

Watery niche may foster life on Mars

* 07 December 2009 by David Shiga

Could snow on Mars harbour life? Perhaps, thanks to a form of greenhouse effect that creates liquid water beneath an icy crust.

As far as anyone can tell, liquid water is rare on Mars. At the equator, temperatures can rise above freezing, but any snow or ice that melts would quickly evaporate due to the low atmospheric pressure. Near the poles, water is abundant but permanently frozen.

New calculations by Diedrich Möhlmann of the German Aerospace Center in Berlin suggest that these frozen deposits could contain liquid water, at least during the day. According to Möhlmann, the heat from sunlight penetrating into ice or snow should get absorbed by any embedded dust grains, warming the dust and the surrounding ice. This heat mostly gets trapped because ice absorbs infrared radiation.

This effect melts the interior of ice and snow deposits in Antarctica, and so may do the same on Mars, an idea first proposed by Gary Clow of the US Geological Survey in 1987. But Clow assumed the liquid water would form within porous snow. On Mars, such water would still be subject to the low pressure of the atmosphere and so prone to evaporation.

This map shows the thickness of layered ice deposits at the south polar region on Mars. The material consists of nearly pure water ice with only a small component of dust (Image: NASA / ESA / ASI / Univ. of Rome)

Möhlmann's calculations assumed an impermeable upper crust of solid ice, which would form as water vapour diffused into pores and refroze. Such a seal would prevent evaporation and trap heat more effectively inside a snow bank, causing it to start melting in a zone that begins a few centimetres below the icy surface and extends a further 10 metres down, he says (Icarus, DOI: 10.1016/j.icarus.2009.11.013).

When two baboon troops go to war

By Matt Walker Editor, Earth News

Two troops of baboons have been filmed going to war, with hundreds of monkeys entering into a pitched battle.

The fight, filmed by the BBC Natural History Unit, appears to be triggered by male baboons attempting to steal females from the harems of rivals.

Usually, the two troops live relatively peacefully alongside one another on a 1km-long cliff in the Awash National Park in Ethiopia. But they violently clash in a sequence broadcast as part of the series Life.

"The scale of the fight and the way the males are so dominant is just unparalleled in primate society," says Miss Rosie Thomas, a member of the Life production team who filmed the sequence.



Baboons live in complex male-led societies.

Scientists have identified four levels at which baboons organise themselves. At the smallest level, a dominant male baboon will control a harem of females. A number of these one-male units, as scientists call them, may organise into clans of monkeys. Units and clans can gather into much larger social groupings, which are called bands. The monkeys within each band coordinate their activities, acting as a cohesive social unit.

Many bands also hang out as part of a huge troop.

A single troop of Hamadryas baboons (*Papio hamadryas*) can contain several hundred individuals.

Inter-troop warfare

At a site called Filoha in the Awash National Park of lowland Ethiopia, scientists including Dr Mathew Pines have been studying how the interactions between these different groups of baboons play out.

A film crew from the BBC Natural History Unit spent five weeks at the site recording the action, alongside Dr Pines and other researchers working for the Filoha Hamadryas Baboon Project.

Four baboon troops live at the cliff in Filoha. Two are relatively small and are difficult to follow and study as they are not habituated to the presence of researchers. However, two troops that live alongside one another are huge, with over 200 monkeys in each.

These troops occasionally clash as they move down from the cliff upon which they sleep to find water, researchers have discovered.

It is the demand for females that usually triggers inter-troop warfare.

Male baboons are either dominant, controlling a harem, or they are 'followers' - helping to protect the harem in exchange for occasional access to the females and mating rights. However, a number of young males are solitary, having no access to females. They cannot steal them from the dominant males in their troop.

"If they are trying to steal them from within their group, they have to overthrow the dominant male to keep them, or the dominant male will just steal them back," says Miss Thomas. "But if they can see an opportunity to steal them from another group, it is much more difficult for the male to steal the female back."

And when these males raid another troop, it sparks a pitch battle. Once the fight is over, the females often suffer further. Males will often attack females in their harem for having considered the attentions of interloping solitary males.

"Baboons are one of the most aggressive primates out there," says Miss Thomas.

"What's interesting about hamadryas baboons is the way they control their social structure through aggression. Just seeing some of the males disciplining their females - it really is quite nasty," she says.

Clan discovery

Such huge troops form for a number of reasons. They offer the baboons protection against predators such as lion, leopard and hyena, researchers believe. Large amounts of doum palms in the region also allow such large groups of baboon to live together. When food becomes scarce, the monkeys then split into smaller bands and units. The complexity of baboon society is also reinforced by a study published last month in the American Journal of Primatology.

Dr Amy Schreier of Duke University in Durham, North Carolina and Dr Larissa Swedell of the City University of New York in Flushing, New York have discovered more about a fourth level of social organisation among the baboons.

As well as troops, bands and single-male units, Drs Schreier and Swedell have confirmed that baboons organise themselves into clans, a discovery first made in the 1970s by researcher Jean-Jacques Abegglen at another site, Erer Gota.

The researchers cannot yet be sure, but they suspect that clans are collections of related males.

When a band splits up, usually because of scarce food, males tend to break away along clan lines, forming inter-related groups, say the researchers. Clan members are also more likely to secure access to females.

The hamadryas baboons at Filoha are only the second population of hamadryas known to organise into clans, though Dr Swedell says it is likely that all hamadryas baboons form clans.

A new method for bone marrow transplantation from mismatched donors restores the immune system faster

Although bone marrow transplants have long been standard for acute leukemia, current treatments still rely on exact matches between donor and patient. Now, scientists at the University of Perugia, Italy, and the Weizmann Institute of Science have improved on a method of transplanting bone marrow-based stem cells from a mismatched donor, making it safer for use when no exact match exists. They were invited to present their findings at the recent annual American Society of Hematology conference in New Orleans.

More than a decade ago, Prof. Yair Reisner of the Weizmann Institute's Immunology Department pioneered a method for transplanting stem cells from family members who are a partial match. Based on these studies (in mice), he joined forces with Prof. Massimo F. Martelli, Head of the Hematology and Clinical Immunology Section at the University of Perugia, to demonstrate in more than 300 patients that the cure rate of these so-called "mega dose" transplants is similar to that of transplants from matched, unrelated donors picked from international bone marrow donor registries. To combat the body's tendency to reject the foreign cells, these stem cells are stripped of immune cells called T cells and given in high doses that overwhelm the host's own immune system. Although removing donor T cells from the bone marrow reduces the risk of graft-versus-host disease – caused when the T cells attack the recipient's tissues – the immune system is slow to recover after the transplant, leaving the patient at risk of serious infection. Doctors are faced with a difficult choice: Either remove the T cells from the bone marrow, increasing the risk of infection, or leave the T cells in the graft, putting the patient at risk for lethal graft-versus-host disease.

Martelli, working with Reisner, has now found a way to facilitate the recovery of the immune responses in recipients of T cell-depleted bone marrow transplants. In a clinical trial, 25 of 26 leukemia and lymphoma patients who received mismatched mega dose T cell-depleted stem cell transplants from relatives showed prompt immune recovery, and their immune systems were functioning well several months later.

The scientists knew that certain regulatory T cells (T regs), rather than causing graft-versus-host disease, could actually help to prevent it in mice. T regs have also been shown to keep other immune responses in check, including preventing autoimmune attacks on the body's own cells. In the present study, after purifying T regs from the donor's blood, the cells were infused intravenously into the cancer patients, who had previously

undergone standard radiation and chemotherapy treatments. Three days later, the patients received the donor stem cells, along with another kind of T cell – those that fight disease.

The patients who underwent this procedure showed quick, lasting improvements in immune activity; most experienced no symptoms even though they received large doses of the T cells that are generally associated with lethal graft-versus-host disease.

Further follow up on these patients and additional clinical trials will be needed before the procedure can be widely adopted. But these results strongly suggest that T regs used in mega-dose stem cells will further enhance the cure rate for bone marrow transplant patients without a matched donor in the family.

Prof. Yair Reisner's research is supported by the M.D. Moross Institute for Cancer Research; the Kirk Center for Childhood Cancer and Immunological Disorders; the Mario Negri Institute for Pharmacological Research Weizmann Institute of Science Exchange Program; the Gabrielle Rich Center for Transplantation Biology Research; the Russell Berrie Foundation; and Mr. and Mrs. Seymour Spira, Palm Beach Gardens, FL. Prof. Reisner is the incumbent of the Henry H. Drake Professorial Chair in Immunology.

The Weizmann Institute of Science in Rehovot, Israel, is one of the world's top-ranking multidisciplinary research institutions. Noted for its wide-ranging exploration of the natural and exact sciences, the Institute is home to 2,600 scientists, students, technicians and supporting staff. Institute research efforts include the search for new ways of fighting disease and hunger, examining leading questions in mathematics and computer science, probing the physics of matter and the universe, creating novel materials and developing new strategies for protecting the environment.

Controversial kidney transplant technique could provide lifeline for very ill patients ***Surgeons perform living donor transplants after removing small renal masses***

Surgeons who successfully performed kidney transplants after removing small cancerous and benign masses from the donated organs, have published their results in the December issue of the urology journal BJUI.

The technique, carried out by US surgeons at the University of Maryland School of Medicine in Baltimore, could offer a vital lifeline to patients with end-stage renal disease as well as increasing the supply of viable organs.

"Transplanting a living donor kidney which has been affected by a renal mass is controversial and considered a high risk" says co-author Dr Michael W Phelan. "However the ongoing shortage of organs from deceased donors, and the high risk of dying while waiting for a transplant, prompted five donors and recipients to push ahead with surgery after the small masses were found in the donor kidneys."

The five renal masses, which were discovered during routine donor evaluation, ranged from 1.0cm to 2.3cm in size. Cancerous cells were found in three of the five masses and the other two were benign.

The kidneys were removed from the donors, put on ice and taken to the recipients' operating rooms. Surgeons carefully removed the renal mass and a portion of the tissue near the mass was rushed through to pathology for confirmation that the tumour had been completely removed. The kidneys were then reconstructed and transplanted into the recipients.

One patient developed acute humoral rejection after surgery and was treated appropriately. There were no long-term problems in the transplanted kidneys and four of the patients were alive at the last follow-up, which ranged from nine to 41 months. The fifth died from an unrelated accident about a year after the transplant. None of the donors or recipients showed any evidence of recurring tumours.

The patients in the study ranged from 47 to 61 years of age, with an average age of 54, and the donors ranged from 38 to 72, with an average age of 38. Two of the five donor pairs were unrelated and three were genetically related. All the patients had end-stage renal disease, together with significant other illnesses, such as severe high blood pressure and complex heart problems.

Prior to the transplant, detailed discussions were carried out with each recipient and donor following the discovery of the renal masses in the donor kidney, so that they were both aware of the risks, including recurrence of the tumour.

"The global increase in patients with end-stage renal disease highlights the importance of identifying novel means to increase the donor pool" says Dr Phelan. "Although donor transplants using organs from deceased people have risen 16 per cent and living donor transplants have risen by 68 per cent, there continues to be a significant shortage and many patients die each year while waiting for a transplant.

"The current study provides evidence to suggest that kidneys from donors with renal masses offer a minor, yet feasible, solution to the current organ shortage. These organs can be transplanted into recipients with limited life-expectancy on haemodialysis after careful removal of the renal mass. However, diligent follow-up of the donor and recipient is imperative in these cases."

Cosmic rays hunted down

Washington University physicists are closing in on the origin of cosmic rays

A thin rain of charged particles continually bombards our atmosphere from outer space. The mysterious particles were first detected 100 years ago but until 10 years ago when a new type of telescope began to come online physicists weren't sure where the "cosmic rays" came from or how they were generated. They suspected the particles were accelerated by supernova shockwaves, but suspicions aren't proof.

Imaging atmospheric Cherenkov telescopes now keeping a watchful eye on the night skies are finally providing the evidence needed to solve this longstanding puzzle. Over the past several years, observations of individual supernovae remnants in our galaxy have gradually strengthened the case for supernova acceleration.

But this fall the evidence suddenly got much stronger. The VERITAS consortium reported their observations of a starburst galaxy. This time the physicists were observing many supernovae at once instead of one by one. As they reported in *Nature* the correlation between the high cosmic-ray density in the core of this galaxy and its high supernova rate provides powerful evidence in support of the theory of supernova acceleration.

Six of the papers co-authors are physicists at Washington University in St. Louis, one of the founding groups in the VERITAS consortium, a collaboration of 22 institutions that runs a four-telescope array in the Santa Rita foothills south of Tucson. The last of the three major imaging atmospheric Cherenkov arrays to come online (the other two are MAGIC in the Canary Islands, H.E.S.S. in Namibia), VERITAS saw "first light" in September 2007, just two years ago.

Cosmic rays discovered

It all began nearly 100 years ago with a tenacious response to what most people would have considered a passing irritation. The Viennese physicist Victor Hess wanted to know why an instrument used to measure radiation, called a gold-leaf electroscope, would slowly discharge even when there was no obvious source of radiation nearby. What was ionizing the air within the instrument case and letting the charge leak away?

To figure out where the radiation was coming from, Hess made balloon ascents in 1911 and 1912, carrying electroscopes with him. He expected the instruments would discharge more slowly at higher altitudes. Instead, he found that they discharged more rapidly.

Hess decided the radiation was coming from outer space and named it cosmic radiation. He won the Nobel Prize in physics in 1936 for his discovery.

Why it took so long

The famous American physicist Robert Millikan called Hess's penetrating radiation "cosmic rays," but "rays" is a misnomer. The "rays" are not light but instead are atomic nuclei, mostly hydrogen nuclei, or protons, with a sprinkling of helium and heavier nuclei.

Unlike light, these particles carry electric charge. And that's a problem because space is laced by magnetic fields, and charged particles spiral around magnetic field lines. These deflections and detours so tangle the particles' paths that by the time they arrive at Earth they appear to be arriving in equal numbers from all directions.

Because the rays themselves don't point back to their sources, astronomers have to track them down by other means. When cosmic rays collide with other atomic nuclei in gas or dust, they produce gamma rays, which are a kind of high-energy light. The gamma-ray portion of the electromagnetic spectrum covers a lot of territory, but some of the most energetic gamma rays have trillions of times the energy of the light we can see.

Because gamma rays travel in straight lines physicists can trace them backward – with luck to objects that can be observed with conventional telescopes at other wavelengths.

But there is another obstacle to overcome. Gamma rays make it nearly to Earth but not quite. They can't penetrate the atmosphere, and so, like cosmic rays, they must also be detected indirectly.

When a very energetic gamma-ray interacts with an atom in the upper atmosphere, the collision can result in debris in the form of a pair of particles: an electron and its antiparticle, the positron. The debris from this collision can interact with another atom yielding more electrons, positrons and photons in an avalanche that results in a cascade of billions of particles called an extensive air shower."

Because the particles are traveling faster than the speed of light in the atmosphere, they create a shock wave similar to the sonic boom from a supersonic jet. The shock wave takes the form of a cone of bluish light known as Cherenkov radiation. (The blue glow of the cooling water in a nuclear reactor is created by the same process.)

The flashes of light from an extensive air shower are so faint and brief they can't be seen with the unaided eye. To record them, Cherenkov telescopes like VERITAS use extremely sensitive and fast "cameras" made of hundreds of photomultiplier tubes.

The Washington University group founded by James H. Buckley, Ph.D., professor of physics in Arts & Sciences and a member of the McDonnell Center for the Space Sciences at the University, designed and built the high-speed electronics capable of making "movies" of the flashes at a blistering half a billion frames per second. The frame rate of a standard movie camera, by contrast, is 24 frames per second.

The four telescopes in the VERITAS array each provide a different view of an air shower, providing a better fix on the direction of the incoming gamma ray.

Accelerators in space

Scientists knew from the start that cosmic radiation had to come from unusual astrophysical sources. Cosmic rays are what is called non-thermal radiation. That is, you can't get this kind of radiation just by heating something up, even to the nuclear furnace temperatures of stellar interiors.

Instead, to make cosmic rays, you need something more like a particle accelerator. But the world's highest-energy accelerator is designed to boost protons to an energy of only a few tera-electron-Volts, and by the standards of cosmic rays, that's nothing. Some of them have energies 100 million times higher.

An accelerator works by using electromagnetic fields to continually kick particles confined to a ring to higher and higher energies. To get up to cosmic ray energies, however, the particles would have to be subject to very strong electromagnetic fields over enormous distances. So, at a minimum, cosmic accelerators must be huge and exceedingly violent objects.

And that's more or less what VERITAS and the other telescopes are finding them to be.

A supernova remnant

Even before all four telescopes were up and running, the VERITAS array was used to observe IC 443, also known as the Jellyfish nebula, a galactic supernova remnant in the constellation Gemini.

IC 443 is thought to be the remains of a star that blew itself apart thousands of years ago. The massive explosion left behind the collapsed remnant of the star's core, in the form of a spinning neutron star, and a rapidly expanding shell of gas.

When material speeding out from the supernova hit the interstellar medium, it created a shock wave. In the southeast corner of the nebula the shock wave is slamming into a dense molecular cloud, perhaps the cloud from which the star originally condensed.

VERITAS found that high energy gamma-ray emission was confined to a region in the remnant where the molecular cloud was thickest.

It seemed the shock wave was acting as a gigantic accelerator, and gamma rays were being unleashed when protons energized by the shock front struck the nearby molecular cloud.

This interpretation of the results made sense, but was it true?

The physicists weren't entirely sure.

For one thing, energetic electrons as well as atomic nuclei can produce gamma rays. Electrons accelerated to high energies by the supernova might be colliding with low-energy photons, boosting them to gamma-ray energies. This is called the inverse Compton effect.

Arthur Compton described the opposite process - in which high energy photons collide with stationary particles - while at Washington University, work for which he won the Nobel Prize in physics in 1927. The theory of the inverse effect was first set out by two of Compton's colleagues at the University, Eugene Feenberg and Henry Primakoff, in 1948.

But Buckley and his colleagues were also aware that one observation was not much to go on. It was possible that supernova remnant IC 443 wasn't typical but rather somehow anomalous or unusual.

Since 2007, VERITAS has taken gamma-ray snapshots of other supernova remnants, including Boomerang and gamma Cygni, observed just this summer. They show much the same gamma-ray emission as IC 443.

Many supernovae at once

The latest find, announced Nov. 1 in the online journal *Nature*, is qualitatively different. This time the telescopes were looking at the diffuse gamma-ray emission from an entire galaxy, one that has many supernova remnants.

They were looking at an entire forest instead of a single tree.

The galaxy is M82, a starburst galaxy five times brighter than the entire Milky Way. There are many starburst galaxies, says Henric Krawczynski, Ph.D., associate professor of physics and a member of the McDonnell Center for the Space Sciences, who together with Buckley, has led many of the VERITAS scientific

programs, "but we chose to observe M82 because it is close to our Milky Way galaxy and combines a high rate of star formation with a high density of interstellar matter. "

M82 is also called the cigar galaxy because it was deformed into a long, fat slug by a collision with a nearby galaxy. The encounter funneled gas into the galaxy's core, creating a compact region where stars are being formed about 10 times faster than in the Milky Way and supernova pop off with alarming frequency.

The ferment of stellar explosions, the astronomers reasoned, should be churning out cosmic rays and gamma rays.

Not that the gamma rays would be easy to see, because the supernovae in the starburst galaxy are much farther away than IC 443 or other supernovae in our galaxy. Although VERITAS is presently the most sensitive gamma-ray observatory in the world, it took almost two years of repeated observations to detect the predicted signal.

But the data, once gathered, indicated that the starburst region of M82 has a cosmic ray density 500 times the average cosmic ray density of our galaxy. Its estimated supernova rate is about 30 times higher than the Milky Way's. The correlation between the cosmic-ray density and the supernova rate strongly supports the long-held theory that supernovae are cosmic ray factories.

What they know and when they knew it

So do physicists feel they now know where and how cosmic rays are generated?

Buckley's response is carefully worded. "After all of these years, we're starting to see evidence both from discrete sources-- the supernova remnants-- and at the galactic scale--the starburst galaxy--that supernova explosions are really the source of cosmic rays."

"If we finally see neutrinos coming from the sources," he says, "then we'll know absolutely that protons, not electrons, are producing the gamma rays, because only the protons will give you neutrinos."

"But even if we knew where they're coming from, we wouldn't know the exact mechanism by which they're accelerated," he continues. "That shock acceleration idea is very nice, but there are problems with it and ultimately the devil is in the details."

Delivering Medicine Directly into a Tumor

Peptide Delivers Anti-Cancer Compounds to Where They Can Do the Most Good

(Santa Barbara, Calif.) - Researchers at Burnham Institute for Medical Research at University of California, Santa Barbara have identified a peptide (a chain of amino acids) that specifically recognizes and penetrates cancerous tumors but not normal tissues. The peptide was also shown to deliver diagnostic particles and medicines into the tumor. This new peptide, called iRGD, could dramatically enhance both cancer detection and treatment. The work is being published December 8 in the journal *Cancer Cell*.

Led by Erkki Ruoslahti, M.D., Ph.D., distinguished Burnham professor at UCSB, this research was built on Dr. Ruoslahti's previous discovery of "vascular zip codes," which showed that blood vessels in different tissues (including diseased tissues) have different signatures. These signatures can be detected and used to dock drugs onto vessels inside the diseased tissue. In addition to homing in on tumor vessels, the new iRGD peptide penetrates them to bind inside the tumor. Previous peptides have been shown to recognize and bind to tumors, but were unable to go beyond the tumor blood vessels.

"This peptide has extraordinary tumor-penetrating properties, and I hope that it will make possible substantial improvements in cancer treatment," says Dr. Ruoslahti. "In our animal studies, the iRGD peptide has increased the efficacy of a number of anti-cancer drugs without increasing their side effects. If these animal experiments translate into human cancers, we would be able to treat cancer more effectively than before, while greatly reducing the side effects the patient would suffer."

The novel iRGD peptide, identified by using phage display for a peptide that binds to the blood vessels of pancreatic and bone tumors, was tested to determine its ability to penetrate tumors. Researchers injected fluorescent-labeled iRGD into tumor-bearing mice and found that the peptide accumulated in a variety of tumors, including prostate, breast, pancreatic, brain and other types. In addition, the peptide only targeted the tumors and did not accumulate in normal tissue.

Iron oxide nanoworms, which can be visualized by magnetic resonance imaging, were coupled to the peptide and shown to penetrate the tumors, whereas uncoupled nanoworms could not. This demonstrates that iRGD can deliver diagnostics to tumors. The anti-cancer drug Abraxane was also shown to target, penetrate and spread more within tumor tissue when coupled to iRGD than with other formulations.

Caffeine doesn't reverse the negative cognitive impact of alcohol, study shows ***Alcoholic 'energy' drinks could raise risks from intoxication***

WASHINGTON - People who drink may want to know that coffee won't sober them up, according to new laboratory research. Instead, a cup of coffee may make it harder for people to realize they're drunk.

What's more, popular caffeinated "alcohol-energy" drinks don't neutralize alcohol intoxication, suggest the findings from a mouse study reported in the journal *Behavioral Neuroscience*, which is published by the American Psychological Association.

"The myth about coffee's sobering powers is particularly important to debunk because the co-use of caffeine and alcohol could actually lead to poor decisions with disastrous outcomes," said co-author Thomas Gould, PhD, of Temple University, in extending the research to what it means for humans.

"People who have consumed only alcohol, who feel tired and intoxicated, may be more likely to acknowledge that they are drunk," he added. "Conversely, people who have consumed both alcohol and caffeine may feel awake and competent enough to handle potentially harmful situations, such as driving while intoxicated or placing themselves in dangerous social situations."

In the laboratory, caffeine made mice more alert but did not reverse the learning problems caused by alcohol, including their ability to avoid things they should have known could hurt them, according to the study.

Scientists gave groups of young adult mice various doses, both separately and together, of caffeine and of ethanol (pure alcohol) at levels known to induce intoxication. The doses of caffeine were the equivalent of one up to six or eight cups of coffee for humans. Control mice were given saline solution.

Gould and co-author Danielle Gulick, PhD, then tested three key aspects of behavior: the ability to learn which part of a maze to avoid after exposure to a bright light or loud sound; anxiety, reflected by time spent exploring the maze's open areas; and general locomotion.

Ethanol, as expected, increased locomotion and reduced anxiety and learning in proportion to the dose given. In other words, intoxicated animals were more relaxed and moved around more but learned significantly less well than control mice to avoid the part of the maze with the unpleasant stimuli.

By itself, caffeine increased anxiety and reduced both learning and locomotion. Compared to the control animals, mice given caffeine were significantly more inhibited, less mobile and less savvy about avoiding the unpleasant stimuli.

When the drugs were given together, ethanol blocked caffeine's ability to make the mice more anxious. Conversely, caffeine did not reverse ethanol's negative effect on learning. As a result, alcohol calmed the caffeine jitters, leaving an animal more relaxed but less able to avoid threats – a combination that the authors speculated could make people more likely to believe they are not drunk or not impaired enough to have problems functioning.

"The alcohol-energy drink combinations have skyrocketed in popularity," Gould noted. He cited other evidence that these drinks produce deficits in general cognitive ability and raise the odds of alcohol-related problems such as drunken-driving citations, sexual misconduct, and needing medical assistance.

"The bottom line is that, despite the appeal of being able to stay up all night and drink, all evidence points to serious risks associated with caffeine-alcohol combinations," he concluded.

The Food and Drug Administration is looking into the safety and legality of combination alcohol-caffeine beverages. In November, it sent letters to 30 manufacturers asking for evidence that such drinks are safe and legal under FDA regulations. To date, the FDA has only approved caffeine as an additive in soft drinks at concentrations less than 200 parts per million and has not approved adding caffeine at any level to alcoholic beverages. Under the Federal Food, Drug and Cosmetic Act, a substance added intentionally to food (such as caffeine in alcoholic beverages) is deemed unsafe and is unlawful unless its particular use has been approved by FDA regulation or is generally recognized as safe.

Article: "Effects of Ethanol and Caffeine on Behavior in C57BL/6 Mice in the Plus-Maze Discriminative Avoidance Task," Danielle Gulick, PhD, and Thomas J. Gould, PhD, Temple University; Behavioral Neuroscience, Vol. 123, No. 6. (Full text of the article is available from the APA Public Affairs Office)

New York autopsies show 2009 H1N1 influenza virus damages entire airway

In fatal cases of 2009 H1N1 influenza, the virus can damage cells throughout the respiratory airway, much like the viruses that caused the 1918 and 1957 influenza pandemics, report researchers from the National Institutes of Health (NIH) and the New York City Office of Chief Medical Examiner. The scientists reviewed autopsy reports, hospital records and other clinical data from 34 people who died of 2009 H1N1 influenza infection between May 15 and July 9, 2009. All but two of the deaths occurred in New York City. A microscopic examination of tissues throughout the airways revealed that the virus caused damage primarily to the upper airway - the trachea and bronchial tubes - but tissue damage in the lower airway, including deep in

the lungs, was present as well. Evidence of secondary bacterial infection was seen in more than half of the victims.

The team was led by James R. Gill, M.D., of the New York City Office of Chief Medical Examiner and New York University School of Medicine, and Jeffery K. Taubenberger, M.D., Ph.D., of the National Institute of Allergy and Infectious Diseases (NIAID) at NIH. The findings are reported in the Archives of Pathology & Laboratory Medicine, now available online and scheduled to appear in the February 2010 print issue.

"This study provides clinicians with a clear and detailed picture of the disease caused by 2009 H1N1 influenza virus that will help inform patient management," says NIAID Director Anthony S. Fauci, M.D. "In fatal cases of 2009 H1N1 influenza, it appears the novel pandemic influenza virus produces pulmonary damage that looks very much like that seen in earlier influenza pandemics."

The new report also underscores the impact 2009 H1N1 influenza is having on younger people. While most deaths from seasonal influenza occur in adults over 65 years old, deaths from 2009 H1N1 influenza occur predominately among younger people. The majority of deaths (62 percent) in the 34 cases studied were among those 25 to 49 years old; two infants were also among the fatal cases.

Ninety-one percent of those autopsied had underlying medical conditions, such as heart disease or respiratory disease, including asthma, before becoming ill with 2009 H1N1 influenza. Seventy-two percent of the adults and adolescents who died were obese. This finding agrees with earlier reports, based on hospital records, linking obesity with an increased risk of death from 2009 H1N1 influenza.

The researchers examined tissue samples from the 34 deceased individuals to assess how 2009 H1N1 influenza virus damaged various parts of the respiratory system. "We saw a spectrum of damage to tissue in both the upper and lower respiratory tracts," says Dr. Taubenberger. In all cases, the uppermost regions of the respiratory tract - the trachea and bronchial tubes - were inflamed, with severe damage in some cases. In 18 cases, evidence of damage lower down in the finer branches of the bronchial tubes, or bronchioles, was noted. In 25 cases, the researchers found damage to the small globular air sacs, or alveoli, of the lungs.

"This pattern of pathology in the airway tissues is similar to that reported in autopsy findings of victims of both the 1918 and 1957 influenza pandemics," notes Dr. Taubenberger.

The researchers also examined 33 of the 34 cases for evidence of pulmonary bacterial infections. Of these cases, 18 (55 percent) were positive for such infections. Not all of those individuals who had bacterial pneumonia along with 2009 H1N1 virus infection had been hospitalized, however, indicating that some had acquired their bacterial infections outside of a health-care setting. This raises the possibility, say the authors, that community-acquired bacterial pneumonia is playing a role in the current pandemic. "Even in an era of widespread and early antibiotic use," write the authors, "bacterial pneumonia remains an important factor for severe or fatal influenza."

Computerized tomography (CT) lung images were available in four cases of pulmonary bacterial infection. In all four cases, the CT scans showed an abnormality known as ground-glass opacity, which are patches of rounded haze not seen in normal lung images. It is not known, say the researchers, whether the abnormalities detected by CT in the four cases also occur in people who have milder H1N1 infections. They call for additional investigation into the utility of CT scans as a tool to help clinicians identify and better treat severe H1N1 infections.

Eat protein to heal a damaged brain

* 20:00 07 December 2009 by **Jessica Hamzelou**

A diet of chicken, fish and protein shakes might do wonders for people with brain injuries.

Akiva Cohen of the University of Pennsylvania in Philadelphia and his colleagues mimicked brain injury in mice by injecting fluid through a hole drilled in their skull. After seven days, the brain-injured mice had much lower levels of three branched-chain amino acids (BCAAs), leucine, isoleucine and valine, compared with control mice. These are found in protein-rich food and are known for their ability to build muscle.

The team then fed another set of brain-injured mice either plain water or water enriched with BCAAs. Five days later, those that had taken BCAAs had normal levels of the amino acids and performed better on a learning task.

Excitation disturbance

Cohen's team reckon they might have figured out how the BCAAs are having this effect. In the hippocampus of a person with a brain injury, the delicate balance of neuronal excitation and inhibition is disturbed, says Cohen. The BCAAs may help restore the balance by making more neurotransmitters, he suggests.

The findings complement observations made by a group of Italian biochemists last year. Simona Viglio of the University of Pavia and colleagues found that minimally conscious patients who were given BCAAs intravenously improved in their "feeding, grooming and toileting" abilities.

"The new findings represent a substantial progression because they provide evidence, on an experimental basis, of the beneficial effects of BCAAs," says Viglio.

Cohen's group will now look at the effects of BCAAs on other areas of the brain, and are hoping to start human trials of amino acid-based treatments soon.

"In the near future, BCAA administration in humans could become a routine treatment," says Viglio.

Journal reference: Proceedings of the National Academy of Sciences, DOI: 10.1073/pnas.0910280107

Lightning-produced radiation a potential health concern for air travelers

Scientists say incidents are likely rare and more research is needed

GAINESVILLE, Fla. - New information about lightning-emitted X-rays, gamma rays and high-energy electrons during thunderstorms is prompting scientists to raise concerns about the potential for airline passengers and crews to be exposed to harmful levels of radiation.

Scientists at the Florida Institute of Technology, University of California, Santa Cruz and the University of Florida have estimated that airplane passengers could be exposed to a radiation dose equal to that from 400 chest X-rays if their airplane happens to be near the start of a lightning discharge or related phenomena known as a terrestrial gamma ray flash.

The big unknown: how often - if ever - commercial airliners are exposed to these thunderstorm events, because the bursts of radiation occur only over extremely brief periods and extend just a few hundred feet in the clouds.

"We know that commercial airplanes are typically struck by lightning once or twice a year," said Joe Dwyer, professor of physics and space sciences at Florida Tech. "What we don't know is how often planes happen to be in just the right place or right time to receive a high radiation dose. We believe it is very rare, but more research is needed to answer the question definitively."

Dwyer is the lead author of a paper about the research set to appear in the *Journal for Geophysical Research - Atmospheres*. Seven researchers from Florida Tech, UC Santa Cruz and UF contributed to the paper.

"Estimation of the fluence of high-energy electron bursts produced by thunderclouds and the resulting radiation doses received in aircraft." It is free and downloadable online from the journal's "papers in press" page. The link is <http://www.agu.org/journals/pip/jd/2009JD012039-pip.pdf>.

The authors did not measure high radiation doses directly with airplanes. Instead, they estimated radiation based on satellite and ground-based observations of X-rays and gamma rays.

The authors "combined observations of lightning-produced X-rays and gamma rays with computer models of the movement of high-energy particles to estimate the amount of radiation that could be produced within, or very near, thunderclouds during lightning storms," said Hamid Rassoul, a co-author and senior researcher from Florida Tech.

The observations included those made from orbiting satellites of "terrestrial gamma-ray flashes," or TGFs, mysterious phenomena that appear to originate within thunderstorms at the same altitudes used by jet airliners. They also included measurements of X-rays and gamma rays from natural lightning on the ground, as well as artificial lightning triggered with wire-trailing rockets fired into storm clouds. Researchers believe the phenomena are linked, because both produce high levels of gamma rays and X-rays and occur along with the actual lightning flash.

The scientists concluded the radiation in a football field-sized space around these lightning events could reach "biologically significant levels," up to 10 rem, according to their paper.

"If an aircraft happened to be in or near the high-field region when either a lightning discharge or a TGF event is occurring, then the radiation dose received by passengers and crew members inside the aircraft could potentially approach 10 rem in less than one millisecond," the paper says.

Ten rem is considered the maximum safe radiation exposure over a person's lifetime. It is equal to 400 chest X-rays, three CAT scans or 7,500 hours of flight time in normal conditions. All airplane passengers are exposed to slightly elevated radiation levels due to cosmic rays.

While the research raises obvious concerns, the scientists stressed that they don't know how often the high-radiation events occur - or how often planes are nearby enough to expose passengers and flight crews to potential danger.

David Smith, an associate professor of physics at UC-Santa Cruz, said recent airborne research suggests the incidents are rare. Flying aboard a National Science Foundation/National Center for Atmospheric Research aircraft this past summer in Florida, Smith and several of the other researchers used a highly sophisticated instrument to measure gamma ray flashes from thunderstorms. Over the course of several flights, they were only able to detect one such flash, at a safe distance from the plane.

“These observations show that although thunderstorms do occasionally create intense gamma-ray flashes, the chance of accidentally being directly hit by one is small,” Smith said.

Martin Uman, another author and a distinguished professor of electrical and computer engineering at UF, noted that airline pilots typically seek to avoid flying through storms.

However, he said, the fact that commercial planes are struck once or twice a year suggests more inquiry is needed. He said he would recommend to the Federal Aviation Administration that it place detectors aboard planes capable of measuring the storm-related, brief and intense radiation bursts to determine how often they occur. He also said more research on the phenomena that generates the bursts is clearly needed.

“What we need to do is supply the right kind of detectors to a lot of planes, and see if this ever happens,” he said. “We also need to spend more time looking at gamma and x-ray radiation from lightning and thunderstorms and trying to understand how it works.”

The paper drew on data from numerous observations and experiments, including experiments involving artificial “triggered” lightning at UF/Florida Tech International Center for Lightning Research and Testing at the Camp Blanding Army National Guard Base near Starke, Florida. UF and Florida Tech researchers at the center were the first to identify X-ray emissions from triggered lightning.

Credits: Writer Aaron Hoover, ahoover@ufl.edu, 352-392-0186 Source Martin Uman, uman@ece.ufl.edu, 352-392-4038 Source Joe Dwyer, jdwyer@fit.edu, 321-674-7208

Nasa tests for life on Mars clues

Scientists from space agency Nasa are testing a mineral only found in one corner of Scotland to see if it can provide clues about life on Mars.

Macaulayite is only believed to exist at a quarry at the foot of Bennachie in Aberdeenshire.

Researchers think it could be the same mineral which gives the planet its red colour.

Samples have now been sent to a testing centre in California in an attempt to verify its presence.

Macaulayite was discovered by researchers from Aberdeen's Macaulay Institute in the late 1970s.

The mineral is formed in the presence of water so if it does occur on the surface of Mars it could provide proof the planet can sustain life. It is formed from granite which has been weathered by tropical climates from before the last Ice Age.

The team which found it was led by mineralogist Jeff Wilson, who is now retired. Dr Wilson told BBC Scotland: "It is exciting because this particular mineral contains water. "It's a very fine grain mineral and water is bound to the inner surfaces. "There's been a lot of speculation about the occurrence of water on Mars. We don't know but it could be associated with this mineral."

The US space agency Nasa is conducting tests on Macaulayite.

Dr Janice Bishop, a Mars specialist from the Search for Extra Terrestrial Intelligence Institute, said: "All life forms as we know it require liquid water so if we can actually find periods of time or places on the planet where there was standing water then the chance of life having formed increase greatly."

Only limited data has been collected about the surface of Mars, through orbiters and probe landings.

Dinosaur-killing impact set Earth to broil, not burn

** 19:49 07 December 2009 by Jeff Hecht*

Debris kicked up by a large asteroid rained back down on the Earth, heating up as it fell. But new research suggests that the first debris to re-enter the atmosphere shielded the surface from the heat of later infalling debris, preventing the world's forests from igniting (Illustration: Don Davis/NASA)

Debris kicked up by a large asteroid rained back down on the Earth, heating up as it fell. But new research suggests that the first debris to re-enter the atmosphere shielded the surface from the heat of later infalling debris, preventing the world's forests from igniting (Illustration: Don Davis/NASA)

The asteroid impact that ended the age of dinosaurs 65 million years ago didn't incinerate life on our planet's surface – it just broiled it, a new study suggests. The work resolves nagging questions about a theory that the impact triggered deadly wildfires around the world, but it also raises new questions about just what led to the mass extinction at the end of the Cretaceous period.

The impact of a 10-kilometre asteroid is blamed for the extinction of the dinosaurs and most other species on the planet. Early computer models showed that more than half of the debris blasted into space by the impact would fall into the atmosphere within eight hours.

The models predicted the rain of shock-heated debris would radiate heat as intensely as an oven set to "broil" (260 °C) for at least 20 minutes, and perhaps a couple of hours. Intense heating for that long would heat wood to its ignition temperature, causing global wildfires.

Yet some species survived, and the global layer of impact debris doesn't contain as much soot as would be expected from burning the world's forests, raising questions about the extent of post-impact wildfires.

To explain the discrepancy, Tamara Goldin of the University of Vienna and Jay Melosh of Purdue University in Indiana studied how ejecta falling through the atmosphere might affect heat transfer from the top of the atmosphere to the ground. Earlier models considered only how atmospheric greenhouse gases would absorb heat.

The study reveals that the first debris to re-enter the atmosphere just a few minutes after the impact helped protect the surface from the debris that followed. "The actual ejecta themselves were getting in the way of the thermal radiation [in the atmosphere] and shielding the Earth," Goldin told New Scientist.

Burning sky

As a result, the surface felt the full heat from the sky for only a few minutes. As more particles drifted down, they blocked more and more of the heat from above, preventing the world's forests from igniting. "With the short pulse [of intense heat], it's really hard to get ignition" far from the impact site, Goldin says.

Surface life would have been broiled, but not burnt to a crisp. Animals that were able to take refuge underground or in the water were likely able to survive the short period of intense heat, explaining why not all life was killed.

"Now we have models and data that match," says Claire Belcher of University College, Dublin, who was not involved with the study.

Climate change

Wendy Wolbach of DePaul University in Chicago, who in 1985 proposed that soot found at the end of the Cretaceous came from global wildfires, agrees. The heat shielding effect "makes sense", she told New Scientist.

Without global wildfires, other mechanisms are needed to explain the mass extinction, Belcher says. These include the idea that dust in the atmosphere cut off sunlight in an "impact winter" that lasted for years before emissions released after the impact caused long-term global warming.

Acid rain following the impact may also have played a role in the extinction, as could the additional stress on global climate from the massive volcanic eruptions that occurred 65 million years ago in India's Deccan Traps.

Journal reference: Geology (vol 37, p 1135)

UCLA researchers demonstrate that stem cells can be engineered to kill HIV ***Innovative strategy could be effective against other chronic viral diseases***

By Enrique Rivero December 07, 2009 Category: Health Sciences, Research

Researchers from the UCLA AIDS Institute and colleagues have for the first time demonstrated that human blood stem cells can be engineered into cells that can target and kill HIV-infected cells - a process that potentially could be used against a range of chronic viral diseases.

The study, published Dec. 7 in the-peer reviewed online journal PLoS ONE, provides proof-of-principle - that is, a demonstration of feasibility - that human stem cells can be engineered into the equivalent of a genetic vaccine.

"We have demonstrated in this proof-of-principle study that this type of approach can be used to engineer the human immune system, particularly the T-cell response, to specifically target HIV-infected cells," said lead investigator Scott G. Kitchen, assistant professor of medicine in the division of hematology and oncology at the David Geffen School of Medicine at UCLA and a member of the UCLA AIDS Institute. "These studies lay the foundation for further therapeutic development that involves restoring damaged or defective immune responses toward a variety of viruses that cause chronic disease, or even different types of tumors."

Taking CD8 cytotoxic T lymphocytes - the "killer" T cells that help fight infection - from an HIV-infected individual, the researchers identified the molecule known as the T-cell receptor, which guides the T cell in recognizing and killing HIV-infected cells. These cells, while able to destroy HIV-infected cells, do not exist in enough quantities to clear the virus from the body. So the researchers cloned the receptor and genetically engineered human blood stem cells, then placed the stem cells into human thymus tissue that had been implanted in mice, allowing them to study the reaction in a living organism.

The engineered stem cells developed into a large population of mature, multifunctional HIV-specific CD8 cells that could specifically target cells containing HIV proteins. The researchers also found that HIV-specific T-cell receptors have to be matched to an individual in much the same way that an organ is matched to a transplant patient.

The next step is to test this strategy in a more advanced model to determine if it would work in the human body, said co-author Jerome A. Zack, UCLA professor of medicine in the division of hematology and oncology and associate director of the UCLA AIDS Institute. The researchers also hope to expand the range of viruses against which this approach could be used.

But the results of the study suggest that this strategy could be an effective weapon in the fight against AIDS and other viral diseases.

"This approach could be used to combat a variety of chronic viral diseases," said Zack, who is also a professor of microbiology, immunology and molecular genetics. "It's like a genetic vaccine."

In addition to Kitchen and Zack, investigators included Michael Bennett, Zoran Galic, Joanne Kim, Qing Xu, Alan Young, Alexis Lieberman, Hwee Ng and Otto Yang, all of UCLA, and Aviva Joseph and Harris Goldstein of the Albert Einstein College of Medicine in New York.

The California Institute for Regenerative Medicine (CIRM) and the UCLA Center for AIDS Research funded this study.

Hops compound may prevent prostate cancer

HOUSTON – The natural compound xanthohumol blocks the effects of the male hormone testosterone, therefore aiding in the prevention of prostate cancer.

"We hope that one day we can demonstrate that xanthohumol prevents prostate cancer development, first in animal models and then in humans, but we are just at the beginning," said Clarissa Gerhauser, Ph.D., group leader of cancer chemoprevention in the Division of Epigenomics and Cancer Risk Factors at the German Cancer Research Center, in Heidelberg, Germany.

Gerhauser presented these findings at the American Association for Cancer Research Frontiers in Cancer Prevention Research Conference, held in Houston, Dec. 6-9, 2009.

Xanthohumol is derived from hops and belongs to the group of flavonoids that are found in many plants, fruit, vegetables and spices. Studies to date have shown that xanthohumol blocks the action of estrogen by binding to its receptor, which may lead to prevention of breast cancer.

Since testosterone receptors act similarly to that of estrogen - by binding, then stimulating hormone-dependent effects, such as gene expression and cell growth - the researchers examined whether xanthohumol might not only block the effects of estrogen, but also of the male hormone androgen.

Gerhauser and colleagues stimulated hormone-dependent prostate cancer cells with testosterone, which led to a massive secretion of prostate specific antigen (PSA). PSA is used for screening and early detection of prostate cancer in men. Cells were then treated with testosterone and xanthohumol and the effects were examined.

"Xanthohumol prevented the receptor from translocating to the cell nucleus, thus inhibiting its potential to stimulate the secretion of PSA and other hormone-dependent effects," she said.

Molecular modeling results showed that xanthohumol directly binds to the androgen receptor structure.

The researchers suggest that this compound may have beneficial effects in animals - when they measured the anti-androgenic potential of xanthohumol in a rat model, they found that although xanthohumol was not able to prevent an increase in prostate weight after testosterone treatment, it could reduce testosterone-increased seminal vesicle weight.

"Although the prostate weights were not changed, xanthohumol still reduced the effects of hormone signaling, such as gene expression, measured in the prostate tissue," said Gerhauser.

Pistachios may reduce lung cancer risk

HOUSTON – A diet that incorporates a daily dose of pistachios may help reduce the risk of lung and other cancers, according to data presented at the American Association for Cancer Research Frontiers in Cancer Prevention Research Conference, held Dec. 6-9.

"It is known that vitamin E provides a degree of protection against certain forms of cancer. Higher intakes of gamma-tocopherol, which is a form of vitamin E, may reduce the risk of lung cancer," said Ladia M.

Hernandez, M.S., R.D., L.D., senior research dietitian in the Department of Epidemiology at the University of Texas M. D. Anderson Cancer Center, and doctoral candidate at Texas Woman's University - Houston Center.

"Pistachios are a good source of gamma-tocopherol. Eating them increases intake of gamma-tocopherol so pistachios may help to decrease lung cancer risk," she said.

Pistachios are known to provide a heart-healthy benefit by producing a cholesterol-lowering effect and providing the antioxidants that are typically found in food products of plant origin. Hernandez and colleagues conducted a six-week, controlled clinical trial to evaluate if the consumption of pistachios would increase dietary intake and serum levels of gamma-tocopherol. A pistachio-rich diet could potentially help reduce the risk of other cancers from developing as well, according to Hernandez.

"Because epidemiologic studies suggest gamma-tocopherol is protective against prostate cancer, pistachio intake may help," she said. "Other food sources that are a rich source of gamma-tocopherol include nuts such as peanuts, pecans, walnuts, soybean and corn oils."

The study, conducted at Texas Woman's University - Houston Center, included 36 healthy participants who were randomized into either a control group or the intervention group consisting of a pistachio diet. There were 18 participants in the control group and 18 in the intervention group. There was a two-week baseline period,

followed by a four-week intervention period in which the intervention group was provided with 68 grams (about 2 ounces or 117 kernels) of pistachios per day; the control group continued with their normal diet.

The effect on the intake and serum cholesterol-adjusted gamma-tocopherol was investigated. Intake was calculated using the Nutrition Data System for Research Version 2007, and consumption was monitored using diet diaries and by measuring the weights of the returned pistachios.

Hernandez and colleagues found a significant increase in energy-adjusted dietary intake of gamma-tocopherol at weeks three and four in those on the pistachio diet compared with those on the control diet. The similar effect was seen at weeks five and six among those on the pistachio diet compared with those on the control diet. For those on the pistachio diet, cholesterol-adjusted serum gamma-tocopherol was significantly higher at the end of the intervention period compared to baseline.

"Pistachios are one of those 'good-for-you' nuts, and 2 ounces per day could be incorporated into dietary strategies designed to reduce the risk of lung cancer without significant changes in body mass index," said Hernandez.

Researchers finds hidden sensory system in the skin

Persons lacking known nerve receptors can still touch and feel; may shed light on causes of unexplained pain such as fibromyalgia

Albany, N.Y., USA - The human sensory experience is far more complex and nuanced than previously thought, according to a groundbreaking new study published in the December 15 issue of the journal *Pain* (<http://www.painjournalonline.com/article/S0304-3959%2809%2900526-0/abstract>). In the article, researchers at Albany Medical College, the University of Liverpool and Cambridge University report that the human body has an entirely unique and separate sensory system aside from the nerves that give most of us the ability to touch and feel. Surprisingly, this sensory network is located throughout our blood vessels and sweat glands, and is for most people, largely imperceptible.

"It's almost like hearing the subtle sound of a single instrument in the midst of a symphony," said senior author Frank Rice, PhD, a Neuroscience Professor at Albany Medical College (AMC), who is a leading authority on the nerve supply to the skin. "It is only when we shift focus away from the nerve endings associated with normal skin sensation that we can appreciate the sensation hidden in the background."

The research team discovered this hidden sensory system by studying two unique patients who were diagnosed with a previously unknown abnormality by lead author David Bowsher, M.D., Honorary Senior Research Fellow at the University of Liverpool's Pain Research Institute. These patients had an extremely rare condition called congenital insensitivity to pain, meaning that they were born with very little ability to feel pain. Other rare individuals with this condition have excessively dry skin, often mutilate themselves accidentally and usually have severe mental handicaps. "Although they had a few accidents over their lifetimes, what made these two patients unique was that they led normal lives. Excessive sweating brought them to the clinic, where we discovered their severe lack of pain sensation," said Dr. Bowsher. "Curiously, our conventional tests with sensitive instruments revealed that all their skin sensation was severely impaired, including their response to different temperatures and mechanical contact. But, for all intents and purposes, they had adequate sensation for daily living and could tell what is warm and cold, what is touching them, and what is rough and smooth."

The mystery deepened when Dr. Bowsher sent skin biopsies across the ocean to Dr. Rice's laboratory, which focuses on multi-molecular microscopic analyses of nerve endings in the skin, especially in relation to chronic pain conditions such as those caused by nerve injuries, diabetes, and shingles. These unique analyses were pioneered by Dr. Rice at Albany Medical College (AMC) along with collaborators at the Karolinska Institute in Stockholm, Sweden. "Under normal conditions, the skin contains many different types of nerve endings that distinguish between different temperatures, different types of mechanical contact such as vibrations from a cell phone and movement of hairs, and, importantly, painful stimuli," said Dr. Rice. "Much to our surprise, the skin we received from England lacked all the nerve endings that we normally associated with skin sensation. So how were these individuals feeling anything?"

The answer appeared to be in the presence of sensory nerve endings on the small blood vessels and sweat glands embedded in the skin. "For many years, my colleagues and I have detected different types of nerve endings on tiny blood vessels and sweat glands, which we assumed were simply regulating blood flow and sweating. We didn't think they could contribute to conscious sensation. However, while all the other sensory endings were missing in this unusual skin, the blood vessels and sweat glands still had the normal types of nerve endings. Apparently, these unique individuals are able to 'feel things' through these remaining nerve endings," said Dr. Rice. "What we learned from these unusual individuals is that there's another level of sensory feedback that can give us conscious tactile information. Problems with these nerve endings may contribute to

mysterious pain conditions such as migraine headaches and fibromyalgia, the sources of which are still unknown, making them very difficult to treat."

In addition to international collaborations such as this one, Dr. Rice and his principle AMC colleague, Dr. *Philip Albrecht*, in the *Center for Neuropharmacology and Neuroscience*, collaborate extensively with neurologists Dr. *Charles Argoff* at AMC and Dr. *James Wymer* of *Upstate Clinical Research Associates*, who also holds a joint AMC appointment. All are co-authors on the study, which included normal subjects from the Albany, N.Y. area. Several studies on chronic pain are being conducted by this team with support from National Institutes of Health (NIH) and several pharmaceutical companies.

About Integrated Tissue Dynamics (INTIDYN)

To facilitate these collaborations, Dr. Rice and Dr. Albrecht, recently founded a new biotechnology company, Integrated Tissue Dynamics, LLC, also known as Intidyn (www.Intidyn.com). Intidyn provides flexible and scalable research capabilities on behalf of pharmaceutical companies to detect chemical and structural changes in the skin that may cause the chronic numbness, pain and itch associated with a wide variety of afflictions such as diabetes, shingles, complex regional pain syndrome, carpal tunnel syndrome, sciatica, fibromyalgia, psoriasis, chemotherapy and even the unintended side effects caused by many drugs. Such afflictions and the associated neurological problems respond poorly to existing treatments. The preclinical and clinical research conducted by AMC and Intidyn facilitates biomarker identification and the evaluation of potential therapeutic strategies to prevent or treat these naturally-occurring afflictions and drug-induced side effects that harm the skin and nerves.

"By looking carefully at genomics and the structural and chemical differences between normal and diseased skin, we can better determine if a treatment is working or if it's even targeting the right problem," said Dr. Rice. "For example, in cases of 'unexplained' pain that's unresponsive to conventional treatment, it's important to know if nerve receptors in the vascular and sweat gland tissue are involved, and if so, whether a given treatment is targeting those nerves. We can also see if a pain treatment is damaging vascular tissue, for example, and make inferences about what the impact of that damage might mean clinically."

Most recently, Intidyn has partnered with neurologists and fellow co-authors, Drs. Argoff and Wymer to study a mysterious condition called fibromyalgia. They suspect the unrelenting pain may be related to the sensory nerve endings on blood vessels deep in the skin.

18 and Under

Hard Questions to Ask After a Cry for Help

By PERRI KLASS, M.D.

Some time ago I got an e-mail message from one of my students: She couldn't come to class. She was having terrible problems, her life had fallen apart, she was just sitting and crying. She was sorry, but her assignment would be late.

Immediately, my mind went back to a familiar acronym: Headsss. The letters stand for an interviewing technique developed in 1991 for adolescent patients - H for home (the doctor starts by asking about the teenager's home situation), E for education and employment, A for activities. And then, in a progression meant to move from less sensitive topics to touchier subjects, it is on to D for drugs and finally the three S's: sexuality, suicide and safety.

These are not easy questions to ask - even home and education may be fraught subjects for many adolescents. Sometimes a teenager will say, "If I tell you something, will you absolutely promise to keep it a secret?"

And the pediatrician must respond with the truth - or, much better, establish the rules with every patient, before the question even comes up. "I say this in front of the parent and the teen," Dr. Michelle S. Barratt, a professor of pediatrics at the University of Texas Medical School at Houston, told me. "I'm going to talk to your teen about some things that are easier to talk about without a parent in the room, and I'm going to keep things confidential unless it's life-threatening." And I use those words."

No, these aren't easy conversations. "There's been a fear that talking to children or adolescents about suicide is somehow suggestive or puts them at higher risk," said Dr. Benjamin N. Shain, head of child and adolescent psychiatry at NorthShore University HealthSystem outside Chicago. "Repeated studies have shown this is not the case."

Dr. Shain was the lead author of the American Academy of Pediatrics' 2007 statement on suicide and suicide attempts in adolescents. As a psychiatrist, he has experience treating adolescents who have attempted suicide, and he is a strong advocate for screening in primary care settings.

In fact, asking the question does not awaken thoughts of suicide - suicidal ideation, as we call it. A 2005 study in *The Journal of the American Medical Association* looked at more than 2,000 New York State high school students in a randomized controlled trial; those screened were not more likely to report suicidal thoughts in the following days.

Dr. Kenneth R. Ginsburg, an adolescent medicine specialist at the Children's Hospital of Philadelphia and the author of "A Parent's Guide to Building Resilience in Children and Teens" (American Academy of Pediatrics, 2006), would prefer to think in terms of a different mnemonic: Sshadess. That first S reminds you to

start the conversation by asking about the teenager's strengths - about what is going well in your patient's life - and move from there to school, home and activities before approaching drugs.

And before you get to the S's, there is the E for emotion, which, Dr. Ginsburg said, should be much more than screening for depression. "If you start by asking boys if they're depressed or sad, most boys will deny that," he told me. "If you start by saying, 'So, are you stressed out?' - every boy, no matter how big and strong, every girl, no matter how much she wants to portray herself as being in control, will admit to stress."

Markers for depression may help identify adults at risk for suicide, but they are not a reliable way to screen adolescents. "Only about half of kids who kill themselves are depressed in the way that we think about depression - sad, not taking care of themselves, not sleeping or sleeping too much, not eating or eating too much," Dr. Ginsburg said. The other half may be impulsive, angry, disappointed, trying to get even.

Dr. Shain said adolescents often changed their ideas and their plans. So an assessment has to go beyond the feelings of the moment to include thoughts they have had, dangerous ways they have behaved and the important questions of intent and ambivalence.

"Sometimes you'll get an 'I don't know' answer," he explained, "which might be ominous, might mean they don't know or might mean they don't want to tell you."

If a teenager does acknowledge thinking about suicide, there are many more questions to be asked. Dr. Lydia A. Shrier, director of clinic-based research on adolescent and young-adult medicine at Children's Hospital Boston, said some young people chronically struggled with these issues.

"If I responded every time they said, 'Yes, I have these thoughts,' by sending them to the E.R., they would spend their lives there," Dr. Shrier said. "You have to ask, but then you have to get the rich detail of somebody's internal experience."

The point of asking, after all, is to help. That means helping in a crisis, of course. "I tell patients, 'If you tell me that you want to kill yourself and you can't tell somebody when you have those feelings and you can't make a safety plan with me, then I can't let you leave this office,'" Dr. Shrier said. But it also means finding therapeutic resources for those who are struggling and helping them understand they are entitled to feel better.

"Kids don't want it to be ignored," Dr. Ginsburg said. "It's a cry for help. No one wants to know that their cry for help was ignored."

"They might act angry. But what you're communicating is: 'I really listened, I heard you. I'm going to see that you get help, I'm going to take the action you deserve.'"

I e-mailed back to my student, "Please come to class." And when she did, I asked her how she was doing. She replied that she was seriously stressed.

I wanted to do a full Headsss assessment. But I was her teacher, not her doctor. So I suggested, as delicately as I could, that with all the stress in her life, she might want to go to student health services, where counseling was available. I walked her over, to make sure she got there.

Testosterone 'breeds fair play'

Giving women more of the male hormone testosterone can turn them into fairer and more amiable game players, according to tests.

A single dose of testosterone was enough to have this effect, European scientists found, but only if the woman was oblivious to the treatment. If she realised she had received the hormone and not a dummy drug, she turned to greed and selfishness. The work in Nature magazine suggests the mind can win over hormones.

Testosterone induces anti-social behaviour in humans, but only because of our own prejudices about its effect rather than its biological activity, suggest the authors. They believe the same is true in men, although they only studied women.

Power of suggestion

For the study, they asked more than 120 women to pair up and play an "ultimatum" bargaining game with real money at stake.

In the game, one of the pair is the "proposer" and is tasked with suggesting to the other player - the responder - how to split the money between them. The responder can then only accept or reject the offer. If they reject it, neither of the pair gets any of the cash.

The researchers gave the proposers either a dummy pill or one containing testosterone, but did not tell the women which pill they had been given.

Once they had played the game, the proposers were asked to say which pill they thought they had taken. Those who received testosterone behaved more fairly, had fewer bargaining conflicts and were better at social interactions. However, women who thought that they had received testosterone, whether or not they actually did,

behaved more unfairly than those who thought that they had received placebo, again whether or not they actually did.

The researchers, led by Ernst Fehr of the University of Zurich, Switzerland, said the results suggested a case of "mind over matter" with the brain overriding body chemistry.

"Whereas other animals may be predominantly under the influence of biological factors such as hormones, biology seems to exert less control over human behaviour," they said.

UK endocrinologist Professor Ashley Grossman said: "This puts hormones in their place. Hormones provide a basic backdrop, but changes in levels will do little to behaviour compared to personality, culture and society."

Ancient Pacific islanders brought to light

The University of Stavanger

When a team of archaeologists began excavating an old coral reef in Vanuatu in 2008 and 2009, they soon discovered it had served as a cemetery in ancient times. So far, 71 buried individuals have been recorded, giving new information on the islands' inhabitants and their funeral rites.

"This is a groundbreaking discovery, as it is the oldest and biggest skeleton find ever in the Pacific Ocean; bigger cemeteries found further east are much younger", says Mads Ravn, head of research at the University of Stavanger's Museum of Archaeology in Norway.

Relatives did not treat their dead gently. Besides being headless, some of them had had their arms and legs broken, in order to fit into the coral reef cavities. Ravn suggests they may have been left to rot first, and buried later as skeletons.

The local museum's staff of the Vanuatu Culture Centre, a range of researchers, lead by Stuart Bedford and Matthew Spriggs from the Australian National University (ANU), forms an international and cross-disciplinary team, working to gather information about the Pacific islands' inhabitants. Mads Ravn's expertise in migration and colonising over great distances, as well as in digital excavation documentation and recording, makes him an important contributor to this cooperative effort.



SKELTONS AND SKULLS: *The archaeologists found that Vanuatu skeletons are headless. The research project "Persistence and Transformation in Ancestral Oceanic Society: the archaeology of the first 1500 years in the Vanuatu archipelago" was initiated by Stuart Bedford and Matthew Spriggs in ANU in collaboration with the Vanuatu cultural Centre in Vanuatu and sponsored by the Australian Research Council. It aims to find out how Vanuatu was colonised and developed over time.* PHOTO: Mads Ravn (head of research at the University of Stavanger's Museum of Archaeology in Norway)

Coral reef tomb

Vanuatu is a nation of 83 islands, located 1,750 kilometres east of Australia. The soil contains remnants from a violent volcano eruption, believed to have taken place exactly 3000 years ago. Scientists have found no sign of human activity predating this event.

"The way these people are buried, bears witness of a body concept which is different from the whole-body concept in Europe the last 5000 years," says Mads Ravn.

"There was no sharp divide between life and death, and the dead were participating in the present. A few decades ago in Bali and other Pacific islands, people were putting their ancestors' skulls on display in their homes," he adds.

This may explain why the Vanuatu skeletons are headless. One skeleton was found with five skulls on his chest, and Ravn believes the heads may have been used in ancestral rituals.

The islanders usually removed the volcanic ash before burying their dead under ashes and sand. Each grave is marked with a pottery jar decorated with intricate patterns, possibly stamped by small pieces of worked bone. The ceramic also depicts faces and eyes, perhaps images of their ancestors.

"I have never seen such beautiful artefacts before. These must be the world's finest pottery jars of that age," says Ravn.

Long distance voyages

Vanuatu's first inhabitants probably came from Taiwan and the Philippines, having travelled thousands of miles by outrigger canoes equipped with sails and big enough to contain large families. The canoers settled on the uninhabited islands, and supported themselves by fishing and cultivating the land. Giant tortoises were

abundant and easy to catch. Volcanic ashes from 3000 years ago contain many tracks of tortoises, but these are entirely non-existent 100 years on.

"It is very interesting to observe the consequences of human beings taking possession over virgin land," says Ravn.

Over a few centuries, several species went extinct -- the giant tortoise among them. Traces of mussel shells also bear witness of excessive consumption. The shells diminish in size as the sediments get younger. According to Ravn, the inhabitants quite simply overextended their resources.

Strong and adventurous

The skeletons' DNA profiles should be ready later this winter, and the scientists hope to uncover kinship links among the dead. But there are already some findings of their health condition.

"People were suffering from gout and caries - both diseases associated with the good life. But we can tell from our samples that the inhabitants were laborious and strong. They were simply genetically disposed to contracting gout from eating shellfish. And starch in food such as Taro and sweet potatoes induced caries," says Ravn.

Tooth analyses also revealed what these first islanders looked like.

"They were most probably fair skinned of Asian origin, unlike the present day Melanesians, whose skin is dark. The original settlers probably travelled on, or mixed up with the Melanesians that arrived later," "But future DNA studies and isotopic analyses may later confirm that", Ravn says.

It is believed that the first Pacific seafarers were spurred on by overpopulation, or by rules of inheritance which granted the first born child the right to inherit land, making it hard for younger siblings to settle down.

But one should not exclude desire for travelling and a spirit of adventure, says Ravn. The desire to venture out has probably been a driving force at all times.

The first Vanuatuans remained on the islands for years, until some of them, probably driven by lust for adventure and fortune set sail further out in the Pacific Ocean again, heading eventually for the Easter Islands. Over two short centuries, the Pacific Ocean was colonised all the way to the Tonga Islands. By then, a distance of more than 3000 kilometres had been covered - by canoe.

Facts:

The research project "Persistence and Transformation in Ancestral Oceanic Society: the archaeology of the first 1500 years in the Vanuatu archipelago" was initiated by Stuart Bedford and Matthew Spriggs in ANU in collaboration with the Vanuatu cultural Centre in Vanuatu and sponsored by the Australian Research Council. It aims to find out how Vanuatu was colonised and developed over time. The University of Stavanger's Museum of Archaeology is one of many research partners. Excavations will continue until 2012, expanding to different parts of Vanuatu over the coming years. Scientists expect to find more headless skeletons and other objects which may explain why colonisation took place. Their findings will be published in articles and books. <http://www.uis.no/research/article21422-51.html>

Personal Health

Shedding Light on a Tremor Disorder

By JANE E. BRODY

"Essential" usually means vital, necessary, indispensable. But in medicine, the word can assume a different cast, meaning inherent or intrinsic, not symptomatic of anything else, lacking a known cause.

Since the mid-19th century, "essential tremor" has been the diagnosis for a disorder of uncontrollable shaking - usually of the hands but sometimes of the head and other body parts, or the voice - that is not due to some other condition. And without knowing what causes it, doctors have been slow to come up with treatments to subdue it.

As a result, millions of individuals suffer to varying degrees with embarrassment and humiliation, social isolation and difficulties holding down a job or performing the tasks of daily life. When you cannot drink a glass of water or eat soup without spilling it because your hand shakes violently, you are unlikely to join others for a dinner out. When you have to depend on someone else to button your shirt or zip your jacket, you may not go out at all.

Wherever those with essential tremor go, people are likely to stare at them and assume they have a drug or alcohol problem, said Catherine Rice, executive director of the International Essential Tremor Foundation in Lenexa, Kan. (Call it at 888-387-3667 or visit its Web site: www.essentialtremor.org.)

Now, thanks to the devoted efforts of a few researchers here and abroad, all this may change. Recent studies have begun to unravel the mysteries of essential tremor, and "essential" may someday be dropped from its name.

"Until very recently," Dr. Elan D. Louis, a pioneering neurologist and epidemiologist at the College of Physicians and Surgeons at Columbia University, told me, "essential tremor was thought to have no known pathology, no changes in the brain, which led to a medical dead end." But in the last five years, Dr. Louis said,

discoveries in three areas - the brain, clinical findings and genetics and environment - "have changed our understanding of this disease." And as our understanding evolves, he predicts that rational therapies will follow.

Common Over Age 65

Essential tremor is a neurological disorder that causes uncontrollable shaking of one or more body parts during voluntary movement. The symptoms disappear at rest. In that way it differs from Parkinson's disease, in which shaking at rest is a common symptom that disappears during movement. But those with essential tremor are four to five times as likely to develop Parkinson's as people without tremor, and both conditions involve related changes in the brain.

Though essential tremor most often affects older people - as many as 1 in 5 over 65 have it - it can occur at any age, even in young children. It is typically progressive, getting worse as people age.

Stephen Remillard of Steamboat Springs, Colo., said he learned he had essential tremor while in kindergarten, when it affected just his hands. But the condition worsened as he got older, and by high school, Mr. Remillard said, "all my extremities as well as my voice were affected." When he had to speak in class, he said, "it came off as if I was nervous, though I've always been a very confident person."

The academic challenges related to tremor prompted him to drop out of college. But the biggest blow to Mr. Remillard's self-esteem came when he tried to join the military and was rejected by the Army, Marines, Air Force and Coast Guard. Rather than feel sorry for himself, he returned to college, graduating last May, and started playing sports. Now 25, he works for a ski corporation and runs marathons to raise money for causes like the Lance Armstrong Foundation.

For Richard Crandell, a 66-year-old guitarist from Eugene, Ore., the problem began around age 60, forcing him to abandon his instrument. But he, too, was not to be defeated: he took up the mbira, an African thumb piano that he plays with two thumbs and an index finger.

Still, Mr. Crandell said, he has problems shaving, brushing his teeth, using a computer and slicing and dicing in the kitchen. And at the bank, he has to ask the teller to fill in his forms "because my handwriting is all over the place."

Ms. Rice said essential tremor ran in her family. "My great-aunts used to shake uncontrollably, starting in their early 40s and becoming quite severe by the time they were 60," she said. "They found it very difficult to cook, though their job was to feed the farmhands. They couldn't pick up a heavy pan without spilling the contents. They had to give up crocheting and other things they truly loved."

New Findings

Dr. Louis and colleagues have established a centralized brain repository that has revealed underlying abnormalities in essential tremor patients. The scientists collect detailed clinical and physiological data on each person, and after death their brains are shipped to Columbia, where they are analyzed and compared with the brains of normal individuals.

Of the 50 brains studied so far, Dr. Louis said, "all are degenerative and have very clear pathological changes, although there are several types, suggesting this is probably a family of diseases." In one subtype, Lewy bodies, which also occur in Parkinson's disease, are found in the brain but in a different area from Parkinson's. (Mr. Crandell's father died of Parkinson's, and there have been suggestions that the disorders may be linked.)

In about 80 percent of the brains, there are degenerative changes in the cerebellum, including a loss of cells that produce a major inhibitory neurotransmitter called GABA. Other abnormal findings include a messy arrangement of neurofilaments, which may interfere with nerve cell transmission.

Clinically, essential tremor is now considered a neuropsychiatric disease that can include unsteadiness, abnormal eye movements, problems with coordination and cognitive changes that sometimes progress to dementia.

Even certain personality types tend to be overrepresented among patients with essential tremor, Dr. Louis said. Many "are very detail-oriented and tightly wound and have higher harm-avoidance scores," he said.

Two environmental toxins have been found to be elevated in tremor patients: lead and a dietary chemical called harmane that occurs naturally in plants and animals. When meat is cooked for long periods or at high temperatures, as in barbecuing, levels of harmane rise sharply. Dr. Louis called these "tantalizing leads."

Despite the problems caused by their disorder, most patients with essential tremor never seek treatment. Two drugs, propranolol (Inderal) and primidone (Mysoline), developed to treat other conditions, have proved helpful for many but not all patients. A costly surgical treatment, deep brain stimulation, has helped to reduce tremors in about 80 percent of patients who have tried it.

Caffeine, certain prescription drugs and undue stress can make symptoms worse and are best avoided. Though alcohol can temporarily relieve tremors, regular heavy drinking is a recognized cause of the disorder.

Life on Mars theory boosted by new methane study

Scientists rule out the possibility that methane is delivered by meteorites into the Martian atmosphere

Scientists have ruled out the possibility that methane is delivered to Mars by meteorites, raising fresh hopes that the gas might be generated by life on the red planet, in research published tomorrow (Wednesday 9 December 2009) in *Earth and Planetary Science Letters*.

Methane has a short lifetime of just a few hundred years on Mars because it is constantly being depleted by a chemical reaction in the planet's atmosphere, caused by sunlight. Scientists analysing data from telescopic observations and unmanned space missions have discovered that methane on Mars is being constantly replenished by an unknown source and they are keen to uncover how the levels of methane are being topped up.

Researchers had thought that meteorites might be responsible for Martian methane levels because when the rocks enter the planet's atmosphere they are subjected to intense heat, causing a chemical reaction that releases methane and other gases into the atmosphere.

However, the new study, by researchers from Imperial College London, shows that the volumes of methane that could be released by the meteorites entering Mars's atmosphere are too low to maintain the current atmospheric levels of methane. Previous studies have also ruled out the possibility that the methane is delivered through volcanic activity.

This leaves only two plausible theories to explain the gas's presence, according to the researchers behind today's findings. Either there are microorganisms living in the Martian soil that are producing methane gas as a by-product of their metabolic processes, or methane is being produced as a by-product of reactions between volcanic rock and water.

Co-author of the study, Dr Richard Court, Department of Earth Science and Engineering at Imperial College London, says: "Our experiments are helping to solve the mystery of methane on Mars. Meteorites vaporising in the atmosphere are a proposed methane source but when we recreate their fiery entry in the laboratory we get only small amounts of the gas. For Mars, meteorites fail the methane test."

The team say their study will help NASA and ESA scientists who are planning a joint mission to the red planet in 2018 to search for the source of methane. The researchers say now that they have discovered that meteorites are not a source of Methane on Mars, ESA and NASA scientists can focus their attention on the two last remaining options.

Co-author, Professor Mark Sephton, Department of Earth Science and Engineering at Imperial College London, adds: "This work is a big step forward. As Sherlock Holmes said, eliminate all other factors and the one that remains must be the truth. The list of possible sources of methane gas is getting smaller and excitingly, extraterrestrial life still remains an option. Ultimately the final test may have to be on Mars."

The team used a technique called Quantitative Pyrolysis-Fourier Transform Infrared Spectroscopy to reproduce the same searing conditions experienced by meteorites as they enter the Martian atmosphere. The team heated the meteorite fragments to 1000 degrees Celsius and measured the gases that were released using an infrared beam.

When quantities of gas released by the laboratory experiments were combined with published calculations of meteorite in-fall rates on Mars, the scientists calculated that only 10 kilograms of meteorite methane was produced each year, far below the 100 to 300 tonnes required to replenish methane levels in the Martian atmosphere.

This research was funded by a grant from the Science Technology Facilities Council.

Notes to editors:

1. "Investigating the contribution of methane produced by ablating micrometeorites to the atmosphere of Mars" *Earth and Planetary Science Letters journal*

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This decade 'warmest on record'

By Richard Black Environment correspondent, BBC News website, Copenhagen

The first decade of this century is "by far" the warmest since instrumental records began, say the UK Met Office and World Meteorological Organization.

Their analyses also show that 2009 will almost certainly be the fifth warmest in the 160-year record.

Burgeoning El Nino conditions, adding to man-made greenhouse warming, have pushed 2009 into the "top 10" years. The US space agency Nasa suggests that a new global temperature record will be set "in the next one or two years". World Meteorological Organization (WMO) and Met Office scientists have been giving details of the new analysis at the UN climate summit in Copenhagen.

The WMO said global temperatures were 0.44C (0.79F) above the long-term average.

"We've seen above average temperatures in most continents, and only in North America were there conditions that were cooler than average," said WMO secretary-general Michel Jarraud. "We are in a warming trend - we have no doubt about it."

Mr Jarraud emphasised that the final analysis would not be complete until early next year; but the UN agency always issues a summary during the annual climate negotiations in order that delegates have the latest information.

The WMO uses three temperature sets - one from the UK Met Office and the University of East Anglia's Climatic Research Unit (CRU), and two from the US, maintained by the National Oceanic and Atmospheric Administration (Noaa) and the space agency Nasa.

Asked whether the controversy surrounding e-mails hacked from CRU could have any bearing on the results, Mr Jarraud replied that all three datasets showed the same result. Vicky Pope from the UK Met Office made the same point: "The datasets are all independent, and they all show warming," she said.

The Met Office figures indicate that the years since 2000 - the "noughties" - were on average about 0.18C (0.32F) warmer than years in the 1990s; and that since the 1970s, each decade has seen an increase of about the same scale.

Although the Met Office has 1998 as the single warmest year, that coincided with strong El Nino conditions - the warming of surface waters in the eastern Pacific that releases heat stored in the deep ocean into the atmosphere, raising temperatures globally.

Now, after a period of La Nina conditions which depressed temperatures in 2008, another El Nino is developing; and it is this, combined with greenhouse warming, that is pushing temperatures upwards again, according to Dr Pope. She declined to give a forecast for the next few years - the Met Office is releasing that later during this summit. But Nasa's GISTEMP unit - the division of the agency that maintains the temperature dataset - suggests further warming is coming, with the temperature record for an individual year likely to be set within the next year or two.

Other researchers, though, believe it more likely that temperatures will remain stable for up to a decade as other natural cycles keep the ocean's surface relatively cool, with rapid warming likely after that.

Climate "sceptics" have claimed that temperatures have not been rising over the last decade. Of the two widely-used global temperature records, one - the UK HadCRUT3 record - shows an apparent plateau from 1998 to 2008. But climate scientists point out that this result is achieved by taking 1998 as the starting point. Taking, for instance, 1997 or 1999 as the starting point, they argue, produces a different result.

Free release

In a separate move, the Met Office has released data from more than 1,000 weather stations that make up the global land surface temperature records.

The decision to make the information available is the latest consequence of the hacked e-mails affair.

"This subset release will continue the policy of putting as much of the station temperature record as possible into the public domain," said the agency's statement. "As soon as we have all permissions in place we will release the remaining station records - around 5,000 in total - that make up the full land temperature record.

"We are dependent on international approvals to enable this final step and cannot guarantee that we will get permission from all data owners."

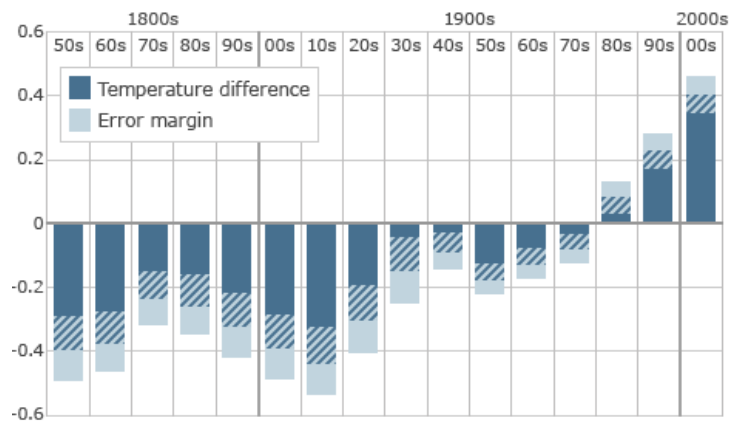
Mr Jarraud said that weather agencies belonging to the WMO had agreed in 1995 that they would, in general, make data "essential for the protection of life and property" freely available. But some agencies did not release all their data, he said. "But whether they all release or not will not alter what we are saying, because the vast majority is already open." *Richard.Black-INTERNET@bbc.co.uk*

The Pitch of Blue Whale Songs is Declining Around the World, Scientists Discover **Researchers' theory: An increase in population size may mean sounds used in mate competition need not travel as far as before; acoustic information extracted from songs could be useful population monitoring tool**

The sound level of songs blue whales sing across the vast expanses of the ocean to attract potential mates has been steadily creeping downward for the past few decades, and a scientist at Scripps Institution of

Global average temperature 1850-2009

Temperature difference from 1961-1990 (°C)



Source: Met Office

Oceanography at UC San Diego and his colleagues believe the trend may be good news for the population of the endangered marine mammal.

Mark McDonald of WhaleAcoustics in Bellvue, Colo., along with John Hildebrand of Scripps Oceanography and Sarah Mesnick of NOAA Fisheries Southwest Fisheries Science Center studied blue whale song data from around the world and discovered a downward curve in the pitch, or frequency, of the songs. The decline was tracked in blue whales across the globe, from off the Southern California coast to the Indian and Southern Oceans.



A blue whale photographed off San Diego. Image: Larry Wagner Jr./ISSI

"The basic style of singing is the same, the tones are there, but the animal is shifting the frequency down over time. The more recent it is, the lower the frequency the animal is singing in, and we have found that in every song we have data for," said Hildebrand, a professor of oceanography in the Marine Physical Laboratory at Scripps.

The study's results are published in the most recent issue of the journal *Endangered Species Research*.

The researchers examined a list of possible causes for the frequency drop—from climate change to a rise in human-produced ocean noise—and believe it may be explained by the increase of blue whale numbers following bans on commercial whaling activities.

While the function of blue whale songs is not known and scientists have much more to learn, they do know that all singers have been determined to be males and that the high-intensity, or loud, and low-frequency songs propagate long distances across the ocean. Blue whales are widely dispersed during the breeding season and it is likely that songs function to advertise which species is singing and the location of the singing whale.

In the heyday of commercial whaling, as blue whale numbers plummeted, it may have been advantageous for males to sing higher frequency songs, the researchers believe, in order to maximize their transmission distance and their ability to locate potential mates (females) or competitors (other males).

"It may be that when (blue whale) densities go up, it's not so far to get to the closest female, whereas back when they were depleted it may have been that the closest female was a long way away," said Hildebrand.

In the 1960s, when blue whale numbers were substantially reduced and recordings of the animals were first made, there may have been a tradeoff in which the male suitors chose to sing higher frequencies that were louder and heard over greater distances, Hildebrand said. In more recent years, as population sizes have increased, it may now be more advantageous for males to sing songs that are lower in frequency rather than louder.

"When they make these songs they need to use most of the air in their lungs," said Hildebrand. "It's like an opera singer that sees how long he can hold a note. The (male) songs are made to impress the females and/or other males, so I think that's how the boy blue whales are impressing the girls, or are showing off to other boys: by making a loud and long song."

The scientists say the same downward pitch phenomenon may be true in other whales such as fin and humpbacks, but the blue whale song, with a comparatively easier song to analyze, is a good springboard to study other species. Hildebrand says such knowledge about whale songs could be important in monitoring whale populations and recovery efforts.

During the study the researchers analyzed thousands of blue whale songs divided into at least 10 worldwide regions. These include the Northeast, Southwest and Northwest Pacific Ocean; the North Atlantic; the Southern Ocean near Antarctica; and the North and Southeast Indian Ocean. Blue whale songs have been recorded for the last 45 years through scientific and military applications by seafloor seismometers tracking regional earthquakes and dedicated whale acoustic recording packages.

In addition to NOAA National Marine Fisheries Service's Southwest Fisheries Science Center, Mesnick is affiliated with Scripps' Center for Marine Biodiversity and Conservation.

This research was funded by the U.S. Navy, NOAA and the National Science Foundation.

Ancient Med flood mystery solved

By Victoria Gill Science reporter, BBC News

Research has revealed details of the catastrophic Zanclean flood that refilled the Mediterranean Sea more than five million years ago.

The flood occurred when Atlantic waters found their way into the cut-off and desiccated Mediterranean basin. The researchers say that a 200km channel across the Gibraltar strait was carved out by the floodwaters.

Their findings, published in Nature, show that the resulting flood could have filled the basin within two years.

The team was led by Daniel Garcia-Castellanos from the Research Council of Spain (CSIC).

He explained that he and his colleagues laid the foundations for this study by working on tectonic lakes.

They developed a model of how the mountain lakes quickly "cease to exist" when erosion produces "outlet rivers" that drain them. This same principle, Dr Garcia-Castellanos said, could be used to explain the Zanclean flood that reconnected the Mediterranean with the rest of the World's oceans.

"We could for the first time link the amount of water crossing the channel with the amount of erosion causing it to grow over time," he told BBC News.



The team made a reconstruction of the Mediterranean during the "megaflood"

New approach

Using existing borehole and seismic data, his team showed how the flood would have begun with water spilling over a sill.

The water would have gradually eroded a channel into the strait, eventually triggering a catastrophic flood, Dr Garcia-Castellanos explained. He and his colleagues created a computer model to estimate the duration of the flood, and found that, when the "incision channel" reached a critical depth, the water flow sped up. In a period ranging from a few months to two years, the scientists say that 90% of the water was transferred into the basin.

"This extremely abrupt flood may have involved peak rates of sea level rise in the Mediterranean of more than 10m per day," he and his colleagues wrote in the Nature paper.

Previous estimates of the duration of the flood were very variable, said Dr Garcia-Castellanos, because scientists "had to assume the size of the channel" rather than measure it.

Some estimates suggested that the flood continued for as long as 10,000 years.

Rob Govers, a geoscientist from Utrecht University in the Netherlands, who was not involved in this study, said that the findings were important. "I think the authors have been very creative using existing data and making sense of it in a completely new way," he said.

Dr Govers said the next important step would be to measure the volume of breccia, or ancient eroded material, in the strait, to confirm whether there was enough material there to have filled the flood channel.

First known binary star is discovered to be a triplet, quadruplet, quintuplet, sextuplet system

Alcor, 1 half of the first known binary star system, has its own surprise star companion

In ancient times, people with exceptional vision discovered that one of the brightest stars in the Big Dipper was, in fact, two stars so close together that most people cannot distinguish them. The two stars, Alcor and Mizar, were the first binary stars - a pair of stars that orbit each other - ever known.

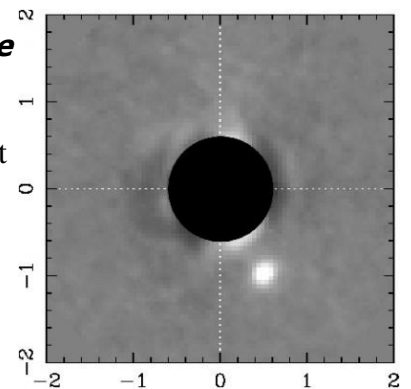
Modern telescopes have since found that Mizar is itself a pair of binaries, revealing what was once thought of as a single star to be four stars orbiting each other. Alcor has been sometimes considered a fifth member of the system, orbiting far away from the Mizar quadruplet.

This image shows Alcor and the newly discovered Alcor B, as imaged by scientists at the University of Rochester.

Now, an astronomer at the University of Rochester and his colleagues have made the surprise discovery that Alcor is also actually two stars, and is apparently gravitationally bound to the Mizar system, making the whole group a sextuplet. This would make the Mizar-Alcor sextuplet the second-nearest such system known. The discovery is especially surprising because Alcor is one of the most studied stars in the sky.

"Finding that Alcor had a stellar companion was a bit of serendipity," says Eric Mamajek, assistant professor of physics and astronomy at the University of Rochester, and leader of the team that found the star. "We were trying a new method of planet hunting and instead of finding a planet orbiting Alcor, we found a star."

Mamajek says that a separate group of scientists, led by Ben Oppenheimer of the American Natural History Museum, has also just found that the Alcor companion is physically associated with the star.



That group has also recorded a rough spectrum of the star, which Mamajek says confirms his prediction that the companion is a cool and dim M-class dwarf star.

Mamajek and colleagues at the University of Arizona used the Multiple Mirror Telescope in Arizona, which has a secondary mirror capable of flexing slightly to compensate for the twinkling the Earth's atmosphere normally imparts to starlight. With the clearest images he could obtain of nearby stars, Mamajek's team used computer algorithms to remove as much glare as possible from the image of a star in the hopes of spotting a planet near the star. Planets are so much dimmer than their parent stars that spotting one is like trying to discern a firefly next to a spotlight from several miles away, says Mamajek.

Though Mamajek was unable to find any planets in the first group of stars he surveyed, he did stumble across the tiny star hidden in the glare of Alcor. Not only did Mamajek's project reveal the image of the star, but its presence was able to explain slight deviations in movement that scientists had noticed in Alcor. In addition, Mamajek estimates that the small companion star is likely a third as massive as our sun, and explains why astronomers have detected unexpectedly high levels of X-rays coming from Alcor - dwarf stars naturally radiate high levels of X-rays.

"It's pretty exciting to have found a companion to this particular star," says Mamajek. "Alcor and Mizar weren't just the first known binaries - the four stars that were once thought to be the single Mizar were discovered in lots of 'firsts' throughout history."

Benedetto Castelli, Galileo's protégé and collaborator, first observed with a telescope that Mizar was not a single star in 1617, and Galileo observed it a week after hearing about this from Castelli, and noted it in his notebooks, says Mamajek. Those two stars, called Mizar A and Mizar B, together with Alcor, in 1857 became the first binary stars ever photographed through a telescope. In 1890, Mizar A was discovered to itself be a binary, being the first binary to be discovered using spectroscopy. In 1908, spectroscopy revealed that Mizar B was also a pair of stars, making the group the first-known quintuple star system.

Mamajek says some astronomers have raised the question of whether Alcor is truly a part of the system made up of the Mizar group of stars because Alcor's motion isn't what scientists would expect it to be if it were gravitationally connected to the Mizar group. Mamajek says that indeed Alcor is part of the same system, and that the influence of Alcor's newly discovered companion is partly responsible for Alcor's unexpected motion.

Mamajek is continuing his efforts to find planets around nearby stars, but his attention is not completely off Alcor and Mizar. "You see how the disk of Alcor B doesn't seem perfectly round?" says Mamajek, pointing toward an image of Alcor and its new companion. "Some of us have a feeling that Alcor might actually have another surprise in store for us."

Tiny molecule slows progression of Lou Gehrig's disease in mice

DALLAS – Researchers at UT Southwestern Medical Center have found that a molecule produced naturally by muscles in response to nerve damage can reduce symptoms and prolong life in a mouse model of amyotrophic lateral sclerosis (ALS).

"We believe we can apply this research toward drug development," said Dr. Eric Olson, chairman of molecular biology at UT Southwestern and senior author of the study, which appears in the Dec. 11 issue of *Science*.

ALS, also known as Lou Gehrig's disease, damages motor nerve cells that control muscles, leading to muscle weakness, paralysis and death. There is no treatment that can slow it, and no cure. As ALS kills nerves, the muscles they control begin to wither. The damaged muscles, however, can "re-innervate" themselves by prompting healthy nerves to send new branches their way, like limbs in a damaged hedge filling in a gap.

Dr. Olson said skeletal muscles produce a molecule called microRNA-206 (miR-206) to serve as a chemical signal to steer the new nerve endings and maintain their interactions with muscles. But the research suggests that miR-206 can only work for so long. As nerves continue to die, there comes a point where the surviving nerves can no longer carry the load, and symptoms like muscle weakness appear.

"While miR-206 initially prompts nearby surviving nerves to send new branches to the muscles, it only delays the inevitable," Dr. Olson said. "Our findings correlate with the observation in ALS patients that the disease is nearly asymptomatic until a large fraction of motor neurons has died, at which point the few remaining ones can't compensate sufficiently. These results provide a new perspective on the mechanisms of ALS," he said. "MiR-206 seems to sense nerve injury and promote regeneration.

"Because miR-206 only exists in skeletal muscle, a drug based on it might not affect other tissues. That limits its risk of side effects and is a key part of its appeal as a potential therapy."

In collaboration with a company he co-founded, called miRagen Therapeutics, Dr. Olson is developing potential drugs based on miR-206.

Dr. Olson is director of the Nancy B. and Jake L. Hamon Center for Basic Research in Cancer and the Nearburg Family Center for Basic and Clinical Research in Pediatric Oncology. He holds the Pogue Distinguished Chair in Research on

Cardiac Birth Defects, the Robert A. Welch Distinguished Chair in Science and the Annie and Willie Nelson Professorship in Stem Cell Research.

Other UT Southwestern researchers taking part in the study included co-lead author Andrew Williams, graduate student; Dr. Viviana Moresi, postdoctoral researcher in molecular biology; Xiaoxia Qi, senior research scientist in molecular biology; John McAnally, research associate in molecular biology; Dr. Jeffrey Elliott, professor of neurology; and Dr. Rhonda Bassel-Duby, professor of molecular biology. Researchers from Harvard University also participated in the study.

The study was funded by the National Institutes of Health, the Donald W. Reynolds Center for Clinical Cardiovascular Research, the Leducq Foundation and the Welch Foundation.

This news release is available on our World Wide Web home page at <http://www.utsouthwestern.edu/home/news/index.html>

Observatory

Bones Show Early Divergence of Dinosaur Lineage

By HENRY FOUNTAIN

The early evolution of dinosaurs, in the late Triassic period, is fuzzy, to say the least. Paleontologists know that the first dinosaurs appeared about 230 million years ago, but fossil evidence is so spotty that it is unclear where and when the major lineages - theropods, sauropods and ornithischians - began to diverge.

Some excellent 215-million-year-old fossils unearthed in Ghost Ranch, in northern New Mexico, are helping to clarify things. The bones, of a theropod that the discoverers have named *Tawa hallae*, provide strong support for the idea that the major lineages diverged early in dinosaur evolution in the part of the supercontinent Pangea that is now South America.

“What *Tawa* does is it helps signify the relationships at the base of dinosauria,” said Sterling J. Nesbitt, a postdoctoral researcher at the University of Texas and lead author of a paper in *Science* describing the find. Dr. Nesbitt did most of the work on the fossils while at the American Museum of Natural History and Columbia University.

Like *T. rex* and other later theropods, *Tawa* walked on two feet and had sharp serrated teeth, good for tearing apart its food - other animals. Its body was probably covered in something like feathers. The most complete specimen found, a juvenile, was a little over two feet high and about six feet long.



*An illustrated reconstruction of the head of the newly discovered Triassic dinosaur *Tawa hallae*. Jorge Gonzalez*

What makes *Tawa* significant is that it shares some features with an early dinosaur, *Herrerasaurus*, that had been a source of confusion for paleontologists. *Tawa*, in effect, shows that *Herrerasaurus* was a theropod. Because *Herrerasaurus* was found in what is now South America near some early sauropods and ornithischians, this strongly suggested that all three main lineages diverged early on.

The New Mexico fossil beds included several other theropods. The researchers found that these dinosaurs were only distantly related to each other and *Tawa*, and were more closely related to different groups of South American theropods. That suggests theropods diverged and radiated from South America. And if the theropods had that pattern of dispersal, the findings suggest, the other lineages probably did, too.

Mars methane 'not from meteors'

The methane found on Mars is not brought to the planet by meteor strikes, scientists say.

Meteoritic material subjected to high temperatures did not release enough methane to account for the amount believed to be released on Mars.

The researchers argue that the methane must therefore be created by geologic or chemical processes, or it is a by-product of microbial life. The work appears in *Earth and Planetary Science Letters*.

The origin of the methane on Mars has remained a mystery since it was first detected in 2004.

Because methane has a limited lifetime in the Martian atmosphere before degrading, some process must be pumping hundreds of tonnes of it into the Martian atmosphere annually to keep it at the levels that have been detected.

Scientists at Imperial College London say they have now ruled out the possibility that the methane is being constantly deposited by meteorites landing on the planet.

They heated meteorite fragments to 1,000C, quantifying the gases produced by measuring how much they absorbed an infrared laser. They then calculated, based on estimates of how many meteorites impact Mars annually, how much methane would be released.

They found that just 10kg of methane is produced from meteors each year, in contrast to the 100-300 tonnes that must be produced to keep the atmospheric concentration at its current levels. That suggests that a number of other possibilities, many of which are based on chemical reactions of the rocks that form the planet's crust.

Alternatively, the gas may be produced by volcanoes or life that survives beneath the crust - or it may be trapped in chemical cages, having been produced long ago.

"As Sherlock Holmes said, eliminate all other factors and the one that remains must be the truth," said study co-author Mark Sephton. "The list of possible sources of methane gas is getting smaller and excitingly, extraterrestrial life still remains an option. Ultimately, the final test may have to be on Mars."

The US space agency Nasa will launch the Mars Science Laboratory in 2011, which will be able to study the methane more closely. In November, the European and American space agencies signed an agreement to collaborate on Mars missions that will return to the planet, starting in 2016.

The battle of the sexes

EMBL scientists uncover the gene responsible for keeping females female

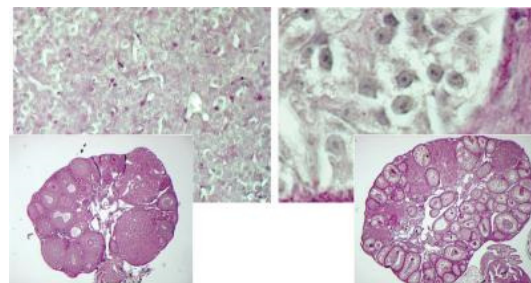
Heidelberg – Is it a boy or a girl? Expecting parents may be accustomed to this question, but contrary to what they may think, the answer doesn't depend solely on their child's sex chromosomes. Scientists at the European Molecular Biology Laboratory (EMBL) in Heidelberg, Germany and the Medical Research Council's National Institute for Medical Research (NIMR) at Mill Hill, UK discovered that if a specific gene located on a non-sex chromosome is turned off, cells in the ovaries of adult female mice turn into cells typically found in testes. Their study, published today in *Cell*, challenges the long-held assumption that the development of female traits is a default pathway. At the same time, it grants a valuable insight into how sex determination evolved.

In humans and most other mammals, an individual's sex is determined by its sex chromosomes: females have two X chromosomes, males have one X and one Y. Scientists had long assumed that the female pathway – the development of ovaries and all the other traits that make a female – was a kind of default: if it had a gene called *Sry*, which is located on the Y chromosome, an embryo would develop into a male, if not, then the result would be a female. But in adult animals it is the male pathway that needs to be actively suppressed, as Mathias Treier and his team at EMBL discovered.

A gene called *Foxl2*, which is located on an autosome – a chromosome other than the sex chromosomes – and therefore present in both sexes, was known to play an important role in the female pathway, but its precise function remained elusive. To elucidate the matter, Treier and colleagues ablated, or 'turned off', this gene in the ovaries of adult female mice.

"We were surprised by the results," says Treier, "We expected the mice to stop producing oocytes, but what happened was much more dramatic: somatic cells which support the developing egg took on the characteristics of the cells which usually support developing sperm, and the gender-specific hormone-producing cells also switched from a female to a male cell type."

Thus, the scientists discovered that *Foxl2* plays a crucial role in keeping female mice female.



These microscopy images show the cellular reprogramming uncovered by EMBL scientists. On the left is an ovary of a normal adult female mouse, with a close-up (top left) showing the typical female granulosa cells. When the Foxl2 gene was silenced in these cells (right, top right: close-up), they took on the characteristics of Sertoli cells, the cells normally found in testes of male mice. Treier/EMBL

Teaming up with the group of Robin Lovell-Badge at the NIMR, they were able to decipher together the underlying molecular mechanism. They showed that *FOXL2* and estrogen receptor act together by repressing a DNA element called *TESCO* that Lovell-Badge's group had previously identified to regulate expression of the testes-promoting gene *Sox9*. *Sox9* was known to function in the embryo to make the early gonads become testes rather than ovaries, but the new studies suggest that it can perform the same task in the adult. *FOXL2* is therefore critical to keep *Sox9* turned off in ovaries throughout life.

"As most vertebrates have *Foxl2*, estrogen receptors and *Sox9*," Lovell-Badge explains, "this mechanism for maintaining female traits probably appeared early on in the evolution of vertebrates, while *Sry* and the mammalian Y chromosome are relatively new inventions."

These findings will have wide-ranging implications for reproductive medicine and may, for instance, help to treat sex differentiation disorders in children, for example where XY individuals develop as females or XX as males, and understand the masculinising effects of menopause on some women.

[The study is discussed by author Mathias Treier in an online video in Cell's 'PaperFlicks' series, which is also available on YouTube.](#)

Earth's atmosphere came from outer space, find scientists

The gases which formed the Earth's atmosphere - and probably its oceans - did not come from inside the Earth but from outer space, according to a study by University of Manchester and University of Houston scientists.

The report published this week in the prestigious international journal 'Science' means that textbook images of ancient Earth with huge volcanoes spewing gas into the atmosphere will have to be rethought.

According to the team, the age-old view that volcanoes were the source of the Earth's earliest atmosphere must be put to rest.

Using world-leading analytical techniques, the team of Dr Greg Holland, Dr Martin Cassidy and Professor Chris Ballentine tested volcanic gases to uncover the new evidence. The research was funded by Natural Environment Research Council (NERC).

"We found a clear meteorite signature in volcanic gases," said Dr Greg Holland the project's lead scientist.

"From that we now know that the volcanic gases could not have contributed in any significant way to the Earth's atmosphere. "Therefore the atmosphere and oceans must have come from somewhere else, possibly from a late bombardment of gas and water rich materials similar to comets. "Until now, no one has had instruments capable of looking for these subtle signatures in samples from inside the Earth - but now we can do exactly that."

The techniques enabled the team to measure tiny quantities of the unreactive volcanic trace gases Krypton and Xenon, which revealed an isotopic 'fingerprint' matching that of meteorites which is different from that of 'solar' gases.

The study is also the first to establish the precise composition of the Krypton present in the Earth's mantle.

Project director Prof Chris Ballentine of The University of Manchester, said: "Many people have seen artist's impressions of the primordial Earth with huge volcanoes in the background spewing gas to form the atmosphere.

"We will now have to redraw this picture."

Notes For Editors The paper: 'Meteorite Kr in Earth's Mantle Suggests a Late Accretionary Source for the Atmosphere' by Dr Greg Holland and Prof Chris J. Ballentine from the University of Manchester and Dr Martin Cassidy from the University of Houston. It is available on request.

The team used an instrument called a multicollector noble gas mass. Multicollection or measuring several isotopes at the same time rather than one after another improves the precision of the measurements. This coupled with the type of sample we are using means we can get higher precision measurements than anyone else - hence we can see these small primitive signatures.

Ancient Amazon civilisation laid bare by felled forest

* 10 December 2009 by Linda Geddes

Signs of what could be a previously unknown ancient civilisation are emerging from beneath the felled trees of the Amazon. Some 260 giant avenues, ditches and enclosures have been spotted from the air in a region straddling Brazil's border with Bolivia.

The traditional view is that before the arrival of the Spanish and Portuguese in the 15th century there were no complex societies in the Amazon basin – in contrast to the Andes further west where the Incas built their cities. Now deforestation, increased air travel and satellite imagery are telling a different story.



Uncovering civilisation (Image: Edison Caetano)

"It's never-ending," says Denise Schaan of the Federal University of Pará in Belém, Brazil, who made many of the new discoveries from planes or by examining Google Earth images. "Every week we find new structures." Some of them are square or rectangular, while others form concentric circles or complex geometric figures such as hexagons and octagons connected by avenues or roads. The researchers describe them all as geoglyphs.

Garden villages

Their discovery, in an area of northern Bolivia and western Brazil, follows other recent reports of vast sprawls of interconnected villages known as "garden cities" in north central Brazil, dating from around AD 1400. But the structures unearthed at the garden city sites are not as consistently similar or geometric as the geoglyphs, Schaan says.

"I firmly believe that the garden cities of Xingu and the geoglyphs were not directly related," says Martti Pärssinen of the Finnish Cultural and Academic Institutes in Madrid, Spain, who works with Schaan.

"Nevertheless, both discoveries demonstrate that [upland] areas of western Amazonia were heavily populated much before the European incursion."

The geoglyphs are formed by ditches up to 11 metres wide and 1 to 2 metres deep. They range from 90 to 300 metres in diameter and are thought to date from around 2000 years ago up to the 13th century.

Human habitation

Excavations have unearthed ceramics, grinding stones and other signs of human habitation at some of the sites but not at others. This suggests that some had purely ceremonial roles, while others may also have been used for defence.

Unusually for defensive structures, however, earth was piled up outside the ditches, and they are also highly symmetrical. "When you think about defence you're just building a wall or a trench," says Schaan. "You don't have to do calculations to make it so round or square." Many of the structures are oriented to the north, and the team is investigating whether they might have had astronomical significance.

"Many of the great early civilisations had a riverine basis and the Amazon has long been underestimated and overlooked in that sense," says Colin McEwan, head of the Americas section at the British Museum in London.

Successful societies

Though there is no evidence that the Amazonians built pyramids or invented written language as societies in ancient Egypt or Mesopotamia did, "in terms of a trend towards increasing social complexity and domestication of the landscape, this wasn't just a pristine forest with isolated nomadic tribes", McEwan adds. "These were substantive, sedentary and in the long term very successful cultures."

While some Inca sites lie just 200 kilometres west of the geoglyphs, no Inca objects have been found at the new sites. Neither do they seem to have anything in common with Peru's Nasca geoglyphs.

"I have no doubt that this is only scratching the surface," says Alex Chepstow-Lusty of the French Institute for Andean Studies in Lima, Peru. "The scale of pre-Columbian societies in Amazonia is only slowly coming to light and we are going to be amazed at the numbers of people who lived there, but also in a highly sustainable fashion. Sadly, the economic development and forest clearance that is revealing these pre-Columbian settlement patterns is also the threat to having enough time to properly understand them."

Journal reference: Antiquity, vol 83, p 1084

Genetic ancestry highly correlated with ethnic and linguistic groups in Asia

73 Southeast Asian and East Asian populations genetically mapped

Several genome-wide studies of human genetic diversity have been conducted on European populations. Now, for the first time, these studies have been extended to 73 Southeast Asian (SEA) and East Asian (EA) populations.

In a paper titled, "Mapping Human Genetic Diversity in Asia," published online Science on 10 Dec. 2009, over 90 scientists from the Human Genome Organisation's (HUGO's) Pan-Asian SNP Consortium report that their study conducted within and between the different populations in the Asia continent showed that genetic ancestry was highly correlated with ethnic and linguistic groups.

The scientists also reported a clear increase in genetic diversity from northern to southern latitudes. Their findings also suggest that there was one major inflow of human migration into Asia arising from Southeast Asia, rather than multiple inflows from both southern and northern routes as previously proposed. This indicates that Southeast Asia was the major geographic source of East Asian and North Asian populations.

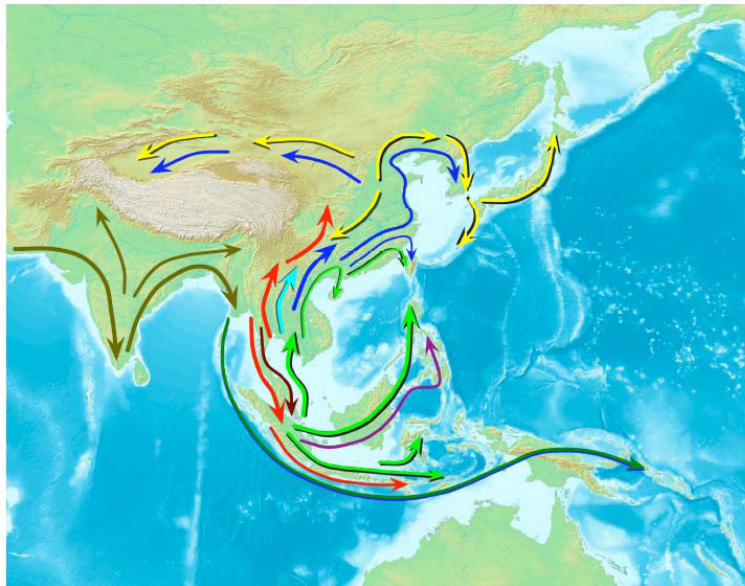
(A figure illustrating the paper shows plausible routes of pre-historical migration of Asian human populations. According to the study, the PanAsia SNP Initiative, the most recent common ancestors of Asians arrived first in India and later, some of them migrated to Thailand, and South to the lands known today as Malaysia, Indonesia, and the Philippines. The first group of settlers must have gone very far south before they settled successfully. These included the Malay Negritos, Philippine Negritos, the East Indonesians, and early settlers of the Pacific Islands. Thereafter, one or several groups of people migrated North, mixed with previous settlers there and, finally, formed various populations we now refer to as Austronesian, Austro-Asiatic, Tai-Kadai, Hmong-Mien, and Altaic. The figure is titled, "Putative Pre-Historical Migration Routes of Asian Human Populations.")

The researchers noted that the geographical and linguistic basis of genetic subgroups in Asia clarifies the need for genetic stratification when conducting genetic and pharmacogenomic studies in this continent, and that human genetic mapping of Asia has important implications for the study of genetics and disease and for research to understand migratory patterns in human history.

HUGO President Edison Liu, M.D., who is Executive Director of the Genome Institute of Singapore (GIS), said, "This study was a milestone not only in the science that emerged, but the consortium that was formed. Ten Asian countries came together in the spirit of solidarity to understand how we were related as a people, and we finished with a truly Asian scientific community. We overcame shortage of funds and diverse operational constraints through partnerships, good will, and cultural sensitivity.

"Our next goal is to expand this collaboration to all of Asia including Central Asia and the Polynesian Islands," said Dr. Liu, one of the corresponding authors of the paper. "We also aim to be more detailed in our genomic analysis and plan to include structural variations, as well as over a million single nucleotide polymorphisms in the next analysis."

While HUGO initiated and coordinated the research, Dr. Liu pointed out, "Affymetrix, led by Dr. Giulia C. Kennedy and based in the US, is our primary technology partner in this endeavour. We greatly appreciate their support."



- Legend**
Most recent common ancestors of Asia
 Malay Negritos
 Philippine Negritos
 East Indonesians and early settlers of the Pacific Islands
 Austronesian
 Austro-Asiatic
 Tai-Kadai
 Hmong-Mien
 Altaic

Authors: Mahmood Ameen Abdulla,1 Ikhlak Ahmed,2 Anunchai Assawamakin,3,4 Jong Bhak,5 Samir K. Brahmachari,2 Gayvelline C. Calaca,6 Amit Chaurasia,2 Chien-Hsiun Chen,7 Jieming Chen,8 Yuan-Tsong Chen,7 Jiayou Chu,9 Eva Maria C. Cutiongco-de la Paz,10 Maria Corazon A. De Ungria,6 Frederick C. Delfin,6 Juli Edo,1 Suthat Fuchareon,3 Ho Ghang,5 Takashi Gojobori,11,12 Junsong Han,13 Sheng-Feng Ho,7 Boon Peng Hoh,14 Wei Huang,15 Hidetoshi Inoko,16 Pankaj Jha,2 Timothy A. Jinam,1 Li Jin,17*,38 Jongsun Jung,18 Daoroong Kangwanpong,19 Jatupol Kampuansai,19 Giulia C. Kennedy,20,21 Preeti Khurana,22 Hyung-Lae Kim,18 Kwangjoong Kim,18 Sangsoo Kim,23 Woo-Yeon Kim,5 Kuchan Kimm,24 Ryosuke Kimura,25 Tomohiro Koike,11 Supasak Kulawonganuchai,4 Vikrant Kumar,8 Poh San Lai,26,27 Jong-Young Lee,18 Sunghoon Lee,5 Edison T. Liu,8* Partha P. Majumder,28 Kiran Kumar Mandapati,22 Sangkot Marzuki,29 Wayne Mitchell,30,31 Mitali Mukerji,2 Kenji Naritomi,32 Chumpol Ngamphiw,4 Norio Niikawa,40 Nao Nishida,25 Bermseok Oh,18 Sangho Oh,5 Jun Ohashi,25 Akira Oka,16 Rick Ong,8 Carmencita D. Padilla,10 Prasit Palittapongarnpim,33 Henry B. Perdigon,6 Maude Elvira Phipps,1,34 Eileen Png,8 Yoshiyuki Sakaki,35 Jazelyn M. Salvador,6 Yuliana Sandraling,29 Vinod Scaria,2 Mark Seielstad,8* Mohd Ros Sidek,14 Amit Sinha,2 Metawee Srikummool,19 Herawati Sudoyo,29 Sumio Sugano,37 Helena Suryadi,29 Yoshiyuki Suzuki,11 Kristina A. Tabbada,6 Adrian Tan,8 Katsushi Tokunaga,25 Sissades Tongsima,4 Lilian P. Villamor,6 Eric Wang,20,21 Ying Wang,15 Haifeng Wang,15 Jer-Yuarn Wu,7 Huasheng Xiao,13 Shuhua Xu,38* JinOk Yang,5 Yin Yao Shugart,39 Hyang-Sook Yoo,5 Wentao Yuan,15 Guoping Zhao,15 Bin Alwi Zilfalil,14 Indian Genome Variation Consortium2

Clever folds in a globe give new perspectives on Earth

* 13:57 10 December 2009 by Jacob Aron

A new technique for unpeeling the Earth's skin and displaying it on a flat surface provides a fresh perspective on geography, making it possible to create maps that string out the continents for easy comparison, or lump together the world's oceans into one huge mass of water surrounded by coastlines.

[See a gallery of the new maps](#)

"Myriahedral projection" was developed by Jack van Wijk, a computer scientist at the Eindhoven University of Technology in the Netherlands.

"The basic idea is surprisingly simple," says van Wijk. His algorithms divide the globe's surface into small polygons that are unfolded into a flat map, just as a cube can be unfolded into six squares.

Cartographers have tried this trick before; van Wijk's innovation is to up the number of polygons from just a few to thousands. He has coined the word "myriahedral" to describe it, a combination of "myriad" with "polyhedron", the name for polygonal 3D shapes.

Warping reality

The mathematical impossibility of flattening the surface of a sphere has long troubled mapmakers. "Consider peeling an orange and trying to flatten it out," says van Wijk. "The surface has to distort or crack."

Some solutions distort the size of the continents while roughly preserving their shape – the familiar Mercator projection, for instance, makes Europe and North America disproportionately large compared with Africa. Others, like the Peters projection, keep landmasses at the correct relative sizes, at the expense of warping their shapes.

An ideal map would combine the best properties of both, but that is only possible by inserting gaps into the Earth's surface, resulting in a map with confusing interruptions. Van Wijk's method makes it possible to direct those cuts in a way that minimises such confusion.

Maps of significance

When generating a map he assigns a "weighting" to each edge on the polyhedron to signal its importance, influencing the placement of the cuts or folds. All the maps are equally accurate, but tweaking the weightings gives dramatically different results.

Assigning more significance to landmass gives a map of all the continents in a line, similar to Buckminster Fuller's Dymaxion map. Making oceans more important than land produces one giant sea surrounded by the world's coastlines.

"Now and then you make an unexpected discovery," says van Wijk. A map that separates land from sea as far as possible, leaving the continents marooned away from a sinuous watery mass, was one such serendipitous result of playing with the algorithm's parameters.

Projection means prize

"His approach was fresh and innovative," says Kenneth Field, editor of the British Cartographic Society's *The Cartographic Journal*, which recently gave van Wijk the Henry Johns award, which recognises the best mapmaking research paper each year. "He managed to achieve a projection that reduces angular deformation to an absolute minimum and preserves area - not an easy trick," adds Field, "it was a unanimous decision to give him the prize."

Van Wijk attributes his success to being somewhat of an outsider. Cartographers typically seek single formulae that can be used to transform the entire globe, he says, while computer scientists look for algorithms that work in small steps and can be more adaptable.

Journal reference: The Cartographic Journal, DOI: 10.1179/000870408x276594

Amount of gene surplus determines severity of mental retardation in males

Leuven - Researchers have discovered a new explanation for differences in the severity of mental illness in males. The more excess copies of a certain gene, the more serious the handicap. The genetic defect is situated on the X-chromosome; and it is suspected that it is the amount of copies of the GDI1 gene that is responsible. The results are being published in the *American Journal of Human Genetics*, and are the result of work by the group of Guy Froyen connected to VIB, a life sciences research institute in Flanders, Belgium at the University of Leuven, in close collaboration with Hilde Van Esch of the Center for Human Genetics (University Hospital Leuven) and colleagues in Germany and Spain.

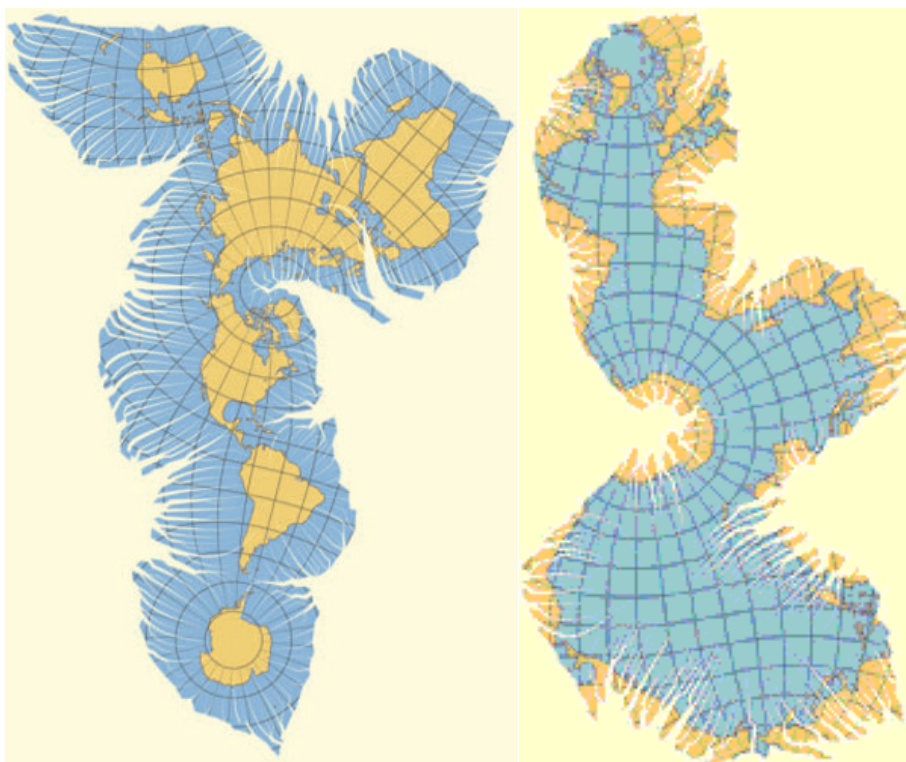
It is for first time that scientists have linked the degree of a mental illness to the number of copies of a gene on the X-chromosome, normally present as a single copy in males. The mental handicap is much more severe in patients with 5 copies than in patients with 2 copies. An intermediate severity has been observed in case of 3 copies. In their publication, the scientists also present a new mechanism by which such defects can arise. This mechanism might also underlie other genetic disorders.

Differences in GDI1 production

Defects in the GDI1 gene have previously been found in a few XLMR (X-Linked Mental Retardation) patients. In these patients, the production of GDI1 in the brain is disturbed, which impedes the transfer of stimuli in the brain. The new finding in this research is that over-production of GDI1 is also harmful. The higher the production, the greater the disruption of signals.

Only in male patients

The discovery was made through DNA research in several families in which only males are afflicted with a mental handicap. In such families, defects appear on the X-chromosome (thus the name X-Linked Mental Retardation). Males have only one version of the X-chromosome. Females have a reserve copy, through which defective information can be masked.



Unravelling the world in novel new ways

(Image: J van Wijk/*The Cartographic Journal*/Maney Publishing)

2 - 3% of the population has a mental handicap

Mental handicap occurs in 2 - 3% of the population. The handicap can be attributed to external factors, such as a deficiency in oxygen at birth, or to defects in the DNA. When the cause is genetic (hereditary), exact identification of the defect is crucially important for providing the patient with the proper medical support or for assessing the risk involved for couples with child wish. Recent estimates are that a defect on the X-chromosome is the cause in about 12% of the patients. However, in over half of the XLMR patients, the responsible gene has not yet been identified. This research makes a contribution toward filling this gap in our knowledge.

Study reveals H1N1 unexpected weakness

Rice, BCM team finds weakness in H1N1's method for evading detection by the immune system

The H1N1 influenza virus has been keeping a secret that may be the key to defeating it and other flu viruses as well.

Researchers at Rice University and Baylor College of Medicine (BCM) have found what they believe is a weakness in H1N1's method for evading detection by the immune system.

Comparing its genetic sequences going all the way back to the virus's first known appearance in the deadly "Spanish flu" outbreak of 1918, they discovered a previously unrealized role of receptor-binding residues in host evasion, which effectively becomes a bottleneck that keeps the virus in check.

Rice's Jianpeng Ma and graduate student Jun Shen and BCM's Qinghua Wang compared the sequences of more than 300 strains of H1N1 to track its evolution; they reported their results in a recent online edition of the scientific journal PLoS ONE.

The researchers were looking in particular at hemagglutinin (HA), the protein "hook" that allows the virus to attach itself to and infect host cells. It's long been known that five regions of H1N1's HA serve as antigenic sites, the protein fragments that trigger the body's immune system. These antigenic sites, first mapped in 1981, shuffle their amino-acid sequences in the endless cat-and-mouse game that viruses play to survive.

The researchers discovered several key residues involved in both antigenic sites and the receptor-binding site, the part of the protein that attaches to a cell and allows the virus to invade. The common belief has been that the receptor binding could not change. "The site is known, but no one thought it was involved in the immune system. In order to recognize the receptor, that particular region has to be robust," Ma said. "But it turns out this region is not only variable, but also interacts with the immune system."

Researchers at Rice University and Baylor College of Medicine (BCM) have found what they believe is a weakness in H1N1's method for evading detection by the immune system. Rice University/Baylor College of Medicine

For a virus to evade antibodies, all five antigenic sites would have to disguise themselves by mutating. The new finding led the researchers to believe the receptor-binding residues would also have to mutate, but not so much that the binding no longer works. "If the binding is abolished, the virus dies," said Ma, a Rice professor in bioengineering with a joint appointment at BCM.

Such dual-function residues are a likely bottleneck for the virus, he said, because they're under the tightest restrictions. Thus, they could be easier to track over time and may chart a path to predict future mutations that will aid in vaccine design. "It becomes a weak link and provides us with a window into the virus that we can monitor," Ma said. "The virus's bottleneck is our opportunity."

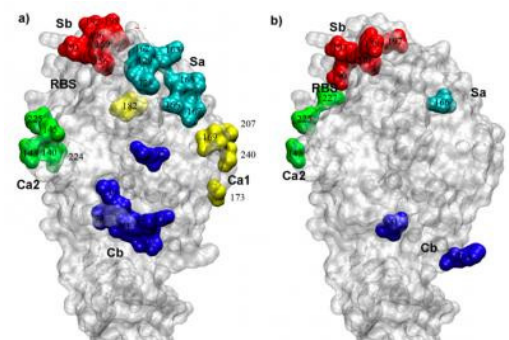
Wang, an assistant professor of biochemistry and molecular biology at BCM who has long studied the structure and function of HA, has been involved in the project since it began and is now working to verify the results in vitro. She hopes confirming the computations will lead to more efficiency in creating vaccines not only for H1N1 but also for other strains of the flu.

"An underlying implication is that this may not be restricted to H1N1," Wang said. "It may apply to other influenza viruses as well. If studying viral evolution can help predict what will cause a severe problem in humans, you can actually pre-stock vaccines, which will save time."

The research was supported by the National Institutes of Health, National Science Foundation, Welch Foundation, the Welch Chemistry and Biology Collaborative Grant from the John S. Dunn Gulf Coast Consortium for Chemical Genomics and the Rice Faculty Initiatives Fund. View the paper at www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0007789

UCLA researchers engineer bacteria to turn carbon dioxide into liquid fuel

Global climate change has prompted efforts to drastically reduce emissions of carbon dioxide, a greenhouse gas produced by burning fossil fuels.



In a new approach, researchers from the UCLA Henry Samueli School of Engineering and Applied Science have genetically modified a cyanobacterium to consume carbon dioxide and produce the liquid fuel isobutanol, which holds great potential as a gasoline alternative. The reaction is powered directly by energy from sunlight, through photosynthesis.

[The research appears in the Dec. 9 print edition of the journal Nature Biotechnology and is available online.](#)

This new method has two advantages for the long-term, global-scale goal of achieving a cleaner and greener energy economy, the researchers say. First, it recycles carbon dioxide, reducing greenhouse gas emissions resulting from the burning of fossil fuels. Second, it uses solar energy to convert the carbon dioxide into a liquid fuel that can be used in the existing energy infrastructure, including in most automobiles.

While other alternatives to gasoline include deriving biofuels from plants or from algae, both of these processes require several intermediate steps before refinement into usable fuels.

"This new approach avoids the need for biomass deconstruction, either in the case of cellulosic biomass or algal biomass, which is a major economic barrier for biofuel production," said team leader James C. Liao, Chancellor's Professor of Chemical and Biomolecular Engineering at UCLA and associate director of the UCLA–Department of Energy Institute for Genomics and Proteomics. "Therefore, this is potentially much more efficient and less expensive than the current approach."

Using the cyanobacterium *Synechococcus elongatus*, researchers first genetically increased the quantity of the carbon dioxide–fixing enzyme RuBisCO. Then they spliced genes from other microorganisms to engineer a strain that intakes carbon dioxide and sunlight and produces isobutyraldehyde gas. The low boiling point and high vapor pressure of the gas allows it to easily be stripped from the system.

The engineered bacteria can produce isobutanol directly, but researchers say it is currently easier to use an existing and relatively inexpensive chemical catalysis process to convert isobutyraldehyde gas to isobutanol, as well as other useful petroleum-based products.

In addition to Liao, the research team included lead author Shota Atsumi, a former UCLA postdoctoral scholar now on the UC Davis faculty, and UCLA postdoctoral scholar Wendy Higashide.

An ideal place for this system would be next to existing power plants that emit carbon dioxide, the researchers say, potentially allowing the greenhouse gas to be captured and directly recycled into liquid fuel.

"We are continuing to improve the rate and yield of the production," Liao said. "Other obstacles include the efficiency of light distribution and reduction of bioreactor cost. We are working on solutions to these problems."

The research was supported in part by a grant from the U.S. Department of Energy.

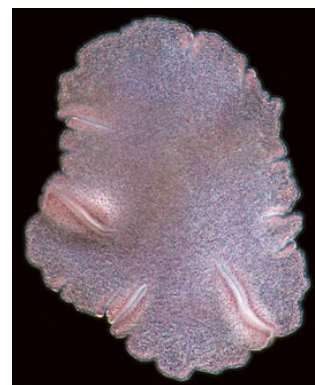
DNA's guardian gene found in placozoans

* 16:10 11 December 2009 by Ed Yong

A vital gene that defends us against cancer has been found in one of the simplest of animals – a flat, amoeba-like creature called a placozoan. The discovery shows that p53, sometimes described as the "guardian of the genome", has been around for over 1 billion years.

The Placozoa are among the most primitive of animals. Their millimetre-long bodies are just three cells thick and have no muscles, nervous systems or organs. They even lack an obvious front or back end. Yet placozoans have a version of p53, also known as TP53, that is strikingly similar to ours, says David Lane, chief scientist at Cancer Research UK.

Lane first discovered p53 in 1984. In humans, the protein it codes for, p53, detects damaged DNA that could trigger cancers. It stops the growth of cells containing damaged DNA by encouraging them to self destruct or by recruiting other proteins to repair the damage.



Trichoplax adhaerens, a pancake of cells first discovered on the walls of a saltwater aquarium in the 1880s. Its genome sequence shows it to be an ancient ancestor of all animals. (Ana Signorovitch/Yale University)

Cancer signature

Faulty or inactive copies of the gene greatly increase the chances that a cell will become cancerous, and more than half of all tumours lack working copies of it.

It is not clear whether p53 has the same function in placozoans. Previous research suggests that the gene originally controlled stem cells or immune response and was only co-opted to defend animals against rogue cells once they became large and long-lived enough to need it.

"Tumour suppression could be a rather recent 'recycling' of p53 functions that were initially evolved to do something else," says Karen Vousden from The Beatson Institute for Cancer Research in Glasgow, UK.

Nonetheless, human and placozoan versions of p53 share essential features, including regions that allow it to attach to DNA and other proteins. These conserved areas suggest it has interacted with a similar network of partner genes since the dawn of the animal kingdom.

Gene partners

One such partner is Mdm2. In humans, it keeps p53 in check, controlling when the protein is released. Lane has found that placozoans have a version of Mdm2 that does the same thing.

Vousden, who discovered the relationship between the two genes, was surprised that Mdm2 exists in such simple animals. "We had believed that Mdm2 was quite recent in terms of evolution," she says.

The results, due to be published in February in the journal *Cell Cycle*, also shed light on the puzzling evolutionary history of p53 in other animals.

Surprisingly, human p53 is a closer match to the placozoan version than it is to counterparts in more closely related animals such as flies and worms. Lane thinks this is because the ancestor of flies and worms duplicated its copy of p53; the original version was lost and it is the divergent copy that now defends their DNA.

The discovery was only possible because the entire placozoan genome was recently sequenced, work which provides clues about genes that were important to the success of the earliest animals.

Journal reference: Cell Cycle, volume 9, issue 3

Scientists identify natural anti-cancer defenses

University of Montreal discovers link between inflammation and cancers

Montreal – Canadian researchers have discovered a novel molecular mechanism that prevents cancer. In the December 11 edition of the prestigious journal *Molecular Cell*, scientists from the Université de Montréal and the Université de Sherbrooke explain how they found that the SOCS1 molecule prevents the cancer-causing activity of cytokines, hormones that are culprits in cancer-prone chronic inflammation diseases such as Crohns, in smokers and people exposed to asbestos.

"Excessive cytokine activity promotes cancer," says Dr. Gerardo Ferbeyre, senior author and a Université de Montréal biochemistry professor. "Discovery of these mechanisms will enable scientists to design a cancer-prevention strategy for people with chronic inflammatory diseases and lead to better understanding of the human body's natural defenses against cancer."

The research team didn't anticipate that SOCS1 would turn out to be linked to p53, the master regulator of natural anticancer defenses. "We were surprised to realize that SOCS1 was directly linked to p53," says first author and Université de Montréal student, Viviane Calabrese.

"Our team showed that SOCS1 is a direct regulator of the p53 gene and that in its absence the p53 pathway is significantly disabled," says Dr. Ferbeyre, noting the p53 gene is frequently lost in human cancer patients as it is SOCS1.

The new research suggests that the effects of SOCS1 loss in patients might also disable the p53 tumor suppression pathway. The research team also showed that the reintroduction of SOCS1 into tumor cells locked them into a permanent dormant state known as cell senescence preventing them from multiplying wildly as is typical of cancer cells. "With this study, we provide new hope of finding a treatment to activate natural anticancer defenses in people at risk of suffering from cancer prompted by chronic inflammation," concludes Dr. Ferbeyre.

Professor Ferbeyre's research is supported by Canadian Institutes of Health Research (www.cihr-irsc.gc.ca) and by the Fonds de la recherche en Santé du Québec (www.frsq.gouv.qc.ca).

About the study:

*The study, "SOCS1 Links Cytokine Signaling to p53 and Senescence," published in *Molecular Cell*, was authored by Viviane Calabrese, Frédérick A. Mallette, Xavier Deschênes-Simard, Adrian Moores and Gerardo Ferbeyre of the Université de Montréal and Subburaj Ilangumaran, Sheela Ramanathan and Julien Gagnon of the Université de Sherbrooke.*

Anti-estrogens may offer protection against lung cancer mortality

SAN ANTONIO – Anti-estrogens as therapy for breast cancer may also reduce the risk of death from lung cancer, according to study results presented at the CTRC-AACR San Antonio Breast Cancer Symposium, held here Dec. 9-13, 2009.

"We found a reduction in lung cancer mortality among women treated with anti-estrogens for breast cancer. This work builds on previous studies that had suggested estrogens have a role in lung cancer development and progression," said Elisabetta Rapiti, M.D., M.P.H., medical researcher with the Geneva Cancer Registry, University of Geneva, Switzerland.

Rapiti and colleagues evaluated whether anti-estrogen therapy for breast cancer patients reduced their risk of subsequently developing and/or dying from lung cancer.

The study included 6,715 women living in the Geneva canton of Switzerland who were diagnosed with breast cancer, between 1980 and 2003. Forty-six percent of the women received anti-estrogen therapy, primarily tamoxifen.

By the end of the study period, 40 cases of lung cancer developed. There was no difference in the incidence of lung cancer among women with or without anti-estrogens compared with the general population. However, the risk of dying from lung cancer was significantly lower among women who received anti-estrogen therapy.

"Our results are particularly relevant to the research agenda exploring endocrine treatment(s) for lung cancer," said Rapiti. "If prospective studies confirm our results and find that anti-estrogen agents improve lung cancer outcomes, this could have substantial implications for clinical practice."

Phase II clinical trials are currently underway in a number of centers to evaluate the use of anti-hormone therapy as an adjunct to traditional chemotherapy for lung cancer, according to Rapiti.

Google demonstrates quantum computer image search

* 17:50 11 December 2009 by Paul Marks

Google's web services may be considered cutting edge, but they run in warehouses filled with conventional computers. Now the search giant has revealed it is investigating the use of quantum computers to run its next generation of faster applications.

Writing on Google's research blog this week, Hartmut Neven, head of its image recognition team, reveals that the Californian firm has for three years been quietly developing a quantum computer that can identify particular objects in a database of stills or video.

Google has been doing this, Neven says, with D-Wave, a Canadian firm that has developed an on-chip array of quantum bits – or qubits – encoded in magnetically coupled superconducting loops.

The team set themselves the challenge of writing an algorithm for the chip that could learn to recognise cars in photos, and reported at the Neural Information Processing Systems conference in Vancouver, Canada, this week that they have succeeded.

Chasing cars

Using 20,000 photographs of street scenes, half of which contained cars and half of which didn't, they trained the algorithm to recognise what cars look like by hand-labelling all the cars with boxes drawn around them.

After that training, the algorithm was set loose on a second set of 20,000 photos, again with half containing cars. It sorted the images with cars from those without faster than an algorithm on a conventional computer could – faster than anything running in a Google data centre today, Neven says.

Classical computers use what is known as a von Neumann architecture, in which data is fetched from memory and processed according to rules defined in a program to generate results that are stored. It is pretty much a sequential process, though multiple versions of it can run in parallel to speed things up a little.

Quantum computers, however, promise much faster processing, by exploiting the principle of quantum superposition: that a particle such as an ion, electron or photon can be in two different states at the same time. While each basic "bit" of data in a conventional computer can be either a 1 or a 0 at any one time, a qubit can be both at once.

Quantum argument

D-Wave's Chimera chip launched to great media interest. But there has been some dispute over whether it is actually a quantum computer, which Neven acknowledges.

"It is not easy to demonstrate that a multi-qubit system such as the D-Wave chip exhibits the desired quantum behaviour, and physicists are still in the process of characterising it," he writes.

Google's quantum move is understandable, says Winfried Hensinger, reader in quantum, atomic and optical physics at the University of Sussex in Brighton, UK.

"Quantum computing has the potential to make search problems much easier to solve – so it is no surprise that Google finds it extremely important to get involved in this emerging area," he says.

"I expect more and more companies to pursue research in quantum computing due to its vast potential not only in search but also for a multiplicity of other problems," he adds.

However, he expects that while questions remain over the exact capabilities of D-Wave's hardware, future developments will centre on different hardware. "It is widely accepted that trapped ions are the most successful implementation of quantum technology."

