen isotopes in chert, a type of fine-grained sedimentary rock consisting primarily of quartz. The chert they studied was from an ancient deposit, formerly underwater but now on dry land in South Africa.

From a cauldron to a nice warm bath

"By looking at both oxygen and hydrogen in these ancient rocks we were able to put some constraints on how different the ancient ocean composition may have been from today, and then use that composition to try to determine how hot the ancient ocean was," said Hren, who is the lead author of a paper describing the work being published online Nov. 12 by Nature. Tice and Chamberlain are coauthors.

Having data from isotope ratios of two elements allowed the researchers to calculate upper and lower bounds for the range of temperature and composition that could have given rise to the observed ratios. They determined that the ocean temperature could not have been more than 40 C (104 F) – the temperature of a hot tub – and may have been lower in some parts.

"This means that by 3.4 billion years ago, there were at least some places on the surface of the Earth where organisms that could not survive in these hot hydrothermal conditions could exist and thrive," Hren said. "It also suggests that the chemical composition of the ancient ocean was probably not identical to today, as previous studies assumed. It may have been quite different."

The researchers found that the ratio of the two stable isotopes of hydrogen in the chert was tilted away from the heavier of the isotopes – called deuterium.

"The ancient ocean had a lot more hydrogen in it, relative to deuterium, than modern oceans," Chamberlain said.

If the composition of the Archean ocean was significantly different from today, then the atmosphere must have been markedly different, too, owing to the ease with which gases move across the air-water boundary as the ocean and lower atmosphere strive to stay in a rough equilibrium.

That means that sometime during the past 3.4 billion years, the ocean had to lose a lot of hydrogen to the atmosphere to bring the hydrogen isotope ratio in seawater to where it is today. And since oxygen, not hydrogen, has built up in Earth's atmosphere over that same period of time, the atmosphere must have discharged a lot of hydrogen to the only other place it could go: space.

Hren said that some recent models of the early Earth atmosphere suggest that there may have been a prolonged period of hydrogen escaping to space, which would be consistent with the Stanford team's findings.



Green and orange photosynthetic microbial mats line an outflow channel from a hot spring in Yellowstone National Park. These thin mats grow only where the downstream water temperature falls below 73 C. The mats become thicker and more complex as the temperature drops. Stanford researchers found evidence for cooler waters in the ancient global ocean that would have allowed photosynthetic life to spread far beyond such narrow confines. Michael Tice, Texas A&M University

Little land, but happy lives on the early Earth

The chemical composition of air and water weren't the only things different about Earth during the Archean era.

"We are talking about a time when, if you were looking at the Earth from space, you would hardly see any land mass at all," Tice said. "It would have almost been an ocean world."

The chert samples came from a formation called the Buck Reef Chert, which covered a broad area from shallow to deep marine environments. Some of the chert was probably deposited on the slopes of a volcanic island,

similar to those in the Hawaiian Islands, that had gone extinct, cooled, eroded and slowly subsided under the sea, he said.

Tice collected the chert samples from South Africa several years ago while he was a graduate student with Don Lowe, professor of geological and environmental sciences. In 2004, Lowe and Tice described a fossil microbial ecosystem preserved in some of the chert that was deposited on a shallow submerged platform, which they deduced was photosynthetic. Tice said the temperature setting was probably somewhat comparable to a modern day tidal flat, where similar photosynthetic microbial mats flourish today, although the depth of the Archean setting was similar to continental shelves of today.

"At the higher temperatures that were hypothesized earlier, those organisms could have survived but they would have had a harder time," he said. "At the temperatures we are suggesting, they would have been completely comfortable. They would have been happy.

"And that is significant because photosynthetic organisms, even bacteria, form the base of essentially every modern food chain," Tice added.

Checking the chert

With major ramifications for the ocean, atmosphere and nature of life on the early Earth coming out of their study, the researchers know their work is likely to receive some scrutiny.

"Anytime you are dealing with something that has been on Earth for 3.4 billion years, it is always going to be a question of whether these are pristine or not," Chamberlain said. But the cherts the Stanford team worked with "are particularly good rocks," he said, "because they have not been stuck deep in the Earth, crushed and heated, and so they preserve something of what the original oceans were like."

Still, to rule out any alteration of the rocks, Hren said they did calculations to see what would happen if the chert had been subjected to later hydrothermal water flowing through it, or other post-depositional processes that could potentially alter the chemistry of the samples.

"We can show some of the data has been altered by later fluids, but some of it is recording this original ocean composition and temperature data," he said. "So by looking at these two separate trends, we can see which data reflects this original formation. "I think it is really giving us a better idea of these conditions at a very early time in the Earth's history," Hren said.

Right first time: Pioneering new methods of drug manufacture

Engineers at the University of Leeds have developed a simple technology which can be used in existing chemical reactors to ensure "right first time" drug crystal formation.

Ensuring drug crystals are formed correctly is crucial to their efficacy and the efficiency of pharmaceutical manufacturers' operations. Using self-assembled monolayers, the team has been able to show that crystals form into their desired product form with the correct shape and particle structure, without the usual problems of polymorphism which results in huge losses to the pharmaceutical sector each year.

"If you imagine the way that oil sits on top of water, that's similar to how the monolayer works," says Professor Kevin Roberts of University's Faculty of Engineering. "We've shown that we can produce a well-defined crystal structure using a self-assembled monolayer bound onto a metal substrate within a regular reactor. This is exciting stuff, because it's a relatively simple system, but could make a huge difference in the efficiency of drug manufacture."

One of the first stages of the crystallisation process is called nucleation. During nucleation, particles are introduced into a reactor to encourage the formation of crystals. However, the way in which this is currently carried out is difficult to control and can often lead to the wrong shape, size or structure of drug crystal, something which affects the usefulness and efficacy of the compound.

The new system proven to work by the Leeds team, working alongside Ana Kwokal from Croatian pharmaceutical company PLIVA, has shown that introducing a self-assembled monolayer – a layer of self-organising molecules that is attractive to the substance being crystallised – into a reactor enables consistent crystal formation.

Professor Roberts says: "Because this is a really simple solution to ensuring consistent crystallisation, it has huge potential commercially. Our next steps are to make sure it's just as efficient on an industrial scale."

This work draws on previous research and experimental systems developed through the Chemicals Behaving Badly II initiative, an Engineering and Physical Sciences Research Council (EPSRC) programme which includes universities and industrial partners.

Mars rover battles for its life

* 11 November 2009 by Rachel Courtland

NASA's twin Mars rovers have outlasted their planned three-month missions for so long that they seem indestructible. Nearly six years on, their presence on the Red Planet is taken for granted, as if they are immutable parts of the Martian landscape.

But we may soon have to confront a new reality. Spirit, which has always suffered more hardships than Opportunity, is facing its toughest challenge yet. When *New Scientist* went to press, the rover was set to begin a risky push to free itself from a sand trap it has been mired in for six months. Mission engineers say it may not survive the attempt. "She's in a very precarious situation, and we don't know for sure if we're going to get her out," says rover driver Scott Maxwell of NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California.

Spirit encountered its latest difficulty in April, as it made its way south along the edge of Home Plate, a plateau of hardened ash that has been its main haunt for more than three-and-a-half years. Its wheels started to slip in the soft, sandy soil filling an 8-metre-wide crater. By the time the rover team decided to stop driving, Spirit was essentially just spinning its wheels.

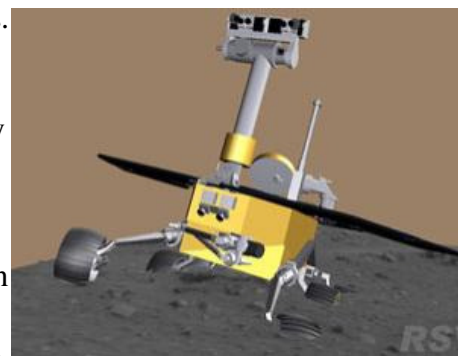


Image used by the Mars Exploration Rover team for assessing movements by Spirit. This illustrates the degree to which Spirit's wheels have become embedded in soft material at the location called "Troy." (Image: NASA/JPL-Caltech)

Both rovers have managed to escape sand traps before, but this time it's different. Spirit is tilted by 12 degrees, with its three left wheels buried almost entirely in the sand (see illustration opposite). Unfortunately its right-front wheel, which is the least buried, is useless - it seized up in 2006 and has been dragged or pushed by the remaining five wheels ever since.

To make matters worse, a pointed rock appears to be touching the rover's belly. So if Spirit's wheels sink further as it moves, the rock could end up bearing some of the rover's weight, further reducing traction. "I look at it as Murphy's law on steroids," says Spirit scientist Ray Arvidson of Washington University in St Louis, Missouri.

As a result, NASA has been extremely cautious about moving the rover, spending months testing escape manoeuvres on two prototype rovers at JPL.

But now, with the Martian winter approaching, a review committee has recommended that NASA start moving the mired rover as soon as possible. Engineers will attempt to drive it out the way it came in, a plan likely to involve a combination of driving straight and angling the rover's wheels uphill to aim for firmer ground.

Progress will be slow, as rotating the wheels enough to produce what would ordinarily be 5 metres of motion might only cause the rover to move a millimetre or two, says John Callas, rover project manager at JPL. "It will be kind of like watching your grass grow," he says. Arvidson adds that there are no guarantees the rover will escape. "This vehicle is not invincible," he says. "We may not get out."

At this critical crossroads, *New Scientist* is taking the opportunity to look back at the rovers' highs and lows.

Slow start

NASA's twin rovers, Spirit and Opportunity, landed on opposite sides of the Red Planet in January 2004.

Almost immediately after touching down, Opportunity found evidence that its landing site at Meridiani Planum had once hosted ancient acidic lakes.

Spirit was not so lucky. Orbital images had suggested that Gusev Crater, where it landed, was once a lake. But for its first six months on the planet, the rover turned up little besides basaltic lava flows - which may have paved over any ancient lake sediments.

High ground

Spirit enjoyed an upturn in its fortunes when it reached the higher terrain of the Columbia hills in June 2004. The hills, named in honour of the astronauts who died in the shuttle disaster of 2003, are even older than the 3-billion-year-old volcanic plains on the floor of Gusev Crater. Here, Spirit found intriguing sulphur-rich rocks that appear to have formed in the presence of water. After cresting the Columbia hills in March 2006, Spirit's right-front wheel seized up. That forced engineers to drive the rover backwards, dragging the wheel behind it. Fortunately, the rover managed to limp to a sunlit slope to sit out the winter.

Watershed discovery

In May 2007, scientists reported that Spirit had made a major discovery: it found evidence of rocks made almost entirely of silica, a telltale sign they were formed in water. Ironically, its immobilised wheel - which dragged behind it like a dead weight - gave rise to the find when it uncovered a patch of bright, silica-rich soil.

The soil likely formed when large amounts of water interacted with hot volcanic material. This area, dubbed "silica valley", lies near a raised plateau called Home Plate that may have formed when layers of volcanic material filled in a crater whose surroundings then eroded away.

Opportunity's trials

Opportunity has always been the "golden" rover, travelling about 19 kilometres - 2.4 times as far as Spirit - since it landed. But it too has suffered setbacks. In April 2005, Opportunity got stuck for about five weeks on a ripple of soil nicknamed Purgatory Dune.

When it got stuck, its priority had been speed. It was cruising along at 200 metres a day and most of its software safeguards - which could have detected its wheels slipping - were turned off. That caused the rover to dig itself in more deeply than it would have otherwise. Engineers learned from the mishap, freeing the rover by backing it out as it had come in and instituting periodic "slip checks" for its wheels. In June 2006, those changes helped the rover quickly escape from a sandy spot nicknamed Jammerbugt - Danish for "Bay of Lamentation".

Editorial: Indefatigable Spirit

Still working

Spirit has been immobile for the past six months, but it has not been idle.

The rover's own observations have revealed the cause of its plight - a small crater filled with yielding, yellow-brown sand. The sand had been hidden beneath a dust-covered crust of weakly cemented sand particles.

Spirit's wheels punched through this centimetres-thick crust, exposing soil with the highest concentration of sulphate minerals ever found by either Spirit or its twin, Opportunity.

Sulphates form in the presence of water, so the find further reinforces the idea that, billions of years ago, the area surrounding Spirit was rich in the liquid.

Researchers suspect Spirit's stomping ground was once a site of intense hydrothermal activity. Pools of hot water and steam vents may have dotted the area, making it a good place for future missions to look for evidence of ancient Martian life, says Spirit scientist Ray Arvidson of Washington University in St Louis, Missouri. "If it were Earth with that kind of environment, it would be teeming with microbes," he says.

Nonetheless, the rover team is keen to move on. "It's an interesting area to be in over the summer," says Arvidson, "but we're ready to leave."

The local winter will descend in the first half of 2010, and NASA is anxious to move the rover before light levels drop drastically, cutting power to its solar panels. The rover might be able to survive the winter in its current orientation, but "just barely", says rover project manager John Callas of NASA's Jet Propulsion Laboratory in Pasadena, California. "Spirit will be one dust storm - or change in dust accumulation - away from not surviving."

Where will Spirit go if it does make it through? Two long-dead volcanoes 170 metres to the south - one with a wealth of exposed bedrock - would be compelling destinations.

Mini ice age took hold of Europe in months

* 11 November 2009 **by Kate Ravilious**

JUST months - that's how long it took for Europe to be engulfed by an ice age. The scenario, which comes straight out of Hollywood blockbuster *The Day After Tomorrow*, was revealed by the most precise record of the climate from palaeohistory ever generated.

Around 12,800 years ago the northern hemisphere was hit by the Younger Dryas mini ice age, or "Big Freeze". It was triggered by the slowdown of the Gulf Stream, led to the decline of the Clovis culture in North America, and lasted around 1300 years.

Until now, it was thought that the mini ice age took a decade or so to take hold, on the evidence provided by Greenland ice cores. Not so, say William Patterson of the University of Saskatchewan in Saskatoon, Canada, and his colleagues.

The group studied a mud core from an ancient lake, Lough Monreagh, in western Ireland. Using a scalpel they sliced off layers 0.5 to 1 millimetre thick, each representing up to three months of time. No other measurements from the period have approached this level of detail.

Carbon isotopes in each slice revealed how productive the lake was and oxygen isotopes gave a picture of temperature and rainfall. They show that at the start of the Big Freeze, temperatures plummeted and lake productivity stopped within months, or a year at most. "It would be like taking Ireland today and moving it up to Svalbard" in the Arctic, says Patterson, who presented the findings at the BOREAS conference in Rovaniemi, Finland, on 31 October.

"This is significantly shorter than what has been suggested before, but it is plausible," says Derek Vance of the University of Bristol, UK. Hans Renssen, a climate researcher at Vrije University in Amsterdam, the

Netherlands, says recent findings from Greenland ice cores indicate the Younger Dryas event may have happened in one to three years. Patterson's results confirm this was a very sudden change, he says.

The mud slices from the end of the Big Freeze show that it took around two centuries for the lake and climate to recover.

Patterson says that sudden climate switches like the Big Freeze are far from unusual in the geological record. The Younger Dryas was brought about when a glacial lake covering most of north-west Canada burst its banks and poured into the North Atlantic and Arctic Oceans. The huge flood diluted the salinity-driven North Atlantic Ocean mega-currents, including the Gulf Stream, and stalled it. Two studies published in 2006 show that the same thing happened again 8200 years ago, when the Northern hemisphere went through another cold spell.

Some climate scientists have suggested that the Greenland ice sheet could have the same effect if it suddenly melts through climate change, but the 2007 report of the Intergovernmental Panel on Climate Change concluded this was unlikely to happen this century.

Patterson's team have now set their sights on even more precise records of historical climate. They have built a robot able to shave 0.05 micrometre slivers along the growth lines of fossilised clam shells, giving a resolution of less than a day. "We can get you mid-July temperatures from 400 million years ago," he says.

Suite of chatterbox genes discovered

*** 18:00 11 November 2009 by Ewen Callaway**

It is often thought of as one of the things that make humans unique. Now, researchers are uncovering the suite of genes that gave us our gift of the gab.

All of them appear to be controlled by a master-switch gene called *Foxp2*. When inactive, this gene causes severe speech and language problems in humans. Although other animals have versions of *Foxp2*, in 2002 a German team identified two small alterations in the protein the human *Foxp2* produces that are not carried by our closest living relative, the chimpanzee. This suggested that the human version of *Foxp2* may function differently, and be a key element in our unique linguistic abilities.

Earlier this year, Wolfgang Enard's team at the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, spliced this human version of *Foxp2* into mice. The mice didn't start speaking, but their sub-sonic vocalizations changed, as did the shape and activity of neurons in a brain area that goes awry in people with *Foxp2*-related language disorders.

To discover what *Foxp2* does differently in humans, neuroscientists Genevieve Konopka and Daniel Geschwind at the University of California, Los Angeles, grew human brain cells lacking *Foxp2* in Petri dishes. To some they added human *Foxp2* and to others the chimp version. They then recorded all the genes that were affected. Out of the hundreds of genes controlled by *Foxp2*, they identified 116 that responded differently to the human version of *Foxp2*.

This set of genes fits well with *Foxp2*'s suggested role in the evolution of language and speech, says Konopka. Many control brain development or have been linked to cognition. Others are involved in controlling body movement and guiding the development of facial and laryngeal tissues that are essential for articulation.

Evolutionary studies of *Foxp2* suggest it acquired its human-specific changes in the last half million years of human evolution – roughly when language is thought to have emerged. Geschwind has done preliminary studies of the evolution of the 116 genes that *Foxp2* affects, which suggest they may have a similar history. "It brings up the possibility, which is not at all remote, that these genes may have evolved in concert," he says, adding that this may even be true for other genes involved in language.

While the results hint at a central role for *Foxp2* in the evolution of language, Geschwind cautions against calling it "the language gene" as some have in the past. "Either *Foxp2* itself is pretty damn important," he says, "or it's part of a regulatory circuit – something else is regulating *Foxp2* that no one else has found yet."

Geschwind's team carried out a second experiment, comparing patterns of gene activation in adult human and chimpanzee brain tissue. They found a striking overlap between the genes whose activity was different in the human brain tissue and the set of genes that are controlled differently by human *Foxp2*.

The finding is preliminary, but if confirmed, it might mean a significant part of the difference between human and chimpanzee brains could be explained by two small changes in one gene, says Wolfgang Enard. "That would be really amazing."

With 116 genes to follow up on, Geschwind and Konopka have their work cut out for them, says Pasko Rakic, a neuroscientist at Yale University. "This paper provides a starting point for future molecular studies on the basis of the evolution of language."

Faraneh Vargha-Khadem, a neuroscientist at University College London, who studies patients with *Foxp2*-linked language disorders, says Geschwind's list makes sense. In addition to their speech problems, her patients' lower faces are partly misshaped as well.

However, Vargha-Khadem cautions against distilling the evolution and development of language down to a single gene and its multitude of effects. Foxp2 may have helped endow humans with the machinery to produce speech, but this does not explain how abstract ideas get translated into utterances, she says.

"Almost by magic these muscles move to produce the sound sequence that makes sense to the listener," Vargha-Khadem says, adding that science has a long journey ahead to understand how the machinery works, let alone how it expresses our thoughts. *Journal reference: Nature, DOI: 10.1038/nature08549 (in press)*

Aisle placements affect grocery sales, UB research shows

BUFFALO, N.Y. - Supermarkets could increase their sales of related items, such as chips and soft drinks, by moving the items closer to each other in their stores, according to research by Ram Bezawada, assistant professor of marketing in the University at Buffalo School of Management.

"Retailers can benefit substantially by having better placement of items in their aisles," Bezawada says. His research shows that aisle placements can influence sales across product categories as much as other marketing variables, such as price or how an item is displayed.

In a study published in the *Journal of Marketing*, Bezawada and co-researchers attempted to determine the optimal placement of cross-category items to increase sales.

Using the cross-category items of chips and soda, the researchers found that stores placing the items facing each other in the same aisle increased weekly sales of those items by more than 9 percent. In contrast, moving the chips and soda one aisle away from each other resulted in a decrease in sales of nearly 1.5 percent.

Both retailers and consumers can benefit from better cross-category placements in stores, according to Bezawada. "The retailers benefit because their overall sales increase, and consumers benefit by having an easier shopping experience," he says. In addition, manufacturers who market items in multiple categories (such as Pepsi Co., which produces both soft drinks and chips) could also see their sales rise.

Bezawada's study was coauthored by S. Balachander, associate professor of management at Purdue University; P.K. Kannan, Harvey Sanders Associate Professor of Marketing at the University of Maryland; and Venkatesh Shankar, professor of marketing and Coleman Chair in Marketing at Texas A&M University.

2 Earth-sized bodies with oxygen rich atmospheres found -- but they're stars not planets ***Astrophysicists find 2 Earth-sized bodies with oxygen rich atmospheres - only snag is they're stars not planets***

Astrophysicists at the University of Warwick and Kiel University have discovered two earth sized bodies with oxygen rich atmospheres – however there is a bit of a disappointing snag for anyone looking for a potential home for alien life, or even a future home for ourselves, as they are not planets but are actually two unusual white dwarf stars.

The two white dwarf stars SDSS 0922+2928 and SDSS 1102+2054 are 400 and 220 light years from Earth. They are both the remnants of massive stars that are at the end of their stellar evolution having consumed all the material they had available for nuclear fusion.

Theoretical models suggest that massive stars (around 7 – 10 times the mass of our own Sun) will consume all of their hydrogen, helium and carbon, and end their lives either as white dwarfs with very oxygen-rich cores, or undergo a supernova and collapse into neutron stars. Finding such oxygen-rich white dwarfs would be an important confirmation of the models.

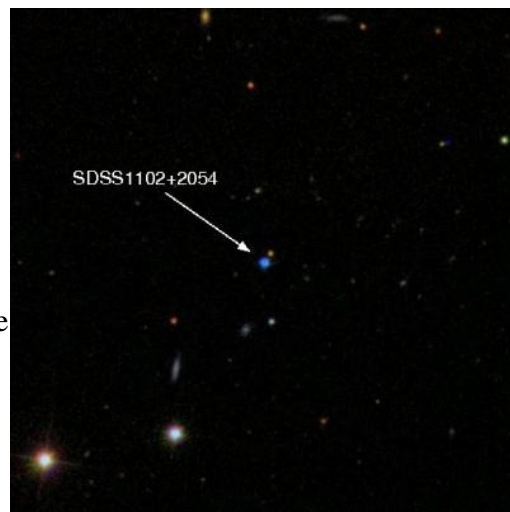
Sloan Digital Sky Survey spectroscopy of this inconspicuous blue object -- SDSS1102+2054 -- reveals it to be an extremely rare stellar remnant: a white dwarf with an oxygen-rich atmosphere The Sloan Digital Sky Survey

Unfortunately, almost all white dwarfs have hydrogen and/or helium envelopes that, while low in mass, are sufficiently thick to shield the core from direct view. However should such a core lose its remaining hydrogen envelope, astrophysicists could then detect an extremely oxygen-rich spectrum from the surface of the white dwarf.

Searching within an astronomical data set of the Sloan Digital Sky Survey (SDSS), the University of Warwick and Kiel University astrophysicists did indeed discover two white dwarfs with large atmospheric oxygen abundances.

Lead author on the paper, astrophysicist Dr. Boris Gänsicke from the University of Warwick, said:

"These surface abundances of oxygen imply that these are white dwarfs displaying their bare oxygen-neon cores, and that they may have descended from the most massive progenitors stars in that class."



Most stellar models producing white dwarfs with such oxygen and neon cores also predict that a sufficiently thick carbon-rich layer should surround the core and avoid upward diffusion of large amounts of oxygen. However, calculations also show that the thickness of this layer decreases the closer the progenitor star is to upper mass limit for stars ending their lives as white dwarfs. Hence one possibility for the formation of SDSS 0922+2928 and SDSS 1102+2054 is that they descended from the most massive stars avoiding core-collapse, in which case they would be expected to be very massive themselves. However current data is insufficient to provide any unambiguous measure of the masses of these two unusual white dwarves.

The full paper "Two white dwarfs with oxygen-rich atmospheres" will be published online by the journal Science on November 12th 2009 at 2pm EST and is written by Dr Boris Gänsicke, Jonathan Girven, Professor Tom Marsh, and Dr Danny Steeghs all of Department of Physics at University of Warwick in the UK and Detlev Koester of the University of Kiel in Germany.

Despite some benefit, drug ads can be harmful to your health

As Congress revisits drug ad regulation, researchers make recommendations for minimizing harm and maximizing benefits of drug ads

WASHINGTON, D.C. - While the debate over prescription drug advertising persists, a new study released online in the American Journal of Public Health offers guidelines for improving drug ads in order to minimize potential harm and maximize benefits. The study reveals that while there are some benefits from prescription drug direct-to-consumer advertising (DTCA), there are significant risks that are magnified by the prominence of DTCA.

"American television viewers see as many as 16 hours of prescription drug advertisements each year, and the reality is that these ads are not doing a good job of helping consumers make better decisions about their health," said Dominick L. Frosch, Ph.D., assistant professor of medicine at the University of California, Los Angeles and lead author of the study. "If the pharmaceutical industry isn't willing to change the ads to make them more useful to consumers, Congress should consider passing legislation that will regulate the ads to improve the information provided in order to help patients make more informed choices."

Several members of Congress, including Rep. Henry Waxman, D-Calif., are calling for changes to FDA regulations of DTCA. Advocates for prescription drug ads claim that these ads educate consumers, improve the quality of care and contribute to better patient adherence. Opponents argue that they lead to inappropriate prescribing and portray nonmedical problems as treatable medical illnesses.

In a review of the evidence for and against DTCA, Frosch and his colleagues confirm that there are some benefits to drug ads, but they are limited and can be improved. The evidence clearly shows that there is significant risk and potential harm associated with the current format of prescription drug ads. The majority of ads fail to provide enough information to allow consumers to clearly identify whether the advertised drug is right for them. The over dramatization and emotional portrayal of a drug's benefits can also be misleading to consumers, while the message about its risks are often diluted by contradicting imagery.

In light of these findings, the authors of the study propose new guidelines to improve prescription drug ads so that they better serve the health choices of consumers:

- * Ads should help consumers identify whether treatment is right for them by explaining how prevalent the relevant conditions are. They should also describe who may be at risk for conditions that don't present obvious symptoms. For conditions that do present obvious symptoms, they should describe what those symptoms are.

- * Ads should provide accurate and specific information about the potential benefits of advertised drugs, and should help consumers realistically judge those benefits by providing precise quantitative information. The ads should state how this drug compared to placebo or other available treatments, including generic drugs.

- * Ads should provide specific quantitative information about the potential risks associated with drugs without other visual or audio distractions, so consumers can better understand the risks associated with the prescription drugs.

The study, "A Decade of Controversy: Balancing Policy with Evidence in the Regulation of Prescription Drug Advertising" will be published online in the American Journal of Public Health on November 12th.

Coffee break: Compound brewing new research in colon, breast cancer

Researcher says no concerns about drinking coffee at this point

College Station – A compound in coffee has been found to be estrogenic in studies by Texas AgriLife Research scientists. Though the studies have not been conducted to determine recommended consumption amounts, scientists say the compound, called trigonelline or "trig," may be a factor in estrogen-dependent breast cancer but beneficial against colon cancer development.

"The important thing to get from this is that 'trig' has the ability to act like a hormone," said Dr. Clinton Allred, AgriLife Research nutrition scientist. "So there is a tie to cancer in the sense that we are looking at estrogen-dependent cancer cells. But that doesn't suggest that it would actually cause the disease. I don't believe there should be any concern about drinking coffee at this point."

His report was published in the Journal of Nutrition. Allred's lab studies dietary compounds that can mimic the hormone estradiol – the primary hormone in women. His main focus has been to look at how estrogen protects against the development of colon cancer. Estradiol is one of three estrogen hormones. "There's a history of these compounds in crops such as soy," Allred said. "Soy has a number of different compounds that actually can mimic estradiol in several disease states some of which are good and some of which have the potential to be more deleterious-type effects."

Allred said a former colleague mentioned an interest in finding the properties of "trig" – a natural compound used in traditional Indian culture for post-menopausal women.

Because the chemical structure of "trig" was so unlike estradiol, Allred didn't think the compound would be estrogenic. "Estrogen-dependent tumors in the presence of estradiol will grow faster," Allred said. "If you use those cells in a laboratory setting, you can determine whether something is estrogenic because they will literally make a tumor grow faster."

He said that a series of experiences and different approaches showed that "trig," a vitamin derivative, was fairly estrogenic at very low concentrations. "We haven't gotten as far as to suggest that if a woman had the disease that it would necessarily be a problem. But what we've proven is that the compound is estrogenic or can be at certain concentrations and doses," Allred said.

He added that "trig" is in coffee beans, though in different amounts depending on the variety of coffee bean. The two major types of coffee beans used for what is consumed in the U.S. both contain it, he said.

"The more you roast a coffee bean, the less there is," Allred said. "But the most critical aspect is that when you do a water extract of ground coffee, which is basically how you make a cup of coffee. It does in fact come out in the water, so we know it is in a cup of coffee."

Nevertheless, the researchers have no idea what the exposure level would be or whether a particularly exposure – say from one cup of coffee – would be in the range seen in the laboratory tests.

"It is way too early to say that drinking a cup of coffee is exposing you to something that is definitely going to be estrogenic. All we know is that there is a compound in there that can be estrogenic in our systems. That is really the take-home message," Allred said.

Allred also cautioned that people often narrow one compound in a food without considering the total mix of compounds and how they interact with each other or in a human body. "There is never a single compound when you're looking at food, and a cup of coffee is a food," Allred said. "There's a whole bunch of other things in it. There's caffeine. There's actually a little bit of fat. There are all sorts of other things in a cup of coffee that could interact with this."

The numerous compounds in each food product means there are complex interactions, he explained, which is why nutritionists advise people that the whole food is better than any individual compound.

"That's why you can't take supplements to make up for food. You can never take all the things that are in a carrot and replace a carrot. In the end, you need to eat the carrot," he said. "We're a long way from understanding what this compound could do in the context of a food."

He said a concern is that menopausal women seek over-the-counter phytoestrogen compounds to relieve symptoms such as hot flashes. Women want what they believe to be a natural and/or safe mechanism, he said, because hormone replacement therapy has such a negative connotation.

But, Allred said, researchers estimate that from the time an estrogen-dependent breast tumor begins until it is diagnosed in a woman is about 30 years. "That means there will be a number of women out there who will become menopausal, and begin to take phytoestrogens in supplement form," he said. "The majority of those come from soy. So our concern was, what if a woman becomes menopausal which means her estrogen levels are going to be low, she has estrogen-dependent breast cancer and doesn't even know it. And now she's consuming phytoestrogens."

"Physicians would never recommend you be on hormone replacement therapy if you had estrogen-dependent cancer. From a toxicology standpoint, it would that be a bad thing if you were consuming these phytoestrogens in high enough doses. It could be really dangerous."

A problem is that people believe that natural or plant-derived compounds are automatically safe which is not necessarily always true, he said. Also, consuming a compound in its pure form as a supplement in high doses may not be healthy.

"If we were getting a hormone from an animal, you wouldn't see people do that," he said. "The only difference is that this is a plant-derived compound, so they feel it is safe when that may not be so." Yet, Allred added, scientists are finding that at least some of these compounds are doing positive things to prevent colon cancer. "So there's going to be places that it's good – just as we've seen with estradiol," he noted.


"There are going to be some disease states that it is quite good for and some disease states that you need to be mindful of."

Still, the compound's potential as a weapon against colon cancer has the researchers "pretty excited about that."

"We're seeing very interesting information as far as tumor formation and the ability of phytoestrogens to prevent colon cancer formation. So any other new, natural phytoestrogen that we are able to identify and relate to the diet, that would be the model we'd bring it in to," Allred said of possible future studies on "trig."

He said a hope would be to develop a drug that could treat colon tissue without getting into the entire body, thus exploiting the compound's mechanism to protect against cancer formation without producing other estrogenic effects.

"It's really important for us to come up with strategies that we can have the benefits in the colon without the risks associated with (estrogenic compounds)," Allred said.

 **AUDIO: A compound in coffee has been found to be estrogenic in studies by Texas AgriLife Research scientists. Though the studies have not been conducted to determine... Click here for more information.**

Noisy parties no problem for musical brains

* 12:41 12 November 2009 by **Aria Pearson**

If you struggle to follow the conversation at noisy parties, music lessons might help.

Nina Kraus and colleagues at Northwestern University in Evanston, Illinois, have previously shown that playing an instrument seems to enhance our ability to pick up emotional cues in conversation.

Now her team has found differences in brain activity that they say make musicians better at picking out speech from background noise.

After establishing that musicians are better at repeating a sentence heard in the presence of background noise, the researchers asked 16 lifelong musicians and 15 non-musicians to listen to speech in a quiet or noisy environment while they were wearing scalp electrodes to monitor their brain activity.

Slow reactions

Background noise delayed the brain's response, but this delay was much shorter in the musicians. What's more, in the noisy environment, the musicians' brainwaves were more similar to the sound waves of the speech than in non-musicians.

The difference could be partly genetic, but Kraus says training is likely to help. "Musicians spend a lot of time extracting particular sounds from a soundscape." If that is the case, musical training could provide real benefits to children with autism or language difficulties, who tend to find understanding speech in a noisy environment particularly difficult, says Kraus – and for other children too.

"Music education is not just about teaching your child how to play the flute, it's about teaching your child to function better in our noisy auditory environment," she says.

Journal reference: The Journal of Neuroscience, DOI: 10.1523/jneurosci.3256-09.2009

The narrow line between love and jealousy

A new study carried out at the University of Haifa has found that the oxytocin hormone, known as the 'love hormone,' also affects antisocial behaviors, such as envy and gloating

A new study carried out at the University of Haifa has found that the hormone oxytocin, the "love hormone", which affects behaviors such as trust, empathy and generosity, also affects opposite behaviors, such as jealousy and gloating. "Subsequent to these findings, we assume that the hormone is an overall trigger for social sentiments: when the person's association is positive, oxytocin bolsters pro-social behaviors; when the association is negative, the hormone increases negative sentiments," explains Simone Shamay-Tsoory who carried out the research.

Previous studies have shown that the oxytocin hormone has a positive effect on positive feelings. The hormone is released in the body naturally during childbirth and when engaging in sexual relations. Participants in an experiment who inhaled the synthetic form of the hormone displayed higher levels of altruistic feelings, and it is supposed that the hormone plays an important role in the formation of relationships between people.

However, in earlier studies carried out by other investigators with rodents, it was found that the hormone is also related to higher levels of aggression. Therefore, it was decided to examine whether the hormone also affects negative social sentiments. The present study, which was published in the journal Biological Psychiatry, included 56 participants. Half of the participants inhaled the synthetic form of the hormone in the first session and were given a placebo (a dummy drug) in the second session; the others were given a placebo in the first session and oxytocin in the second session. Following drug administration each participant was asked to play a game of luck along with another competitor, who was in fact – and without their knowledge – a computer. Each of the participants was asked to choose one of three doors and was awarded the sum of money that was hidden behind that door. Sometimes the participant gained less money than the other player, and sometimes more, creating conditions in which a person might well develop feelings of envy and gloating.

The findings show that those participants who inhaled the "hormone of love" displayed higher levels of envy when the opponent won more money and of gloating when they were ahead. Another interesting result was that as soon as the game was over, no differences between the participants were evident with regards to these sentiments. This indicates that the negative feelings were empowered only in the course of the game itself. "Following the earlier results of experiments with oxytocin, we began to examine the possible use of the hormone as a medication for various disorders, such as autism. The results of the present study show that the hormone's undesirable effects on behavior must be examined before moving ahead," Dr. Shamay-Tsoory concludes.

Common cold may hold off swine flu

* 12 November 2009 by **Debora MacKenzie**

A VIRUS that causes the common cold may be saving people from swine flu. If this intriguing idea turns out to be true, it would explain why swine flu's autumn wave has been slow to take off in some countries and point to new ways to fight flu.

"It is really surprising that there has not been more pandemic flu activity in many European countries," says Arnold Monto, an epidemiologist at the University of Michigan, Ann Arbor.

It is really surprising that there has not been more pandemic flu activity in many European countries

In France, flu cases rose in early September, then stayed at about 160 per 100,000 people until late October, when numbers started rising again. The delayed rise was puzzling, says Jean-Sebastien Casalegno of the French national flu lab at the University of Lyon.

He reports that the percentage of throat swabs from French respiratory illnesses that tested positive for swine flu fell in September, while at the same time rhinovirus, which causes colds, rose (Eurosurveillance, vol 14, p 19390). He told New Scientist that in late October, rhinovirus fell - at the same time as flu rose. He suspects rhinovirus may have blocked the spread of swine flu via a process called viral interference.

This is thought to occur when one virus blocks another. "We think that when you get one infection, it turns on your antiviral defences, and excludes the other viruses," says Ab Osterhaus at the University of Rotterdam in the Netherlands.

How important such interference is in viral epidemics is unclear, however: there are also cases in which there is no interference, and people catch two viruses at the same time. Normally, we don't get a chance to see how rhinovirus affects flu, as flu epidemics usually strike in winter, whereas rhinovirus hits when schools start (late summer in the northern hemisphere).

But this year the pandemic meant flu came early - and France isn't the only country in which rhinovirus seems to have held it at bay. In Eurosurveillance last month, Mia Brytting of the Swedish Institute for Infectious Disease Control in Solna reported a rise in rhinovirus coupled with a swine flu lull just after school resumed in Sweden at the end of August (see graph). She too says rhinovirus has now fallen, as flu has climbed. Researchers in Norway report rhinovirus rose there as flu fell in August, while Ian Mackay at the University of Queensland found the same trend in Australia.

What's more, in March, Mackay reported that people with rhinovirus are less likely to be infected with a second virus than people with other viruses, and are just one-third as likely to have simultaneous seasonal flu (Journal of Clinical Virology, DOI: 10.1016/j.jcv.2009.03.008).

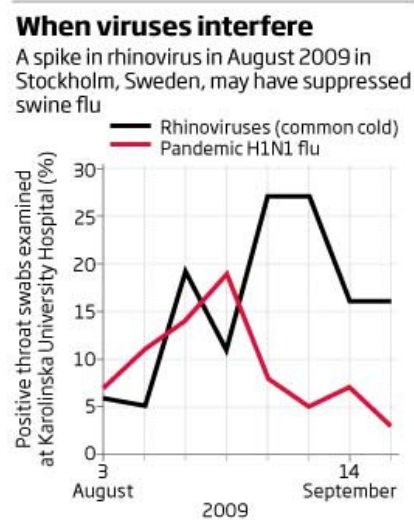
So why hasn't the US, for example, seen a dip in pandemic cases during a back-to-school rhinovirus outbreak? Mackay speculates that interference from rhinovirus may not be enough to fend off flu if someone is exposed repeatedly. There were far more cases of swine flu in the US in September than in Europe.

The effects of rhinovirus, often dismissed as "only" a cold, are too poorly understood, say all the researchers. Its seeming ability to block swine flu may already have saved lives in France by buying the nation time before the vaccine arrived. It may even lead to a drug that induces the antiviral state, but without the sniffles.

Too much selenium can increase your cholesterol

A new study from the University of Warwick has discovered taking too much of the essential mineral selenium in your diet can increase your cholesterol by almost 10%.

Selenium is a trace essential mineral with anti-oxidant properties. The body naturally absorbs selenium from foods such as vegetables, meat and seafood. However, when the balance is altered and the body absorbs too much selenium, such as through taking selenium supplements, it can have adverse affects.



A team led by Dr Saverio Stranges at the University's Warwick Medical School has found high levels of selenium are associated with increased cholesterol, which can cause heart disease.

In a paper recently published in the *Journal of Nutrition*, the research team examined the association of plasma selenium concentrations (levels of selenium in the blood) with blood lipids (fats in the blood).

The researchers found in those participants with higher plasma selenium (more than 1.20 $\mu\text{mol/L}$) there was an average total cholesterol level increase of 8% (0.39 mmol/L (i.e. 15.1 mg/dL). Researchers also noted a 10% increase in non-HDL cholesterol levels (lipoproteins within your total cholesterol that can help predict the risk of someone suffering a heart attack or chest pain). Also, of the participants with the highest selenium levels, 48.2% admitted they regularly took dietary supplements.

The study was conducted among 1042 participants aged 19-64 in the 2000-2001 UK National Diet and Nutrition Survey. All participants were interviewed face-to-face to assess lifestyle factors such as diet and drinking habits. Blood samples were then taken for analysis.

Dr Saverio Stranges said although high selenium levels were not exclusively caused by people taking dietary supplements, the results of the study were concerning because the use of selenium dietary supplements had risen considerably in the UK in recent years. He said this was largely due to the perception that selenium can reduce the risk of cancer and other diseases.

He said: "This use has spread despite a lack of definitive evidence on selenium supplements efficacy for cancer and other chronic disease prevention. The cholesterol increases we have identified may have important implications for public health. In fact, such a difference could translate into a large number of premature deaths from coronary heart disease.

"We believe that the widespread use of selenium supplements, or of any other strategy that artificially increases selenium status above the level required is unwarranted at the present time. Further research is needed to examine the full range of health effects of increased selenium, whether beneficial or detrimental."

Notes to editors For more information please contact Kelly Parkes-Harrison, k.e.parkes@warwick.ac.uk, 02476 574255, 07824 540863

Piezoelectronics gets green makeover

* 18:05 12 November 2009 by **MacGregor Campbell**

A new generation of lead-free piezoelectric materials could lead to greener actuators, sensors and even ultra-dense data storage. The new materials, which generate an electric field when squeezed, copy the crystal structure of conventional piezoelectric materials but use bismuth instead of lead.

Since the EU banned lead (see *Uncovering the hazards in our electronic gadgets*) from electrical devices in 2006, scientists and manufacturers have been scrambling to find alternatives to key materials that depend on the toxic metal for their function. In particular, piezoelectrics – materials that can convert mechanical stress into an electric field and vice versa – have proved challenging to replace. Now a new design, based on clever crystal geometry, could soon deliver comparable performance with less environmental impact.

The best-performing piezoelectric materials are currently made from lead zirconium titanate (PZT). This has a crystal structure consisting of atoms arranged in the shapes of squares and diamonds. An electric field causes the diamonds to flip into square shapes, changing the structure of the crystal and altering its overall length by up to 10 per cent.

Robert Zeches, Ramamoorthy Ramesh and colleagues at University of California, Berkeley have developed a way to reproduce this behaviour using layers of non-toxic bismuth ferrite, which naturally forms into a square crystal structure. They start with an electrically charged grid of squares that are slightly smaller than those usually formed by bismuth ferrite. They then deposit the bismuth ferrite onto the grid using an ultraviolet laser. As the film builds up, some of the squares maintain their shape, while others get skewed as they attempt to form the natural, larger crystal structure.

The result is a mixture of box and diamond shapes, which behave in similar way to those in PZT. In the presence of the electric field, the new material can change its length by around 1.5 per cent – not as much as PZT, but enough for many practical purposes. The team says these could include making ultra-dense data storage in which a bit is stored in a region of the crystal that is extended. The data would be written and read using an atomic force microscope tip.

"One of the drivers of this research is trying to find ferroelectric materials that perform on a par with lead-based compounds but that don't have lead in them," says Zeches.

"We want something that could be a viable replacement for what's in the field." The team still needs to improve the material's piezoelectric response, says Muhtar Arhart, a materials researcher at the Carnegie/Doe Alliance Center in Washington DC, not involved with the research. "If it doesn't have lead but still has huge piezo properties, that would be very nice. Lead has all kinds of hazardous properties."

Cocaine and pepper spray – a lethal mix?

* 13 November 2009 by Shanta Barley

DEATHS in US police custody during the early 1990s may have been the result of an interaction between capsaicin, the key ingredient in pepper sprays, and psychostimulant drugs, an experiment in mice suggests.

If the two have a fatal interaction in people then police forces might have to rethink their use of pepper spray as a non-lethal weapon, says John Mendelson of the Addiction and Pharmacology Research Laboratory at St Luke's Hospital in San Francisco, who led the mouse research.

In the early nineties, anecdotal reports emerged in the US of people dying after being sprayed by police. "They seemed to die very quickly," says Mendelson. At post-mortem, many of these people showed signs of having taken cocaine, so Mendelson wondered if capsaicin and cocaine could interact fatally in the body.

To investigate, his team injected cocaine, capsaicin or both at once into the abdomens of several groups of about 30 mice. Injections allowed them to control the dose of capsaicin the mice received, which wouldn't have been possible if the mice were simply sprayed, says Mendelson.

In one group of mice, cocaine was injected at a dose of 60 milligrams per kilogram of mouse weight, which killed just a few of them. But when the researchers injected a group with the same dose of cocaine plus capsaicin, the death toll was about half. "The presence of capsaicin in mice makes smaller amounts of cocaine more lethal," Mendelson says. When the team gave another group of mice capsaicin along with a higher dose of cocaine - enough to kill half of the mice on its own - the death toll rose to 90 per cent (Forensic Toxicology, DOI: 10.1007/s11419-009-0079-9). "We don't actually know how capsaicin reacts with cocaine to produce a lethal effect," admits Mendelson.

However, his team also reviewed 26 autopsy reports and Californian police reports between 1993 and 1995 of people who died shortly after being subdued with pepper spray. They noted that 19 of them had evidence of psychostimulants in their blood and nine had cocaine. Mendelson suspects that a fatal interaction takes place in the brain between capsaicin and psychostimulants.

Toxicologists are intrigued, but say further evidence is needed. "In real-life situations, humans inhale pepper spray, whereas these mice had the substance injected directly into their abdominal cavities," says Andy Smith of the Medical Research Council in Cambridge, UK. Kathryn Cunningham of the Department of Pharmacology and Toxicology at the University of Texas in Galveston says we don't know how much of the capsaicin that is sprayed in someone's face makes it into their bloodstream.

Peter Bibring, an attorney at the American Civil Liberties Union in Los Angeles, says the study adds weight to the ACLU's concern that pepper spray could be fatal. "Police departments need to make adjustments to minimise the chance it will be used on those under the influence of cocaine."

Norm Leong, a sergeant at the Sacramento Police Department in California says this could be a tough call: "It's impossible to know if someone is under the influence of cocaine, some other drug", has mental issues, or is just resisting arrest.

Fat collections linked to decreased heart function

(Boston) - Researchers from Boston University School of Medicine (BUSM) have shown that fat collection in different body locations, such as around the heart and the aorta and within the liver, are associated with certain decreased heart functions. The study, which appears on-line in *Obesity*, also found that measuring a person's body mass index (BMI) does not reliably predict the amount of undesired fat in and around these vital organs.

The prevalence of obesity is rising rapidly in the United States. Recent estimates suggest that approximately 30 percent of the adult population meets this criterion. Past studies have shown that fat accumulation in the liver and around the heart are linked to cardiovascular disease and type 2 diabetes.

BUSM researchers compared fat volumes in obese persons (BMI over 30), all of whom had high blood pressure and/or diabetes, and lean healthy persons (average BMI of 22). All subjects underwent magnetic resonance imaging (MRI) and proton MR spectroscopy to quantify pericardial and peri-aortic lipid volumes, cardiac function, aortic compliance and intra-hepatic lipid content. Fasting plasma lipoproteins, glucose, insulin, and free fatty acids were also measured among the subjects.

The researchers found fat collections in anatomically separate locations, such as within the liver and around the heart, to be associated to cardiovascular function – including a decrease in cardiac pumping function – as fat around the heart increased. However, they also found that the amount of fat around the heart and aorta was not predicted by the BMI of the individual in this population.

"Our study found that fat collection around the heart, the aorta and within the liver is clearly associated with decreased heart functions and that an MRI can quickly and noninvasively measure fat volume in these areas. Our study also found that looking at BMI of the individual does not reliably predict the amount of undesired fat in and around organs," said James

Hamilton, PhD, senior author and project leader, and a professor of biophysics, physiology and biomedical engineering at BUSM.

According to the researchers, this method of measuring cardiac function and fat depots can be done in less than one hour, and may provide a basis for future individualized treatment.

Failed stellar bombs hint at supernova tipping point

* 13:57 13 November 2009 by Stephen Battersby

Oxygen on a planet might be a sign of life, but in two peculiar white dwarf stars it could indicate a narrow escape from a violent death. Their oxygen content marks them as failed stellar bombs – the remnants of stars that almost went supernova.

The new stars are among thousands of white dwarfs picked up by the Sloan Digital Sky Survey. Like all white dwarfs they are the dead, cooling cores left behind by mainstream stars, and are mainly made of helium. Usually the second most plentiful ingredient is carbon – but when a group of astronomers led by Boris Gänsicke at the University of Warwick, UK, analysed the spectrum of light from these two white dwarfs, they found that the objects hold far more oxygen than carbon.

"It's extreme – these things look very different from any white dwarfs we've seen before," says team member Danny Steeghs.

Creating so much oxygen requires a nuclear furnace fiercer than that needed for a carbon-rich mixture, so the stars that spawned these white dwarfs must have been hot and massive. Simulations suggest that they must have been almost too big to end their days gently – any larger, and they would have grown a core so massive and dense that it would inevitably have collapsed, releasing enough energy to blow the rest of the star apart in a supernova explosion.

The critical mass needed to create such a supernova is thought to be between 7 and 10 times that of the sun. These almost-bombs might help astrophysicists to pin down the threshold more precisely, and Gänsicke hopes to use the Very Large Telescope in Chile's Atacama Desert to get a clearer spectrum and reveal their chemistry in more detail. "It will give the theoreticians something to work with," he says.

Journal reference: Science, DOI: 10.1126/science.1180228

U of M researchers find 2 units of umbilical cord blood reduce risk of leukemia recurrence **Finding may give hope to more leukemia patients so they may live cancer-free**

MINNEAPOLIS/ST. PAUL (November 11, 2009) – A new study from the Masonic Cancer Center, University of Minnesota shows that patients who have acute leukemia and are transplanted with two units of umbilical cord blood (UCB) have significantly reduced risk of the disease returning. This finding has the potential to change the current medical practice of using one unit of UCB for treatment of patients who are at high risk for recurrence of leukemia and other cancers of the blood and bone marrow.

Michael Verneris, M.D., and John Wagner, M.D., who specialize in research and treatment of children with cancer, led the research team on this breakthrough study. The results are published in the current issue of the scientific medical journal *Blood*. This study was funded with grants from the National Cancer Institute and the Children's Cancer Research Fund.

Verneris and his colleagues studied 177 patients treated at the University of Minnesota Medical Center, Fairview and the University of Minnesota Amplatz Children's Hospital between 1994 and 2008. The average age of the patients in this study was 16 years. Eighty-eight patients had acute lymphoblastic leukemia (ALL) and 89 had acute myeloid leukemia (AML).

"Our analysis showed that patients in first or second remission from the leukemia had a significantly lower likelihood of leukemia recurrence if they were transplanted with two UCB units than if they were transplanted with one (19 percent vs. 34 percent)," says Verneris.

"We believe our finding provides evidence that using two units of UCB for transplantation may be more effective in preventing leukemia relapse and gives hope to patients with hematological malignancies so that they may live cancer-free," he says.

Blood and marrow stem cell transplantation has been a mainstay treatment for patients with high risk leukemia and other hematological malignancies for the past 30 years. In the last decade, the blood in the placenta and umbilical cord has been collected and banked for public use. Now, UCB is routinely used throughout the world as an alternative to bone marrow transplantation.

However, because of the limited number of cells in UCB, this stem cell source has been reserved for young children and small adults. The practice of using two UCB units (from two different individuals) was pioneered at the University of Minnesota approximately 10 years ago. By using two UCB units, nearly all patients can now use this stem cell source for transplantation.

Previous research studies have also shown that about 25 to 30 percent of patients suffer leukemia relapse after transplant. The relapse or disease recurrence rates are similar regardless of whether the stem cells used for transplantation are from bone marrow, peripheral blood, or umbilical cord blood.

Verneris and his colleagues compared the outcomes of patients who were transplanted with one versus two UCB units. Forty-seven percent of the patients received one unit of UCB; the remaining patients received two units. The choice to receive one versus two units was based on the number of stem cells contained in the UCB. Since the number of stem cells needed for a successful transplant varies with the patient's weight, older patients and those who weigh more need more stem cells than infants and young children.

"Given that adult patients were more likely to receive two UCB units and that they tend to have more aggressive leukemia, we think that the lower relapse rates with two UCB units is remarkable," says Verneris. He notes that while promising, these results will have to lead to a national study comparing one versus two cord blood units in children with leukemia.

"Prior to the research done by my predecessors, the co-infusion of two UCB units had not previously been performed," says Verneris. "We now know that without this double transplantation procedure, the majority of the patients treated would have had no other reasonable treatment option for their leukemia. The fact that they had less leukemia relapse was a wonderful surprise."

Study reveals why certain drug combinations backfire

BOSTON, Mass. (Nov. 12, 2009) — Combination drug therapy has become a staple for treating many infections. For instance, doctors treat extensively drug resistant forms of tuberculosis with one drug that breaks down the pathogen's protective barriers and opens the door for another to deliver the deathblow.

Just as some drugs work better together, however, other pairings are counter-productive. "The question we asked was how can it be that two drugs in combination are less effective than one of them alone," said senior author and Harvard Medical School associate professor of systems biology Roy Kishony.

Kishony and his team have found that the answer lies in the way some antibiotic drugs influence a bacterial cell's gene expression levels. Combinations of these altered genetic behaviors can "put the cell in a better position for survival," said Kishony. The work, which was done in collaboration with Stanford University research associate Selwyn Quan, is described in the November 13 *Cell*.

Kishony's work on drug combinations began in 2006 when his lab found that understanding why certain drugs work well or poorly together can help researchers identify the cellular functions they attack. For instance, drugs that block protein production work poorly with drugs that block DNA replication, but they work well with drugs that weaken the cell wall.

According to first author and research fellow in systems biology Tobias Bollenbach, clinical researchers are primarily interested in drugs that together work better than either alone, and so studies tend to focus on explaining some of the mechanisms behind synergistic drug pairings. However, ever since the Kishony lab discovered in 2008 that antagonistic drug pairings slow down the evolution of antibiotic resistance, it has become increasingly clear that these drug combinations warrant further study.

To explore the dynamics of these antagonistic drug interactions, Kishony, Bollenbach, and doctoral candidate Remy Chait zeroed in on two classes of antibiotics that suppress one another. One class of drugs he investigated interrupts the replication of DNA and the other blocks the manufacture of proteins. They studied their combined effects on the bacteria *Escherichia coli*.

Drugs that impede DNA synthesis, such as Ciprofloxacin (a drug rarely used these days), interrupt cell division. As a result, *E. coli* enters a state of stress.

Normally, when a cell is in a stressful state it responds by trying to repair itself and by scaling back on its other activities, such as production of ribosomes, the molecular machines that manufacture proteins.

But with Ciprofloxacin, the cells try to repair DNA while still producing ribosomes. This is not in the cell's best interest, because making ribosomes uses up cellular resources and creates a surplus of proteins, which is even more costly.

When the team added the additional stress of a protein-synthesis inhibiting drug, such as Tetracycline, instead of causing the cells more trouble, the second drug counteracted the overproduction of ribosomes and proteins. "Since this other drug inhibits the ribosome, it corrects for the fact that the cell made too many in the first place," said Bollenbach.

The team hypothesized that the second drug restored the cellular equilibrium that the first drug distorted. This enabled the bacteria to flourish in the midst of this dual-antibiotic assault, though it isn't yet mechanistically clear why.

To corroborate these initial findings, the team conducted a second round of experiments in which they impaired the ability of *E. coli* to produce ribosomes. As a result, the cells could more easily withstand the assault of the first drug, yet succumbed to the second, completely removing the strong antagonism between the drugs.

This work "suggests that there are things about antibiotics and other inhibitors that we never suspected," said University of British Columbia microbiologist Julian Davies, "We are so naive about how drugs work. We are so naive about the activities of these compounds once they are actually in human beings. What I think will be important about this work is that people will be able to design model studies with animals. If one can reproduce these results in animal models, they could be adapted to a human situation."

The discovery has inspired Kishony and his team to ask a more general question about antibiotic interactions. Kishony recently received a federal stimulus grant to pursue a study that explores the genetic determinants of drug interactions more broadly and investigates whether cells can be synthetically manipulated to change the way drugs interact.

"Understanding how cells alter their genetic programs in the presence of antibiotic drugs could provide insights into new ways to discourage the growth of pathogens and encourage the growth of 'good' bacteria in the lab and in the clinic," said Kishony.

This research was funded by the National Institutes of Health. Bollenbach received support from an Alexander von Humboldt fellowship.

CITATION: *Cell*, Nov 13, 2009, Vol 139, No. 4 "Nonoptimal Microbial Response to Antibiotics Underlies Suppressive Drug Interactions" Tobias Bollenbach (1), Selwyn Quan (3), Remy Chait (1) and Roy Kishony (1,2)

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Today's children decide their school and career path early

'What is very striking,' says Professor Croll, 'is that for this generation there is absolutely no gender stereotyping in hopes for the future. Furthermore, what children say at the age of 11 about school participation after the age of 16 is highly predictive of their actual behaviour.'

The research concludes that to increase participation in schooling post-16, schools need to focus on giving advice and information to children as soon as they enter secondary education. Greater attention also needs to be paid to social relationships, in order to make school a more enjoyable experience for some children. But the study acknowledges that schools face a difficult balance between encouraging high expectations and providing realistic opportunities and goals.

Girls are as likely as boys to see themselves as supporting families and boys are as likely as girls to see marriage and children as a significant part of their lives. However, by far the most important, for both boys and girls, is getting a good job. School is seen as instrumental in achieving this. 'A major background of the research is concern for relatively low levels of participation in education post-16,' says Professor Croll, 'as well as the under-representation of children from disadvantaged backgrounds at university.'

However, the study found no support for the view that children from disadvantaged backgrounds have attitudes to education or value systems that are incompatible with those of school. Indeed, virtually all children think school is important. Furthermore, although intentions for post-16 participation are lower than might be hoped, only a small proportion of the children said that they definitely would not go to university. This suggests that the possibility of higher education is becoming a norm for this generation of young people.

The study found that a significant number of children were confused about the educational routes available to them and did not understand the link between specific educational and employment opportunities. For example some planned to go to university but also said they intended to leave school at 16.

More significantly, the children in the study were occupationally ambitious with 70 percent choosing professional and managerial occupations. Children whose own parents were in such occupations were more likely to be ambitious but two-thirds of children whose parents were in manual occupations wanted professional and managerial jobs for themselves.

'Many more children wanted these kinds of jobs regardless if these jobs will be available in the future,' says Professor Croll, 'and the question arises of not just who wants them but also who will get them.'

Professors Croll and Attwood have fed their findings into the Government initiative on raising the participation age (RPA) and have briefed MPs on their work.

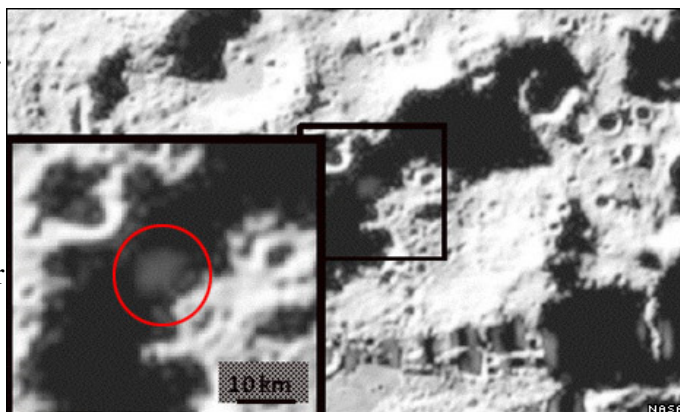
The study, which is designed to advance our understanding of how young children see the educational and occupational possibilities available to them and how they begin to make choices, shows that boys and girls from all backgrounds see education as important for the future.

The ESRC will return to this issue of young people's aspirations as part of the longitudinal study, Understanding Society. For the first time thousands of young people will be surveyed about their attitudes offering a new insight into this group.

'Significant' water found on Moon

By Jonathan Amos Science reporter, BBC News

Nasa's experiment last month to find water on the Moon was a major success, US scientists have announced. The space agency smashed a rocket and a probe into a large crater at the lunar south pole, hoping to kick up ice. Scientists who have studied the data now say instruments trained on the impact plume saw copious quantities of water-ice and water vapour. One researcher described this as the equivalent of "a dozen two-gallon buckets" of water "We didn't just find a little bit; we found a significant amount," said Anthony Colaprete, chief scientist for the Lunar Crater Observation and Sensing Satellite (LCROSS) mission.



A camera on the probe shows the ejecta plume about 20 seconds after impact

No doubt

October's experiment involved driving a 2,200kg Centaur rocket stage into the 100km-wide Cabeus Crater, a permanently shadowed depression at the Moon's far south. At the time, scientists were hoping for a big plume of debris some 10km high which could be seen by Earth telescopes. The actual debris cloud was much smaller, about 1.6km high, but sufficiently large to betray the evidence researchers were seeking.

The near-infrared spectrometer on the LCROSS probe that followed the rocket into the crater detected water-ice and water vapour. The ultraviolet-visible spectrometer provided additional confirmation by identifying the hydroxyl (OH) molecule, which arises when water is broken apart in sunlight.

"We were able to match the spectra from LCROSS data only when we inserted the spectra for water," Dr Colaprete said. "No other reasonable combination of other compounds that we tried matched the observations. The possibility of contamination from the Centaur also was ruled out."

Useful resource

The total quantity of H₂O spied by the instruments was more than 100kg. It came out of a 20m-30m wide hole dug up by the impacting Centaur rocket.

The LCROSS scientists stressed that the results presented on Friday were preliminary findings only, and further analysis could raise the final assessment of the amount of water in Cabeus.

Peter Schultz, from Brown University and a co-investigator on the LCROSS mission, said: "What's really exciting is we've only hit one spot. It's kind of like when you're drilling for oil. Once you find it in one place, there's a greater chance you'll find more nearby."

The regular surface of the Moon as seen from Earth is drier than any desert on our planet. But researchers have long speculated that some permanently shadowed places might harbour considerable stores of water, perhaps delivered by impacting comets billions of years ago. If future investigations find the quantities to be particularly large, this water could become a useful resource for any astronauts who might base themselves at the lunar poles. "It can be used for drinking water," said Mike Wargo, Nasa's chief lunar scientist for exploration systems. "You can break it down and have breathable air for crews. But also, if you have significant quantities of this stuff, you have the constituents of one of the most potent rocket fuels - oxygen and hydrogen."

In September, data from three spacecraft, including India's Chandrayaan probe, showed that very fine films of H₂O coat the particles that make up lunar soil.

Scientists behind that finding speculated that this water might migrate to the even cooler poles, much as water vapour on Earth will condense on a cold surface.

This cold sink effect could be supplementing any water delivered by comets, they said. If cometary material did reside in places like Cabeus Crater it would be fascinating to examine it, commented Greg Delory, from the University of California, Berkeley. "The surfaces in these permanently shadowed areas, such as the one LCROSS impacted, are very cold," he told reporters. "That means that they tend to trap and keep things that encounter them - compounds, atoms and so forth. And so they act as record keepers over periods as long as several billion years. They have a story to tell about the history of the Moon and the Solar System."

LCROSS was launched by Nasa on 18 June as part of a double mission which included the Lunar Reconnaissance Orbiter (LRO). The latter, which continues to circle the Moon, measured a temperature of minus 230 Celsius at the base of Cabeus Crater.

Indus civilisation reveals its volumetric system

Combination of 'V' signs and linear strokes were used to indicate volumes

CHENNAI: The Indus civilisation had a volumetric system with inscriptions on ceramic vessels (glazed pots from Harappa) indicating that the sign 'V' stood for a measure, a long linear stroke equalled 10, two long strokes stood for 20 and a short stroke represented one, according to Bryan Wells, who has been researching the Indus script for more than 20 years.

These markings on the pots are identical to those found on the incised tablets and bas-relief tablets also found in Harappa, said Dr. Wells, who earned his Ph.D. from Harvard University for his thesis on "The Epigraphic Approaches to Indus Writing." It is to be published as a book in 2010.

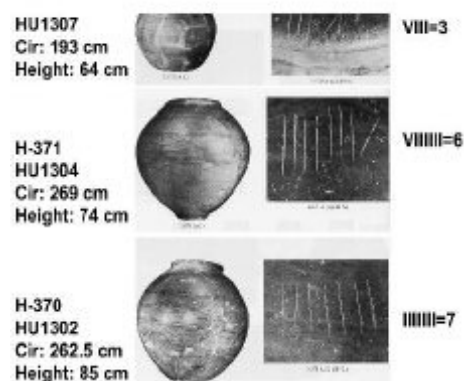
Besides, a ceramic vessel from Mohenjo-Daro, which had fragments of blue-coloured bangles inside, had one long stroke and seven short strokes inscribed on it. When these broken pieces were reconstructed with a computer, they turned out to be 17 bangles. This again established that one long stroke equalled 10 and each short stroke one, Dr. Wells said. He described the findings as "an important discovery" and "very interesting."

Dr. Wells has proposed that "these sign sequences [sign 'V' plus numerals] are various values in the Indus volumetric system. The bas-relief tablets might have been used as ration chits or a form of pseudo-money with the repetitive use of 'V' paired with II, III, IIII relating to various values in the Indus volumetric system. The larger the ceramic vessel, the more strokes it has. This postulation can be tested by detailed measurements of whole ceramic vessels with clear inscriptions."

For instance, he recently measured the volume of the three pots from Harappa, which are now with the Archaeological Survey of India (ASI) at Purana Quila in New Delhi. While the smallest of them had three long strokes and a 'V' sign, the bigger one had six long strokes and a 'V' sign and the biggest seven long strokes and a scale inscribed below it. When he measured their volumes, Dr. Wells found that the pot with three long strokes had an estimated volume of 27.30 litres, the vessel with six long strokes 55.56 litres and the one with seven 65.89 litres. Thus, the calculated value of one long stroke was 9.24 or approximately 10 litres.

Dr. Wells (58), who is now a Senior Researcher in the Institute of Mathematical Sciences, Taramani here, has also focussed on creating an adequate sign list and corpus for the Indus script and the structural analysis of the Indus texts.

He said he first saw the pictures of these pots with markings in the "Corpus of Indus Seals and Inscriptions," edited by Asko Parpola and his colleagues. When he learnt that the pots were with the ASI at Purana Quila, Dr. Wells travelled there to measure their volumes.



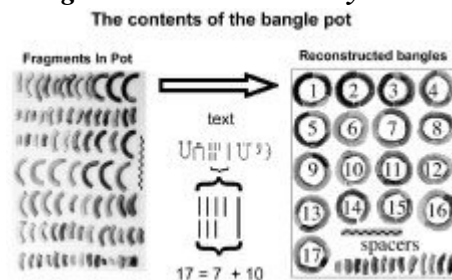
(Above) The three pots from Harappa with volumetric inscriptions on them. Calculations indicate that the Indus volumetric system is based on multiples of 9.24 litres.

(Below) A reconstruction of broken bangles from the Moneer area of Mohenjo-Daro. The number of reconstructed bangles (17) matches the number from the sealing text on the pot that had the broken bangles inside. The other photo shows Indus fish signs. -Photo credits: Bryan Wells

No coincidence

It was Michael Jansen, another researcher on Indus civilisation, who discovered the pot with broken bangles at Mohenjo-Daro in 1987. What intrigued Dr. Wells was the text of one long stroke and seven short strokes inscribed on it. When he reconstructed these broken pieces, using their internal circumferences, with a computer, he found that 17 bangles must have remained intact inside. Besides, the rake sign in the Indus script had a value of hundred and the double rake sign, 200. "This is completely regular" and "not a result of coincidence," he said. When the 'V' sign with linear strokes that occurred on the Harappan tablets were found repeated on a number of ceramic vessels, "it gave me the idea that the 'V' sign is probably a measure," Dr. Wells explained.





It was possible that wages were paid in grain (from these vessels) dispersed from a centralised storage facility, or in the case of incised tablets, material for construction projects and other short-term projects was



distributed. He asserted that “there is archaeological evidence bearing on this issue in the form of standardised ceramics with texts describing their contents.”

“Fish” for weights

Dr. Wells agreed with another Indus scholar Steve Bonta’s (Pennsylvania State University) theory that the “fish” sign in the script stood for weights. According to Dr. Bonta the fish sign occurred frequently with numbers in the script and in clusters too. He later found that the Akkadian Sargonic texts referred to the weight systems of Dilmun (Bahrain) as “minus.” The system of weights from Dilmun was exactly the same as that of the Indus system. Dr. Bonta, who speaks Tamil, realised that “min” in Tamil meant fish. “So our theory is that the term “minus” is derived from the Indus and that the fish are weights,” Dr. Wells said. There were fish signs with one long stroke, two long strokes, a single rake or a double rake. “So the sign graph is doubling and the value is doubling. I think this is too much of a coincidence. But I am aware that a lot of people will disagree with me on the fish sign,” he added. *T.S. Subramanian © Copyright 2000 - 2009 The Hindu*

| Indus Fish Signs | | |
|---|----|-------|
|  | | = 10 |
|  | | = 20 |
|  | ⊥ | = 100 |
|  | ⊥⊥ | = 200 |

First universal programmable quantum computer unveiled

* 18:00 15 November 2009 by Colin Barras

The world's first universal programmable quantum computer has been put through its paces. But the test program revealed significant hurdles that must be overcome before the device is ready for real work.

Earlier in the year, a team at the National Institute of Standards and Technology in Boulder, Colorado, built a quantum computer capable of processing two quantum bits, or qubits. Qubits store more information than the simple "on" or "off" bits of conventional computing, which means that a quantum computer outperform conventional computers in tasks such as cryptanalysis.

As in a classical computer, a series of logic gates processes the information – although here the gates are quantum logic, or qubit, gates. "For example, a simple single-qubit gate would change a 'one' to a 'zero' and vice versa," says David Hanneke, a member of the team. But unlike the physical logic gates of a classical computer, the quantum logic gates used in the team's device are each encoded into a laser pulse.

Logic trick

The experimental device uses beryllium ions to store qubits in the way they spin while the laser-pulse quantum gates perform simple logic operations on the qubits. The trick to making a quantum logic gate is in designing a series of laser pulses that manipulate the beryllium ions in a way that processes information. Another laser then reads off the results of the calculations. "Once we had demonstrated we could successfully combine lots of components in this way, we ask: what can you do with that?" says Hanneke.

They found their answer in quantum computational theory. "One of the more interesting results to come out of the early years of quantum information was that you can do any quantum operation on any number of qubits using only single and two-qubit logic gates," says Hanneke. Although one and two-qubit gates have already been built and used to perform specific algorithms, no one had yet built a device capable of all possible quantum routines. Until now.

Infinite possibilities

At the heart of the device is a gold-patterned aluminium wafer containing a tiny electromagnetic trap some 200 micrometres across, into which the team placed four ions – two of magnesium and two of beryllium. The magnesium ions act as "refrigerants", removing unwanted vibrations from the ion chain and so keeping the device stable.

There are an infinite number of possible two-qubit operations, so the team chose a random selection of 160 to demonstrate the universality of the processor. Each operation involves hitting the two qubits with 31 distinct quantum gates encoded into the laser pulses. The majority were single-qubit gates, and so the pulse needed to interact with just one ion, but a small number were two-qubit gates requiring the pulse to "talk" to both ions.

By controlling the voltage on the gold electrodes surrounding the trap, the team can couple the ions when single-qubit gates are needed and couple them again for two-qubit operations.

Not perfect

The team ran each of the 160 programmes 900 times. By comparing the results with theoretical predictions, they were able to show that the processor had worked as planned.

But it did so with an accuracy of only 79 per cent, says Hanneke. "Each gate is more than 90 per cent accurate, but when you stack them together the total figure falls to 79 per cent or so for a given operation," he says.

That's because each of the laser pulses that act as the gates varies slightly in intensity. "They're not 'square' pulses [that switch on and off cleanly] – they fluctuate," he says. And the beam has to be split, reflected and manipulated in various ways beforehand, which also introduces errors.

Such errors would drown the results of any more extensive computations. The fidelity needs to increase to around 99.99 per cent before it could be a useful component of a quantum computer. That could be done by improving the stability of the laser and reducing the errors from optical hardware, says the team.

If those levels of accuracy can be reached, the new chip could form an integral part of a useful quantum processor. "If you have a simple and repetitive task you might have a dedicated region [of the processor] to do that," he says. "But you need regions that can do all kinds of stuff – this is just such a device."

Journal reference: *Nature Physics*, DOI: 10.1038/nphys1453

Paradox lost: molecular collisions kept early Earth warm

* 18:00 15 November 2009 by Jeff Hecht

Some 2.5 billion years ago, the sun was so faint, the oceans should have been ice. They weren't, and this "faint young sun paradox" has puzzled scientists for decades. Now a modelling study suggests the answer lies with the greenhouse effect, and an extra helping of nitrogen.

Previous modelling efforts to resolve the paradox by loading the early atmosphere with greenhouse gases assumed that it has always had the same concentration of nitrogen. Instead, Colin Goldblatt of NASA Ames Research Center in California ran a model in which the pressure of nitrogen was twice what it is today.

Nitrogen is not a greenhouse gas, but the pressure rise would have led to more collisions between these molecules and greenhouse gases, causing them to absorb more infrared wavelengths.

Goldblatt found that this would have raised global temperatures by 4.4 degrees C (*Nature Geoscience*, DOI: 10.1038/ngeo692). He admits that this doesn't close the temperature gap entirely, but it could be part of the answer. Goldblatt says he has evidence that the crust and mantle have since absorbed the extra nitrogen.

Early cooling in cardiac arrest may improve survival

Abstract 13

Study highlights:

*** In a European study, patients were more likely to survive without brain damage after a cardiac arrest if emergency medical technicians lowered their body temperature early during resuscitation.**

*** Cooling is recommended for comatose patients after cardiac arrest, and this study demonstrates the potential benefits of beginning cooling even sooner during the arrest in the pre-hospital setting.**

ORLANDO, FLA. – Rapidly cooling a person in cardiac arrest may improve their chance of survival without brain damage, according to research presented at the American Heart Association's Scientific Sessions 2009.

"We now have a method that is safe and can be started within minutes of cardiac arrest to minimize damage during this very critical period," said Maaret Castrén, M.D., lead author of the study and professor of emergency medicine at the Karolinska Institute in Stockholm.

For years, people hospitalized after cardiac arrest have been cooled to reduce injury to the brain and other tissues that occurs when the blood supply returns after being temporarily halted.

In the PRINCE (Pre-Resuscitation Intra-Nasal Cooling Effectiveness) investigation, Castrén and colleagues at 14 other centers across Europe used a new tool, RhinoChill, that cools the brain during ongoing cardiopulmonary resuscitation (CPR).

Researchers randomized 200 adults going into witnessed cardiac arrest to receive either standard resuscitation or resuscitation with cooling started as soon as possible during the arrest, with ongoing CPR. All patients who survived to hospitalization were further cooled according to standard criteria.

Eighteen patients were excluded from the analysis because a 'do-not-resuscitate' order was found or there was a non-cardiac reason for their cardiac arrest.

In the 182 patients reported, 83 (average age 66 years, 71 percent male) were randomized to receive nasal cooling (although two were not cooled because of user or device problems) and 99 (average age 64.8, 78 percent male) received standard care.

RhinoChill is a non-invasive device that introduces coolant through nasal prongs. The system is battery-powered and requires no refrigeration, making it suitable for emergency medical technicians in the field to use while a person is receiving CPR.

The patients in each group were similar in their initial heart rhythms, how much time lapsed before CPR was started and whether CPR restored a pulse. The median time between arrest and the initiation of cooling was 23 minutes. On arrival at the hospital, the cooled patients' temperatures (measured at the eardrum) were significantly lower (average 34.2°C, 93.56°F) than those receiving standard care (35.5°C, 95.9°F, p = 0.0001).

In the total group:

* 46.7 percent of those cooled survived to hospital discharge, compared with 31 percent of those receiving standard care;

* 36.7 percent of those cooled were in good neurological condition on hospital discharge, compared with 21.4 percent of those receiving standard care.

In the 137 patients in whom resuscitation efforts began within 10 minutes of cardiac arrest:

* 59.1 percent of those cooled survived to hospital discharge, compared with 29.4 percent of those receiving standard care;

* 45.5 percent of those cooled were neurologically intact at hospital discharge, compared with 17.6 percent of those receiving standard care (p=.01, adjusted for age, bystander CPR, ALS arrival; p=.028, unadjusted).

“Our results show that the earlier you can do the cooling, the better,” Castrén said. “When resuscitation efforts were delayed, there was no significant difference in survival.”

In a time analysis, patients who received a combination of early CPR started within six minutes of collapse and cooling had the best outcomes.

Patients with ventricular fibrillation (VF), whose heart chambers aren't pumping blood because they are twitching rapidly and erratically instead of fully contracting, are the subgroup of cardiac arrest patients most likely to survive. In this study, of the 56 patients who had VF:

* 62.5 percent of those cooled survived to hospital discharge, compared with 47.6 percent of those who received standard care;

* 50 percent of those cooled were neurologically intact at hospital discharge, compared to 28.6 percent of those who received standard care.

“RhinoChill is easy and safe to use during a cardiac arrest outside of the hospital,” said Denise Barbut, M.D., senior author of the study and president and chairman of BeneChill, Inc., maker of the device.

“Although the study was not powered to look at outcomes, there seemed to be a significant benefit on survival and neurologically intact survival, specifically in those treated within 10 minutes.”

Eighteen adverse reactions were reported after the treatment, including three nosebleeds and 13 nasal discolorations. Coloring spontaneously returned to normal in all patients who survived. Serious adverse events, such as seizure or repeat cardiac arrest, occurred in seven cooled patients and 14 controls.

RhinoChill has been approved for marketing in Europe and the company expects to start selling the device there in March 2010.

Other authors are Per Nordberg, M.D.; Didier Desruelles, M.D.; Frank Eichwede, M.D.; Pierre Mols, M.D., Ph.D.; Leif Svensson, M.D., Ph.D.; Fabio Taccone, M.D.; Jean-Louis Vincent, M.D., Ph.D.; Hans-Jörg Busch, M.D.; Michael Vergnion, M.D.; Christian Storm, M.D.; Antonio Pesenti, M.D., Ph.D.; Fabien Guérisse, M.D.; Thomas Elste, M.D.; Markus Roessler, D.E.A.A.; Harald Fritz, M.D.; and Pieterjan Durnez, M.D. Author disclosures are on the abstract.

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