DNA template could explain evolutionary shifts

HOUSTON – (June 21, 2009) – Rearrangements of all sizes in genomes, genes and exons can result from a glitch in DNA copying that occurs when the process stalls at a critical point and then shifts to a different genetic template, duplicating and even triplicating genes or just shuffling or deleting part of the code within them, said researchers from Baylor College of Medicine in a recent report in the journal Nature Genetics. The report further elucidated the effect of the fork stalling and template switching mechanism involved in some forms of copy number variation.

"I think this is going to make people think very hard about copy number variation with respect to genome evolution, gene evolution and exon shuffling," said Dr. James R. Lupski (http://www.bcm.edu/genetics/facultyaz/lupski.html) , vice chair of molecular and human genetics at BCM and senior author of the report.

The mechanism not only represents a newly discovered method by which the genome generates copy number variation among genes, but it also demonstrates that copy number variation can occur at a different time in the life of a cell. DNA replication takes place as the cell is dividing and becoming two – a process known as mitosis. Copy number variation involves structural changes in the human genome that result in the deletion of genes or parts of them or extra copies of genes. Often, this process is associated with disease or with evolution of the genome itself.

DNA (deoxyribonucleic acid) exists as two complementary strands that remain together because of the attraction between nucleotides. A, or adenine, is always attracted to T, or thymine. C, or cytosine, is always attracted to G, or guanine.

When a cell divides, it must reproduce its DNA so that each cell that results from the division has the same genetic code. That means it must replicate its DNA. During this process, an enzyme called a helicase separates the two strands, breaking the hydrogen bonds between the A – T and G – C base pairs. The two separating strands become the replication fork. On one strand, an enzyme called DNA polymerase reads the genetic material in the strand as a template and makes a strand of complementary DNA to pair to it. Again, the code is A to T and C to G. This process is continuous. On the lagging strand, the complementary strand is made in short, separated segments by a process that involves RNA and a series of enzymes.

Until the 1990s, researchers studying reasons for genetic mutations or changes looked at molecular "typos" in this process, tiny changes in the As, Ts, Cs or Gs called single nucleotide polymorphism (SNPs). They changed the message of the gene. However, in the early 1990s, Lupski was one of the early champions of a newly discovered mechanism in which the structure of the DNA itself was grossly duplicated or deleted to change numbers of copies of a gene that occurred in the genetic material. This "copy number variation" wrote a new chapter in the understanding of human genetic variation.

In a previous report (http://www.bcm.edu/news/item.cfm?newsID=1038) , Lupski and colleagues described how the process that copies DNA during cell division stalls when there is a problem with the genetic material. In some cases, the process seeks a different template, often copying another similar but significantly different stretch of DNA before it switches back to the appropriate area.

In this newer report, Lupski and colleagues describe how this process – called fork stalling and template switching (FoSTeS) in humans or microhomology-mediated break-induced replication (MMBIR) in simpler models – generated genomic rearrangements ranging in size from several megabases to a few hundred base pair during normal cell division, resulting in the duplication or even triplications of individual genes or the rearrangements of single exons (the coding region of genes).

"This phenomenon occurs throughout the genome," said Dr. Feng Zhang, a postdoctoral associate in Lupski's laboratory and the first author of the report.

In studies of subjects with abnormalities in the gene associated with Charcot-MarieTooth type 1A (PMP22), the researchers found that the fork stalling, template switching phenomenon explained the changes, from those that involved triplication of a gene to others that resulted from shuffling within an exon.

Studies of one family – two children and a mother – demonstrated that the event occurred during mitosis or cell division, a significant finding that further confirms the significance of the event.

The researchers noted that finding this mitotic rearrangement of the gene in the mother, who did not have the disorder, of two children with a neuropathy suggests that the mechanism might be considered in genetic counseling about the risk of having another child with the disorder.

The scientists wrote, "We propose that FoSTeS/MMBIR may be a key mechanism for generating structural variation, particularly nonrecurrent CNV (copy number variation), of the human genome. "

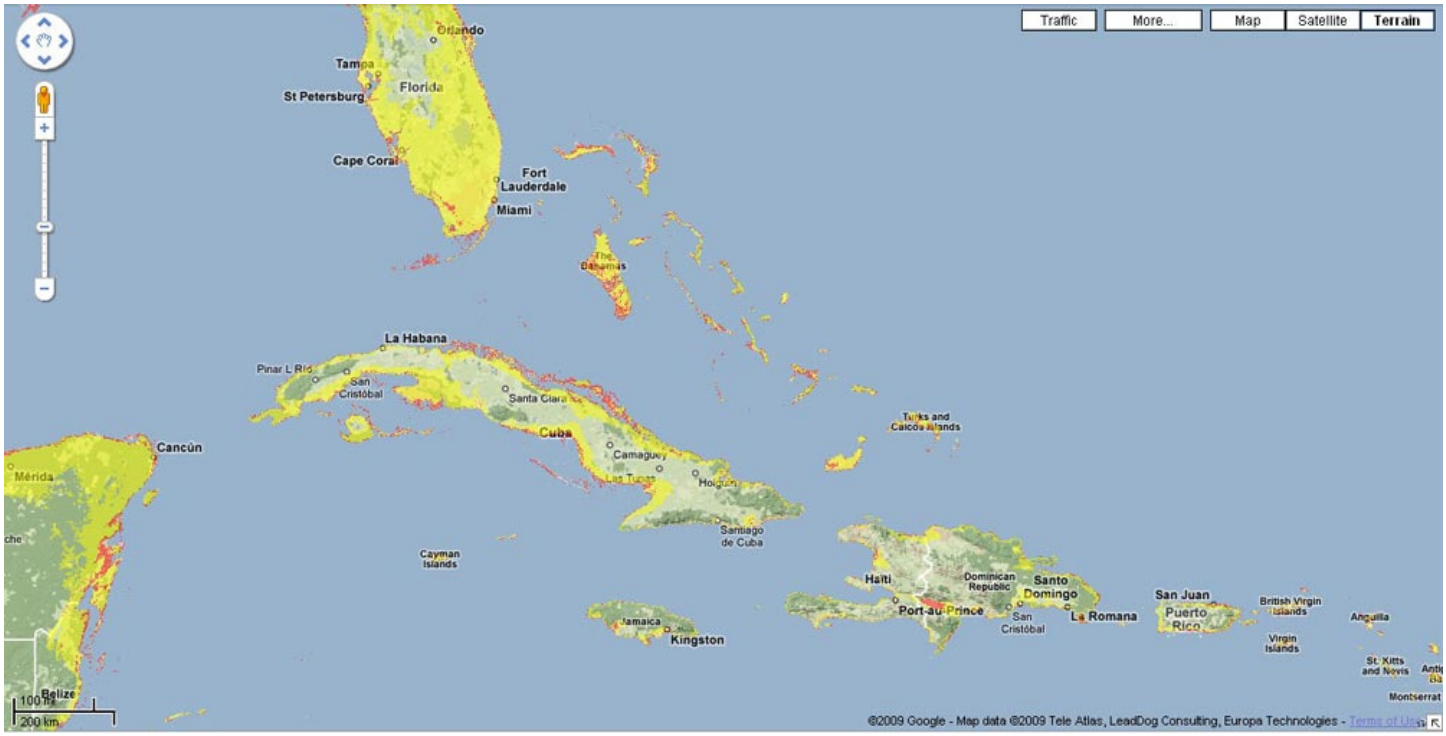
The observation of mosaicism for an apparent mitotically generated, FoSTeS/MMBIR-mediated complex PMP22 rearrangement in the unaffected mother of two children with neuropathy suggests this mechanism can have implications for genetic counseling regarding recurrence risk.

Others who took part in this research include Mehrdad Khajavi of BCM, Anne M Connolly of the Washington University School of Medicine in St. Louis, Mo., and Charles F Towne and Sat Dev Batish of Athena Diagnostics in Worcester, Mass. Funding for this work came from the Charcot Marie Tooth Association and the National Institute of Neurological Disorders and Stroke.

When the embargo lifts, the article will be available at http://www.nature.com/ng/index.html

Earth's coastlines after sea-level rise, 4000 AD

* 18:00 21 June 2009 **by Catherine Brahic**



Caribbean islands will be severely affected by sea level rise of a couple of metres (red). Yellow shading shows areas that lie within 25 metres of present sea levels **(Image: Google – Map data © 2009 PPWK, Tele Atlas. Overlay: heywhatsthat.com)**

Even if we could freeze-frame the atmosphere as it is today, sea levels would still rise by 25 metres, says the latest study into the effects of climate change on melting ice sheets.

Eelco Rohling of the UK National Oceanography Centre at the University of Southampton and colleagues reconstructed sea level fluctuations over the last 520,000 years and compared this to global climate and carbon dioxide levels data for the same period. They found a tight coupling between carbon dioxide and sea level rise.

Based on this relationship, the team calculated that if the amount of carbon dioxide in the atmosphere were fixed at current levels, temperature rises over the next couple of millennia would eventually drive sea levels up by 25 metres.

The team emphasise that the rise would not happen overnight or even over the next century. Two studies published last year suggested that there is a limit to how fast the water can rise. According to one, sea-levels could rise by approximately 1.3 metres by 2100. The other set the upper limit at 2 metres.

For an idea of what the European, Eastern US and Caribbean coastlines would look like with 2 metres (red) and 25 metres (yellow) sea level rise, have a look at the maps to the right.

Journal reference: Nature Geoscience (DOI: 10.1038/NGEO557)

Brain could adapt well to cyborg enhancements

* Updated 12:08 23 June 2009 **by Linda Geddes**

When you brush your teeth, the toothbrush may actually become part of your arm – at least as far as your brain is concerned. That's the conclusion of a study showing perceptions of arm length change after people handle a mechanical tool.

The brain maintains a physical map of the body, with different areas in charge of different body parts. Researchers have suggested that when we use tools, our brains incorporate them into this map.

To test the idea, Alessandro Farné of the University of Claude Bernard in Lyon, France, and colleagues attached a mechanical grabber to the arms of 14 volunteers. The modified subjects then used the grabber to pick up out-of-reach objects.

Shortly afterwards, the volunteers perceived touches on their elbow and fingertip as further apart than they really were, and took longer to point to or grasp objects with their hand than prior to using the tool.

The explanation, say the team, is that their brains had adjusted the brain areas that normally control the arm to account for the tool and not yet adjusted back to normal.

"This is the first evidence that tool use alters the body [map]," says Farné.

Farné says the same kind of brain "plasticity" might be involved in regaining control of a transplanted hand or a prosthetic limb when the original has been lost. The brain might also readily incorporate cyborg additions – a cyborg arm or other body part – into its body schema, says Farné, "and possibly new body parts differing in shape and/or number, for example four arms."

Small implants such as pacemakers are inserted in the existing body so do not need to be accepted by the body schema, adds Farné, "but a pair of wings would – that would be tough!"

Journal reference: Current Biology (DOI: 10.1016/j.cub.2009.05.009)

Study finds cancer is the second most frequent cause of death in individuals with schizophrenia

People with schizophrenia are four times as likely to die from all causes and are 50 percent more likely to die from cancer compared to people in the general population. That is the conclusion of a new study published in the August 1, 2009 issue of CANCER, a peer-reviewed journal of the American Cancer Society. The study's results suggest that extra efforts should be made to improve cancer prevention and early detection in patients with schizophrenia.

Schizophrenia is associated with an increased incidence of premature death, in part due to a high rate of suicide among individuals with the disease. However, suicide alone does not account for the shortened life expectancy seen in schizophrenia patients. Some studies have indicated that cancer mortality may play a role, but other data suggest that cancer rates are actually lower among individuals with schizophrenia compared with the general population.

To more precisely determine the prevalence of cancer in patients with schizophrenia, Prof. Frédéric Limosin of the University of Reims, Robert Debré Hospital, in Reims, France and colleagues prospectively studied 3,470 patients with schizophrenia and tracked cancer incidence beginning in 1993. The investigators also sought to identify characteristics that might help predict which schizophrenic patients are likely to develop cancer.

The researchers found that 476 (14%) patients died during the eleven years of the study, a death rate was nearly four-fold higher than in the general population. Seventy-four patients died of cancer, making it the second most frequent cause of death behind suicide. In men with schizophrenia, the risk of death due to lung cancer was significantly higher than that in the general population, but the risk of overall cancer death was not significantly higher. In women, the risk of overall mortality was significantly higher than among the general population. The proportion of patients who were smokers was significantly higher in the study population than in the general population (56.3 vs. 33.0%). In female schizophrenic patients, the risk of death due to breast cancer was significantly higher than in the general population. The authors say possible explanations include is a delay in diagnosis due to patients paying less attention to symptoms; the difficulty for schizophrenic patients to benefit from optimum treatment; and less compliance to treatment.

Prof. Limosin and his collaborators noted that additional studies should further examine cancer rates in individuals with schizophrenia and should better define the characteristics of tumors that arise in these patients.

Article: "Cancer mortality in patients with schizophrenia: 11-year prospective cohort study." Eric Tran, Frédéric Rouillon, Jean-Yves Loze, Françoise Casadebaig, Alain Philippe, Fabien Vitry, and Frédéric Limosin. CANCER; Published Online: June 22, 2009 (DOI: 10.1002/cncr.24383); Print Issue Date: August 01, 2009.

Drinking milk in the morning may help stave off lunchtime hunger

New research finds reaching for fat free milk instead of a fruit drink at breakfast helps you feel fuller and eat less at lunchtime

Now there's a new reason for the weight-conscious to drink fat free milk at breakfast time, suggests a new study published in the July issue of the American Journal of Clinical Nutrition. Researchers in Australia found that drinking fat free milk in the morning helped increase satiety, or a feeling of fullness, and led to decreased calorie intake at the next meal, as compared with a fruit drink. The milk drinkers ate about 50 fewer calories (or nearly 9% less food) at lunch.

In the study, 34 overweight but otherwise healthy men and women participated in two testing sessions – one in which they were served about 20 ounces of fat free milk, and one in which they were served the same amount of a fruit drink (both beverages contributed about 250 calories to the breakfast meal). During the four hours between breakfast and lunch, the men and women gauged their feelings of fullness and were allowed to eat until comfortably full at lunch. The researchers found that the milk-drinking adults reported feeling fuller, more satisfied and therefore ate fewer calories at lunch.

The researchers suspect that milk's protein content (providing 16% of the daily value per cup), the lactose (the natural sugar in milk) or simply the thickness of the beverage may play a role in the satiety benefits. And, research suggests choosing foods that can help enhance satiety is an important success factor in any weight management plan.

Experts are increasingly focused on small behavior changes that can make a big difference when it comes to maintaining a healthy weight. A calorie decrease as little as 50 calories per day can add up in the long run. Americans may be gaining weight at a rate of up to two pounds per year, likely caused by an average of less than 100 calories per day, according to recent research.

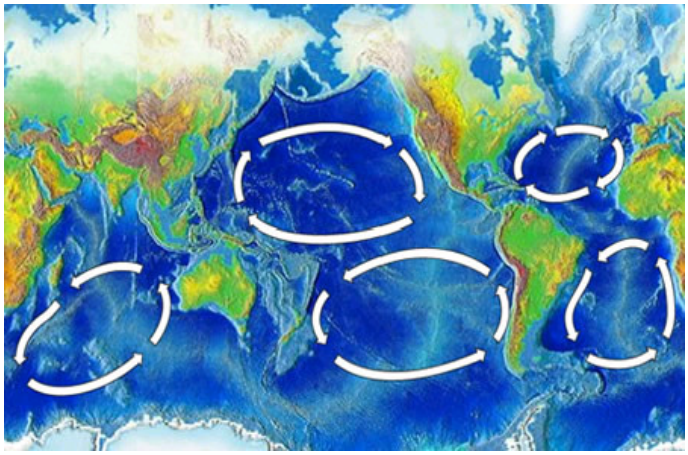
Fat free milk is packed with nine essential nutrients Americans need, including calcium and vitamin D, and contains 80 calories per 8-ounce serving. The Dietary Guidelines for Americans recommend three servings of fat free or lowfat milk each day.

Dove, ER, Hodgson JM, Puddey IB, Beilin LJ, Lee YP, Mori TA. Skim milk compared with a fruit drink acutely reduces appetite and energy intake in overweight men and women. American Journal of Clinical Nutrition. 2009;90:70-75.

Subseafloor sediment in South Pacific Gyre

Biomass, metabolic activity much lower than at previously explored sites

NARRAGANSETT, R.I. – June 22, 2009 – An international oceanographic research expedition to the middle of the South Pacific Gyre – a site that is as far from continents as it is possible to go on Earth's surface – found so few organisms beneath the seafloor that it may be the least inhabited sediment ever explored for evidence of life.



Yet since half of the world's ocean is composed of similar gyres, biomass and metabolic activity may be equally low in sediment throughout much of the world. Those are among the results of a study led by University of Rhode Island oceanographer Steven D'Hondt published in the online edition of the Proceedings of the National Academy of Sciences during the week of June 22. Other URI members of the research team were Marine Research Scientist Robert Pockalny and Oceanography Professors Arthur Spivack and David Smith.

There are five major ocean-wide gyres — the North Atlantic, South Atlantic, North Pacific, South Pacific, and Indian Ocean gyres. Each is flanked by a strong and narrow "western boundary current," and a weak and broad "eastern boundary current". **National Oceanic and Atmospheric Administration**

"We wanted to know what life is like in subseafloor sediment where you have the least amount of organic matter produced in the overlying water column," said D'Hondt, a professor at the URI Graduate School of Oceanography. "So we deliberately went where no one ever goes to compare it with sites previously studied."

Gyres are semi-still areas in the middle of the oceans where there is little wind, little current, and very little upwelling of deep water, so the water is clear and contains few nutrients. The South Pacific Gyre is the largest of Earth's gyres, encompassing an area twice the size of North America. D'Hondt describes its center as "the deadest spot in the ocean."

Because the region is so far from terrestrial sources of sediment and so few organisms live in its water, its sediment accumulates extraordinarily slowly – as few as 8 centimeters per million years.

In 2007, the international team of scientists and students collected nearly 100 cores that reached up to 8 meters below the seafloor of the South Pacific Gyre and measured the number of living cells and the amount of respiration in the sediment. Their cell counts were three to four orders of magnitude lower than have been found at similar depths outside of the gyres, and the rate of respiration was one to three orders of magnitude lower.

Equally surprising was their finding that the subseafloor community is aerobic, unlike all other previously explored sites. "In most places, oxygen is gone just a few centimeters below the seafloor, but we found that oxygen goes many meters below the seafloor at these sites, and possibly all the way through the sediment to the underlying igneous rock," D'Hondt said.

In addition, D'Hondt said that the burial rate of organic matter was so low in the sediment that the principle food source for the microorganisms living there may be hydrogen released by the radioactive splitting of water due to the natural decay of elements in the sediment.

"As you get deeper, this hydrogen probably becomes a more important food source than buried organic matter," D'Hondt said. "And when you get deep enough, it might be the only food available. The next step in our research is to test if that is the case."

The research expedition was funded by the Ocean Drilling Program of the U.S. National Science Foundation.

Less frequent social activity linked to more rapid loss of motor function in older adults

Loss of muscle strength, speed and dexterity is a common consequence of aging, and a well-established risk factor for death, disability and dementia. Yet little is known about how and why motor decline occurs when it is not a symptom of disease.

Now, researchers at Rush University Medical Center have found that, among the elderly, less frequent participation in social activities is associated with a more rapid decline in motor function. The study is published in the June 22 issue of the Archives of Internal Medicine.

"It's not just running around the track that is good for you," said Dr. Aron Buchman, associate professor of neurological sciences at Rush University Medical Center. "Our findings suggest that engaging in social activities may also be protective against loss of motor abilities."

"If the causal relationship is confirmed by others, the implications are enormous for interventions that can help the elderly. Our data raise the possibility that we can slow motor decline and possibly delay its adverse health outcomes by supporting social engagement – a relatively low-cost solution to a very large public health problem."

The researchers recruited 906 older individuals from retirement facilities, subsidized housing complexes, church groups and social service agencies in northeastern Illinois who had no signs of dementia or history of Parkinson's disease or stroke.

At the outset of the study, the participants filled out a survey indicating their level of participation in a variety of activities involving social interactions, such as doing volunteer work, visiting friends or relatives, or attending church or sporting events. Frequency of participation in these activities was measured using a five-point scale, with one indicating participation in a particular activity once a year or less; two, several times a year; three, several times a month; four, several times a week; and five, every day or almost every day. Demographic information, weight, height and disabilities were also recorded.

The researchers then annually assessed the participants' basic motor function, including muscle strength in the arms and legs, and motor performance, including walking and balance. Participants were followed for an average of five years.

The study found that motor decline was more rapid in those who less frequently participated in social activities, with each one-point decrease in a participant's social activity associated with an approximate 33-percent more rapid rate of decline.

A one-point decrease on the social activity scale was equivalent to being approximately five years older at the start of the study, according to Buchman.

"Statistically, that amount of change translates into a more than 40-percent increased risk of death and a more than 65-percent increased risk of developing disability," Buchman said.

Motor function was also associated, as expected, with other factors, such as joint pain, depression, disability and vascular disease, but even when these factors were considered in the analysis, the association between social activity and motor decline still held up.

"There is gathering evidence that physical activity is only one component of an active and healthy lifestyle. Studies have shown, for example, that increased cognitive and social activities in the elderly are associated with increased survival and a decreased risk of dementia," Buchman said. "Our study extends these findings, showing that social activity late in life is closely linked with healthy motor function."

Other researchers at Rush involved in this study were Patricia Boyle, PhD, Robert Wilson, PhD, Debra Fleischman, PhD, Sue Leurgans, PhD, and Dr. David Bennett.

The study was funded by the National Institute on Aging, the Illinois Department of Public Health, and the Robert C. Borwell Endowment Fund.

Adults with asthma not getting their flu shots

At-risk population under-vaccinated

San Diego, CA, June 22, 2009 – Because of increased risk of complications from influenza, vaccination of adults and children with asthma is recommended by the Advisory Committee on Immunization Practices. The Healthy People 2010 Objectives call for annual influenza vaccination of at least 60% of adults aged 18-64 years with asthma. However, Centers for Disease Control and Prevention (CDC) investigators have determined that the vaccination levels among asthma sufferers falls well short of this guideline. The results of their study are published in the August 2009 issue of the American Journal of Preventive Medicine.

The Behavioral Risk Factor Surveillance System (BRFSS) has been in use since 1984 and collects state-specific data from random telephone surveys of US adults. This study analyzed the responses of 173,572 adults aged 18-64 years and found that 8.4% had asthma. In the 2006-2007 influenza season, vaccination estimates ranged from 26.9% in California to 53.3% in Tennessee with a median across all states of 43.1%.

Influenza vaccination coverage was 33.9% for adults aged 18-49 years with asthma compared to 54.7% for adults aged 50-64 years with asthma. Among people aged 18-64 years without asthma, vaccination coverage was 28.8%. In addition, the researchers found a race/ethnicity gap of 8 to 10 percentage points between levels among non-Hispanic whites compared to levels among non-Hispanic blacks or Hispanics, despite adjustments for a set of socio-demographic and access-to-care variables.

Lead investigator Peng-jun Lu, National Center for Immunization and Respiratory Diseases, CDC, and co-investigators advise, "The National Asthma Education and Prevention Program identified influenza vaccination as one of several 'key clinical activities that should be considered as essential for quality asthma care.' The panel included influenza vaccination among the 'core set of 10 key clinical activities' to reducing asthma morbidity and mortality…. To further improve vaccination coverage among people with asthma, providers should address barriers to delivery and acceptance of influenza vaccination among those with high-risk conditions, including asthma. Providers should also be encouraged to use evidence-based immunization strategies (such as standing orders, patient reminder/recall, provider reminder, provider assessment and feedback); screen for asthma or other high-risk conditions; and routinely offer influenza vaccination."

The article is "Influenza Vaccination Among Adults with Asthma: Findings from the 2007 BRFSS Survey" by Peng-jun Lu, MD, PhD, Gary L. Euler, DrPH, and David B. Callahan MD. It appears in the American Journal of Preventive Medicine, Volume 37, Issue 2 (August 2009) published by Elsevier.

Why do cows attack?

WHO, WHAT, WHY? The Magazine answers...

A fortnight ago a cow left David Blunkett with a black eye and cracked rib. Now a vet walking her dogs has been trampled to death by cattle. Why?

With its limpid eyes and slow gait, the cow is generally a placid creature. But once this gentle giant - typically weighing about 1,000lb (450kg) - has a calf to protect, it's best to steer clear.

Liz Crowsley, a vet, has been trampled to death by a herd of cattle while walking the Pennine Way with her two dogs. And a fortnight ago, a cow left David Blunkett with a black eye and a cracked rib. Also on a walking holiday, the former home secretary was accompanied by his guide dog Sadie.

In both cases, the cows are thought to have been trying to drive off the dogs in order to protect their young.

While such attacks are rare, Health and Safety Executive figures show that 18 people - excluding Ms Crowsley - have been killed and 481 injured by cows in the past eight years.

Spring and early summer are when cows feel most vulnerable to interlopers, but they can be spooked into reacting at any time of year, says Sharon Woods of the Ramblers' Association.

"We hear of one or two incidents each week, but these don't usually involve serious injuries."

Farmers and vets on call-outs are also at risk.

Keep calm, carry on

If you find yourself in a field of suddenly wary cattle, move away as carefully and quietly as possible, she says. "Keep dogs close and on a leash - and if the cows charge, let go the leash. The dog will outrun the cows and it will outrun you."

Because generally it is this four-legged threat the cows are trying to see off. But the dog's owner may be caught up in the attack if the dog cannot run away and instead tries to hide behind its human.

While Mr Blunkett let go of Sadie and she shot off, he stumbled to the ground and the cow fell over too. "She hit my side and broke my rib. Had her full weight of around a tonne hit me, I'd have been a gonner."

Those without canine companions should follow similar advice: move away calmly, do not panic and make no sudden noises. Chances are the cows will leave you alone once they establish that you pose no threat.

The National Farmers' Union also recommends that walkers avoid crossing fields.

"Cows are quite docile animals, but can get nervous," says Ms Woods.

And at five feet tall and weighing at least 1,000 pounds (450kg), it wouldn't do to make a cow too nervous.

'Secret' questions leave accounts vulnerable

* 17:16 22 June 2009 **by Jessica Griggs**

What's your secret question? Your mother's maiden name? Your first pet? For many people, facts like these are all that protect their email and other accounts should they forget their password.

Now a new study (pdf) by researchers at Microsoft Research in Redmond, Washington, US, reveals just how easy the answers of such security questions are for other people to guess.

Acquaintances of 32 webmail users – people with whom they would not normally share their login details – were asked to try and guess the answers users assigned to protect their accounts. The volunteers managed to guess correctly nearly a fifth of the time, raising questions over how secure the commonly used system is.

However, a second Microsoft study suggests a more secure alternative: relying on trusted friends to vouch for you if an account becomes locked.

Skeleton key

Securing webmail is important because email accounts typically allow an attacker access to other accounts, for example, eBay and Amazon, points out Ross Anderson, a security engineer from Cambridge University, UK, because it is possible to request password reminders that will be sent to the compromised account.

"If I can recover these passwords via your email account then I can spend the balance of your credit card on flat-screen TVs," he says.

Hackers can break open webmail accounts by guessing the password. However, many providers, including the four biggest in AOL, Google, Microsoft, and Yahoo, use secret questions to trigger a password reset, something that let a hacker compromise the Yahoo account of US vice presidential hopeful Sarah Palin last year.

Trusted friends

Under the new system proposed by Stuart Schechter and Rob Reeder at Microsoft, users select several "trustees". If a user becomes locked out of their account their trustees receive a message asking them to download a "recovery code." The user must collect codes from multiple trustees to unlock their account.

A group of 19 Hotmail users trialed the system and 17 successfully regained access to their Hotmail account. That 90-per-cent success rate compares favourably to 80-per-cent success rate of the standard secret question system, say Schechter and Reeder. In the trial, most users recovered their accounts within two days.

However, when the researchers got users' acquaintances to ask the trustees to give up the codes, many of them did so. Reeder says this attack could be avoided by getting account holders to advise trustees of their role in advance. In the trial, trustees simply received an email containing the code out of the blue.

References required

Rather than replacing the standard secret questions approach, the new method should be an optional choice for users, says Anderson, who agrees that it is important to train trustees to be appropriately security conscious.

But the idea has promise, says Reeder, pointing out that it is not a new idea to have people use third parties to back up their identity. "When I opened my first bank account, in the early 70s, I had to provide three references," he says.

The two Microsoft papers were presented at the Security and Human Behaviour conference at MIT, Massachusetts, US, last week.

Toxic molecule may help birds 'see' north and south

CHAMPAIGN, Ill. — Researchers at the University of Illinois report that a toxic molecule known to damage cells and cause disease may also play a pivotal role in bird migration. The molecule, superoxide, is proposed as a key player in the mysterious process that allows birds to "see" Earth's magnetic field.

The discovery, reported this month in Biophysical Journal, occurred as a result of a "mistake" made by a collaborator, said principal investigator Klaus Schulten, who holds the Swanlund Chair in Physics at Illinois. His postdoctoral collaborator, Ilia Solov'yov, of the Frankfurt Institute for Advanced Studies, did not know that superoxide was toxic, seeing it instead as an ideal reaction partner in a biochemical process involving the protein cryptochrome in a bird's eye.

Cryptochrome is a blue-light photoreceptor found in plants and in the eyes of birds and other animals. Schulten was the first to propose (in 2000) that this protein was a key component of birds' geomagnetic sense, a proposal that was later corroborated by experimental evidence. He made this prediction after he and his colleagues discovered that magnetic fields can influence chemical reactions if the reactions occur quickly enough to be governed by pure quantum mechanics.

"Prior to our work, it was thought that this was impossible because magnetic fields interact so weakly with molecules," he said. Such chemical reactions involve electron transfers, Schulten said, "which result in freely tumbling spins of electrons. These spins behave like an axial compass."

Changes in the electromagnetic field, such as those experienced by a bird changing direction in flight, appear to alter this biochemical compass in the eye, allowing the bird to see how its direction corresponds to north or south.

"Other researchers had found that cryptochrome, acting through its own molecular spins, recruits a reaction partner that operates at so-called zero spin. They suggested that molecular oxygen is that partner," Schulten said. "We propose that the reaction partner is not the benign oxygen molecule that we all breathe, but its close cousin, superoxide, a negatively charged oxygen molecule."

When Solov'yov showed that superoxide would work well as a reaction partner, Schulten was at first dismissive.

"But then I realized that the toxicity of superoxide was actually crucial to its role," he said. The body has many mechanisms for reducing concentrations of superoxide to prevent its damaging effects, Schulten said. But this gives an advantage, since the molecule must be present at low concentrations – but not too low – "to make the biochemical compass work effectively," he said.

Although known primarily as an agent of aging and cellular damage, superoxide recently has been recognized for its role in cellular signaling.

However, its toxicity may also explain why humans, who also have cryptochrome in their eyes, do not have the same ability to see Earth's electromagnetic field, Schulten said. "Our bodies try to play it safe," he said. "It might be that human evolution chose longevity over orientational ability."

Schulten directs the theoretical and computational biophysics group at the Beckman Institute for Advanced Science and Technology at Illinois.

Really?

The Claim: Heat Should Be Applied to a Sprained Ankle

By ANAHAD O'CONNOR

Leif Parsons

THE FACTS Ankle sprains are one of the most common sports injuries; they send about a million Americans to clinics every year and cause chronic problems for many.

The problem is clear, but the first-aid treatment is not: heat or cold?

Many people swear by heat, saying it soothes the pain and promotes healing by stimulating blood flow. Others advocate ice, precisely because it does the reverse, slowing blood flow and minimizing inflammation.

According to research, ice wins every time.

In multiple studies, scientists have compared heat and ice by randomly assigning people who showed up at sports clinics with sprains to receive one treatment or the other, in combination with a pain reliever like ibuprofen. One prominent study found that immediate ice therapy "resulted in earlier return to activity, as defined by ability to walk, climb stairs, run and jump without pain."

In people with the most severe injuries — including torn ligaments — treatment with ice resulted in a 13-day recovery, compared with 30 days for those treated with heat.

For the best results, experts recommend the Price method: protection, rest, ice, compression and elevation. They caution that ice should be applied only 20 minutes at a time.

THE BOTTOM LINE Ice is far better than heat for ankle sprains.

Feather fibers fluff up hydrogen storage capacity

COLLEGE PARK, M.D., June 23 – Scientists in Delaware say they have developed a new hydrogen storage method — carbonized chicken feather fibers — that can hold vast amounts of hydrogen, a promising but difficult to corral fuel source, and do it at a far lower cost than other hydrogen storage systems under consideration.

The research, presented here today at the 13th Annual Green Chemistry & Engineering Conference, could eventually help overcome some of the hurdles to using hydrogen fuel in cars, trucks and other machinery.

The conference is organized by the ACS Green Chemistry Institute®, a nonprofit organization devoted to promoting and advancing the discovery and design of chemical products and processes that eliminate the generation and use of hazardous substances in all aspects of the global chemical enterprise.

"Carbonized chicken feather fibers have the potential to dramatically improve upon existing methods of hydrogen storage and perhaps pave the way for the practical development of a truly hydrogen-based energy economy," says Richard P. Wool, Ph.D., professor of chemical engineering and director of the Affordable Composites from Renewable Resources program at the University of Delaware in Newark.

The research was presented by Erman Senoz, a graduate student in the Department of Chemical Engineering at the University of Delaware in Newark.

Chicken feather fibers are mostly composed of keratin, a natural protein that forms strong, hollow tubes. When heated, this protein creates crosslinks, which strengthen its structure, and becomes more porous, increasing its surface area. The net result is carbonized chicken feather fibers, which can absorb as much or perhaps more hydrogen than carbon nanotubes or metal hydrides, two other materials being studied for their hydrogen storage potential, Wool says. Plus, they're cheap.

Using carbonized chicken feathers would only add about $200 to the price of a car, according to Wool. By comparison, making a 20-gallon hydrogen fuel tank that uses carbon nanotubes could cost $5.5 million; one that uses metal hydrides could cost up to $30,000, Wool says.

Hydrogen, the most common element in the universe, has long been touted as a clean and abundant energy alternative to fossil fuels. But its physical characteristics make it very difficult to store and transport — as a pressurized gas it takes up about 40 times as much space as gasoline; as a liquid it needs to be kept at extremely low temperatures.

Wool estimates that it would take a 75-gallon tank to go 300 miles in a car using carbonized chicken feather fibers to store hydrogen. He says his team is working to improve that range.

"The problem with hydrogen as a gas or liquid is its density is too low," Wool says. "Using currently available technology, if you had a 20-gallon tank and filled it with hydrogen at typical room temperature and pressure, you could drive about a mile. When we started we didn't know how well carbonized chicken feathers would work for hydrogen storage, but we certainly suspected we could do a lot better than that."

In addition to hydrogen storage, Wool and his colleagues are working on ways to transform chicken feather fibers into a number of other products including hurricane-resistant roofing, lightweight car parts and bio-based computer circuit boards.

This research, "Hydrogen Storage On Carbonized Chicken Feather Fibers," (paper #14), will be presented at 10:55 a.m., Tuesday, June 23, in rooms 2101/2103/2105 at the Marriott Inn and Conference Center, University of Maryland University College, during the symposium, 'Technologies for a Hydrogen Economy."

Richard P. Wool, Ph.D., is a professor of chemical engineering and director of the Affordable Composites from Renewable Resources program at the University of Delaware in Newark. This research was funded by a grant from USDA-CSREES.

Erman Senoz is a graduate student in the Department of Chemical Engineering at the University of Delaware in Newark.

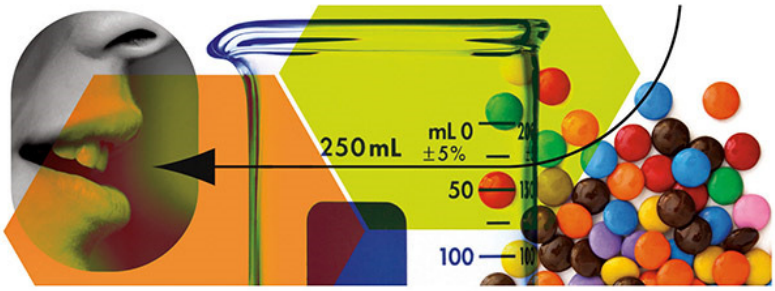
Well

How the Food Makers Captured Our Brains

By TARA PARKER-POPE

As head of the Food and Drug Administration, Dr. David A. Kessler served two presidents and battled Congress and Big Tobacco. But the Harvard-educated pediatrician discovered he was helpless against the forces of a chocolate chip cookie.

In an experiment of one, Dr. Kessler tested his willpower by buying two gooey chocolate chip cookies that he didn't plan to eat. At home, he found himself staring at the cookies, and even distracted by memories of the chocolate chunks and doughy peaks as he left the room. He left the house, and the cookies remained uneaten. Feeling triumphant, he stopped for coffee, saw cookies on the counter and gobbled one down.



Stuart Bradford

"Why does that chocolate chip cookie have such power over me?" Dr. Kessler asked in an interview. "Is it the cookie, the representation of the cookie in my brain? I spent seven years trying to figure out the answer."

The result of Dr. Kessler's quest is a fascinating new book, "The End of Overeating: Taking Control of the Insatiable American Appetite" (Rodale).

During his time at the Food and Drug Administration, Dr. Kessler maintained a high profile, streamlining the agency, pushing for faster approval of drugs and overseeing the creation of the standardized nutrition label on food packaging. But Dr. Kessler is perhaps best known for his efforts to investigate and regulate the tobacco industry, and his accusation that cigarette makers intentionally manipulated nicotine content to make their products more addictive.

In "The End of Overeating," Dr. Kessler finds some similarities in the food industry, which has combined and created foods in a way that taps into our brain circuitry and stimulates our desire for more.

When it comes to stimulating our brains, Dr. Kessler noted, individual ingredients aren't particularly potent. But by combining fats, sugar and salt in innumerable ways, food makers have essentially tapped into the brain's reward system, creating a feedback loop that stimulates our desire to eat and leaves us wanting more and more even when we're full.

Dr. Kessler isn't convinced that food makers fully understand the neuroscience of the forces they have unleashed, but food companies certainly understand human behavior, taste preferences and desire. In fact, he offers descriptions of how restaurants and food makers manipulate ingredients to reach the aptly named "bliss point." Foods that contain too little or too much sugar, fat or salt are either bland or overwhelming. But food scientists work hard to reach the precise point at which we derive the greatest pleasure from fat, sugar and salt.

The result is that chain restaurants like Chili's cook up "hyper-palatable food that requires little chewing and goes down easily," he notes. And Dr. Kessler reports that the Snickers bar, for instance, is "extraordinarily well engineered." As we chew it, the sugar dissolves, the fat melts and the caramel traps the peanuts so the entire combination of flavors is blissfully experienced in the mouth at the same time.

Foods rich in sugar and fat are relatively recent arrivals on the food landscape, Dr. Kessler noted. But today, foods are more than just a combination of ingredients. They are highly complex creations, loaded up with layer upon layer of stimulating tastes that result in a multisensory experience for the brain. Food companies "design food for irresistibility," Dr. Kessler noted. "It's been part of their business plans."

But this book is less an exposé about the food industry and more an exploration of us. “My real goal is, How do you explain to people what’s going on with them?” Dr. Kessler said. “Nobody has ever explained to people how their brains have been captured.”

The book, a New York Times best seller, includes Dr. Kessler’s own candid admission that he struggles with overeating.

“I wouldn’t have been as interested in the question of why we can’t resist food if I didn’t have it myself,” he said. “I gained and lost my body weight several times over. I have suits in every size.”

This is not a diet book, but Dr. Kessler devotes a sizable section to “food rehab,” offering practical advice for using the science of overeating to our advantage, so that we begin to think differently about food and take back control of our eating habits.

One of his main messages is that overeating is not due to an absence of willpower, but a biological challenge made more difficult by the overstimulating food environment that surrounds us. “Conditioned hypereating” is a chronic problem that is made worse by dieting and needs to be managed rather than cured, he said. And while lapses are inevitable, Dr. Kessler outlines several strategies that address the behavioral, cognitive and nutritional factors that fuel overeating.

Planned and structured eating and understanding your personal food triggers are essential. In addition, educating yourself about food can help alter your perceptions about what types of food are desirable. Just as many of us now find cigarettes repulsive, Dr. Kessler argues that we can also undergo similar “perceptual shifts” about large portion sizes and processed foods. For instance, he notes that when people who once loved to eat steak become vegetarians, they typically begin to view animal protein as disgusting.

The advice is certainly not a quick fix or a guarantee, but Dr. Kessler said that educating himself in the course of writing the book had helped him gain control over his eating.

“For the first time in my life, I can keep my weight relatively stable,” he said. “Now, if you stress me and fatigue me and put me in an airport and the plane is seven hours late — I’m still going to grab those chocolate-covered pretzels. The old circuitry will still show its head.”

Common ECG finding may indicate serious cardiac problems

Prolongation of PR interval may increase risk of heart rhythm disturbances, more study needed

BOSTON – A common electrocardiogram (ECG) finding that has largely been considered insignificant may actually signal an increased risk of atrial fibrillation (a chronic heart rhythm disturbance), the future need for a permanent pacemaker and an increased risk for premature death. In their report in the June 24 Journal of the American Medical Association, researchers from Massachusetts General Hospital (MGH) and Boston University School of Medicine describe results of the first large-scale study looking at the significance of a prolonged PR interval in a general population.

"Lengthening of the PR interval is commonly seen on routine electrocardiograms, more often in older patients, and has been considered a relatively harmless finding," says Susan Cheng, MD, a cardiology fellow at MGH and Brigham and Women's Hospital who is lead author of the JAMA paper. "But our results indicate that PR interval prolongation is not as benign as previously thought."

A common diagnostic test available in most physicians' offices, the electrocardiogram records the heart's electrical activity and translates it into waveforms that reflect how the contraction signal moves through the heart muscle. A prolonged PR interval represents a delay in the time it takes for the signal to move across the atria at the top of the heart, which receive blood flowing in from the veins, into the ventricles at the bottom of the heart, which pump blood out into the arteries. Although a prolonged PR interval can signify conduction problems related to serious conditions such as a heart attack, a prolonged PR interval is most commonly seen in generally healthy, middle-aged to older adults and has been thought to reflect normal age-related changes. But previous investigations of the impact of PR prolongation were limited to younger, healthy participants, such as members of the military.

The current study analyzed data from more than 7,500 participants in the Framingham Heart Study, followed for more than three decades. Although only 124 of those participants showed a prolonged PR interval on the electrocardiogram taken when they entered the study, PR prolongation proved to be a significant risk factor. A PR interval of less than 200 milliseconds is considered normal, and participants whose interval was longer than 200 milliseconds had twice the overall risk of developing atrial fibrillation, three times the risk of needing a pacemaker and almost one and a half times the risk of early death. Further prolongation of the PR interval led to even greater risk.

"We do not yet know why a subtle finding such as a prolonged PR interval is associated with such serious adverse outcomes, but it may be a marker for progressive problems with the heart's electrical conduction system," says Thomas Wang, MD, of the MGH Heart Center, the study's senior author. "We need to learn more

about how a prolonged PR interval is linked to these serious events and what should be done to prevent them. Right now, clinicians might consider that their patients with PR prolongation may be at increased risk of these problems and follow their electrocardiograms more closely." Wang is an assistant professor of Medicine at Harvard Medical School.

Co-authors of the JAMA report are Elizabeth McCabe, MS, and Christopher Newton-Cheh, MD, MPH, MGH Cardiology; Michelle Keyes, PhD, Martin Larson, ScD, Daniel Levy, MD, Emelia Benjamin, MD, ScM, and Ramachandran Vasan, MD, Boston University School of Medicine. The Framingham Heart Study is supported jointly by the National Heart, Lung and Blood Institute and Boston University.

Basics

When an Ear Witness Decides the Case

By NATALIE ANGIER

Serge Bloch

Spoken clearly, the sounds “dah” and “bah” are easy to distinguish. Yet if you play a film clip in which the soundtrack says “dah” while the image on the screen shows a mouth saying “bah,” people will swear they heard “bah.”

If you ask people to count the number of times that a light flashes, and you flash the light seven times together with a sequence of eight beeping tones, people will say the light flashed eight times.

When confronted with conflicting pieces of information, the brain decides which sense to trust. In the first scenario, those clearly percussing lips could never be articulating a “d,” and so vision claimed the upper hand. But on matters that demand a temporal analysis, and making sense of similar sounds in a sequence, the brain reflexively counts on hearing.

Click click click. You can listen to a series of clicks at 20 beats per second and know they are separate clicks rather than a single continuous tone. Run a series of images together at 20 frames per second and — welcome to the movies.

“The temporal resolution of our vision,” said Barbara Shinn-Cunningham of Boston University, “is an order of magnitude slower than what our auditory system can cope with.”

It’s easy to take hearing for granted, that sprawling stereophonic Babylonia where the gates never close and there are soapboxes for all. You can shut your eyes against a bright sun or avert your gaze from a grim scene. But when one neighbor’s leaf blower sets off another neighbor’s car alarm, hey, where are my earlids? We’ve been called the visual primate, and the size of our visual cortex dwarfs the neural platform assigned to audition. Most people, when asked, claim they would rather lose their hearing than their sight.

Yet in ways that researchers are just beginning to appreciate, we humans are beholden to our ears. Mechanically, electrically, behaviorally and cosmetically, our paired sounding boards are a genuine earmark of our species. And if the words aural and oral are often confused, they should be, for our ears and our mouths jointly gave us our voice.

Scientists now suspect that the origin of human language owes as much to improvements in the early hominid ear as to more familiar spurs like a changing vocal tract or even a generally expanding brain. In one recent molecular analysis, John Hawks of the University of Wisconsin reported that eight genes involved in shaping the human ear appear to have undergone significant changes over the past 40,000 years, some as recently as the dawn of the Roman Empire. Only with highly refined auditory infrastructure, researchers said, could our ancestors have tuned in to the sort of tiny fluctuations in pressure waves that characterize all human speech, let alone properly conjugated Latin.

Moreover, the avidity with which our auditory sense seeks to organize ambient noise into a meaningful acoustical pattern - a likely consequence of our dependence on language - could help explain our distinctly human musicality.

Every human culture studied makes music, and human babies are born loving music, yet the old saw notwithstanding, music will do nothing to soothe the average nonhuman beast. Emerging evidence suggests that many of our fellow mammals, including dogs, cats, rodents and monkeys, are indifferent to music and may even dislike it. In a study of cotton top tamarins and common marmosets, Josh McDermott, now at the Center for Neural Science at New York University, found that while the monkeys showed some signs of preferring slow-tempo music to livelier tunes, their favorite song of all was the sound of one hand clapping. “They’re in a room with nothing else to do, and they could be listening to a nice, soothing lullaby,” Dr. McDermott said. “But if you give the monkeys a choice between music and silence, they choose silence pretty strongly.”

Whatever the preferred playlist, our auditory system is a superb piece of engineering, and indeed many auditory researchers have an engineering as well as a neuroscience background. The pressure waves that are

sound enter the ears through the curved and lobed pinna, a structure as specific to each individual as a fingerprint that is essential for gauging the vertical contours of an incoming sound wave and hence how near or far the sound source may be.

As the displacement of air molecules proceeds through the ear canal and across the membranous ear drum, the vibrations wiggle the three tiny bones of the middle ear, which, as Jeremy Wolfe's "Sensation and Perception" vividly puts it, act like a set of levers and a stiletto heel striking a wooden floor, to amplify the wave's energy and so make even faint sounds audible. Venturing next into the dense snail shell of the inner ear, the mechanical vibrations are further amplified and translated into neurally appropriate electrical signals by pulsing arrays of fringed hair cells.

Shihab Shamma of the University of Maryland argues that the brain interprets visual and audio signals using many similar tricks. For example, it looks for the edges and the overall geometry of the signal. "What distinguishes one vowel from another is the shape of the waveform entering the ear," Dr. Shamma said. "This would be analogous to what distinguishes a square from a circle." The brain also has a penchant for symmetry. Many objects in the natural world are bilaterally symmetrical — they have a left and a right side — and the brain uses that symmetry as a cue to group together similar objects and distinguish one from the next. The equivalent of symmetry in aural cues is pitch, the frequency profile of a sound wave that makes a C note sound different from a G-flat. Most sounds consist not of pure notes of a single gorgeous oscillating sine wave, but of harmonics, overlaid multiples of those sine waves, and the brain seizes on them as one, just as it treats the left and right half of a painting or a tree as elements of a single object.

Unlike the eyes, of course, the ears are not limited to sensory stimulants in front of the face. "Because auditory signals go around objects," said Dr. Shamma, "they're extremely important for communicating in a cluttered environment."

A penguin locates its chick or a human mother her lost daughter by listening for the telltale cry. If ears are the eyes in the back of our head, maybe it's best that these eyes never blink.

Warning over 'superbug' risk from pets

* 17:59 23 June 2009 **by Andy Coghlan**

"Superbugs" originating in hospitals are now increasingly being found in cats and dogs, and in victims of bites.

Ironically, most animals probably acquired their infections originally from their owners. The bugs then easily spread between pets and household members. The rise parallels the increasing abundance of community associated methicillin-resistant Staphylococcus aureus (CA-MRSA) over the past decade or so.

"Pet owners need to be aware of the potential for transmission of infections from their pets," says Richard Oehler of the University of South Florida College of Medicine in Tampa, who has reviewed reported cases of pet infection with MRSA. "An increase of pet-associated infections has been documented in the literature and has paralleled the increase in human MRSA infections," he says.

Antibiotic resistant

The first case was reported in the UK in 1988, in a pet cat kept on a geriatric ward. 2006 saw the first report in pets of USA300, an emergent "community" strain of MRSA in the US. And, in the same year, researchers in Pennsylvania found that MRSA accounted for 35 per cent of 111 S. aureus samples originally taken from cats and dogs.

Oehler says that the strains pose a special risk because they're resistant to antibiotics, and so may be more difficult than usual to treat if they result from cat or dog bites. Severe infections occur in about 20 per cent of bites. Sepsis can be a severe complication of bite wounds.

Children are at special risk, especially boys aged five to nine who provoke animals without realising the dangers. Often, because they're shorter than adults, they receive severe bites to the face, neck or head, whereas adults are most often bitten on the hand.

'Serious consequences'

"Bite infections can result in serious consequences, but MRSA can produce serious infections independent of the method of exposure," warns Oehler.

One study found, for example, that MRSA often occurs in simple skin infections in pets, and can easily spread to owners. In the wake of his findings, Oehler recommends measures to avoid infection. "Wash hands before and after pet contact, and be wary of dogs licking your face, any medical devices or open wounds," he says.

"Also, be aware of your pet's health status, and keep open wounds on yourself and your pet covered when you're in contact with each other," he says.

Human contact

Oehler says that further research is needed to establish how superbugs circulate to pets, but the most likely route is via the owners.

The US Centers for Disease Control in Atlanta, Georgia, agrees. "Most MRSA in humans is acquired by direct contact with other humans," it said in a statement to New Scientist. "In most cases, MRSA in companion animals is a result of humans exposing the animals to MRSA, so pets can become colonised or infected with MRSA by contact with colonised or infected humans."

Journal reference: The Lancet (vol 9, p 439)

Facedown Burials Widely Used to Humiliate the Dead

James Owenfor National Geographic News June 23, 2009

Burying the dead facedown in ancient times didn't mean RIP, according to new research that says the practice was both deliberate and widespread. Experts have assumed such burials were either unusual or accidental.

But the first global study on the facedown burials suggests that it was a custom used across societies to disrespect or humiliate the dead.

Lead study author Caroline Arcini of Sweden's National Heritage Board detected a common thread in the burials she studied: "That society sanctioned this apparently negative treatment of the dead," she said.

The unnerving burials often appear to signify "behavior that is out of the norm - it is not accepted, what [the dead] have done," Arcini said. Shaming the dead "is most probably a deep-rooted behavior in humankind."

Social Status

Arcini searched existing literature to make the first ever catalog of facedown burials from around the world.

She found descriptions of more than 600 bodies from 215 grave sites, from Peru to South Korea.

Dating from 26,000 years ago all the way up to World War I, these so-called prone burials include men, women, and children, though the majority were men. Facedown burials occurred in all sorts of graves, including single graves, double graves, and mass graves.

(Related: "Earliest Known Nuclear Family Found; Died in Masacres?")

In locations with several prone burials, the dead were often buried in shallow graves toward the edge of the cemetery, most of them without coffins. The phenomenon has various possible explanations, Arcini said.

Some people had their hands and feet tied together, suggesting they had been criminals or prisoners of war.

Other burials indicate the practice was linked to social status, as in the case of 80 bodies found in a Mexican cemetery that dates to between 1150 and 850 B.C., Arcini said.

There, 6 men are sitting in their graves, while the other 74 are in a prone position, Arcini noted. "It might be that the people [buried in a sitting position] are high priests, and the others are in a lower social position."

Religious Conflict

The archaeologist highlights religious and cultural conflict as another potential factor.

The highest frequency of facedown burials in Sweden, for instance, dates to the period of the Viking age when Christianity arrived in the region, Arcini said.

Pagan Vikings may not have accepted those who converted to Christianity and may have buried the bodies in a way that reflected their dislike, she explained.

Rule-breaking nuns and convicted witches were also buried in prone positions, she added.

The findings appear in the June issue of the journal Current Archaeology.

Q & A

What a Sweat I'm In

By C. CLAIBORNE RAY

Q. How can you distinguish between night sweats that indicate a serious medical condition and those that don't?

A. There is no easy way for a layperson to do so, but there are some clues, said Dr. Shari R. Midoneck, an internist at Iris Cantor Women's Health Center in New York. Night sweats that are a matter of concern soak through your pajamas repeatedly, she said. And "if other symptoms are associated with them, like fever, weight loss, swollen lymph nodes and extreme fatigue, then this could be serious and you should see a doctor."

Night sweats on a warm night are probably normal in those who feel fine otherwise, in younger women around their periods or in older women around menopause, Dr. Midoneck said.

Dr. Carla Boutin-Foster, who teaches at NewYork-Presbyterian/Weill Cornell Medical Center, narrowed the definition to drenching sweats when it is not too warm. Other symptoms that can indicate a severe problem, she said, include itching, cough, sputum production, shortness of breath, palpitations, chest pain and diarrhea.

Some possible causes of serious night sweats include acute or chronic infections, lymphoma and other tumors, low blood sugar in patients with diabetes, and some medications.

Anyone with night sweats plus other symptoms should be seen by a doctor, Dr. Boutin-Foster said, especially people with a known chronic medical condition. Even those with no other symptoms should monitor the sweats and keep a record of temperature, medications and foods, she said, and anyone with persistent sweats should also be evaluated.

Longer life linked to specific foods in Mediterranean diet

Research: Anatomy of the health effects of the Mediterranean diet, the Greek EPIC prospective cohort study, BMJ online

Some food groups in the Mediterranean diet are more important than others in promoting health and longer life according to new research published on bmj.com today.

Eating more vegetables, fruits, nuts, pulses and olive oil, and drinking moderate amounts of alcohol, while not consuming a lot of meat or excessive amounts of alcohol is linked to people living longer.

However, the study also claims, that following a Mediterranean diet high in fish, seafood and cereals and low in dairy products were not indicators of longevity.

While several studies have concluded that the Mediterranean diet improves chances of living longer, this is the first to investigate the importance of individual components of the diet.

Professor Dimitrios Trichopoulos at the Harvard School of Public Health explains that they have surveyed over 23,000 men and women who were participants in the Greek segment of the European Prospective Investigation into Cancer and Nutrition (EPIC).

Participants were given dietary and lifestyle questionnaires when they enrolled onto the study and they were subsequently followed up for around 8.5 years with interviews. Their diets were rated from 0 to 10 based on the level of conformity to a traditional Mediterranean diet.

As part of the interview process, participants were also asked about their smoking status, levels of physical activity and whether they had ever been diagnosed with cancer, diabetes and heart disease.

The authors maintain that when high intake of vegetables, low intake of meat or moderate alcohol intake were excluded from the rating system, the benefits of following a Mediterranean diet were substantially reduced. They also note that there are clear benefits in combining several of the key components, for example high consumption of vegetables and olive oil.

Professor Trichopoulou, lead author of the study, concludes that the main reasons why the Mediterranean diet can lead to living longer are moderate consumption of ethanol (mostly in the form of wine during meals, as traditionally done in the Mediterranean countries), low consumption of meat and meat products, and high consumption of vegetables, fruits and nuts, olive oil and legumes.

How to confirm the causes of iron deficiency anemia in young women

Iron-deficiency anaemia (IDA) is commonly seen in women aged <50 years. The diagnostic workflow in young women affected by IDA is not clearly established. The British Society of Gastroenterology recommends gastroscopy only in IDA women younger than 45 years presenting with gastrointestinal (GI) symptoms. However, symptoms are often mild and aspecific in IDA women and the gastroscopy is an invasive procedure associated with a high number of refusals. In a previous work on IDA premenopausal women, gastroscopy was performed in all patients, later deemed unnecessary in almost 30% of the studied women because these were affected only by menorrhagia.

A research team led by Bruno Annibale from Italy prospectively evaluate the usefulness of a pre-endoscopic serological screening for H. pylori infection and celiac disease with the use of two tests (human recombinant tissue transglutaminase IgA antibodies and anti-H. pylori IgG antibodies) in women aged < 50 affected by IDA in order to increase the compliance for gastroscopy. Their study will be published on June 14, 2009 in the World Journal of Gastroenterology

In this study, 115 women aged < 50 years with IDA were tested by human recombinant tissue transglutaminase IgA antibodies (tTG) and anti-H. pylori IgG antibodies. All cases underwent gastroscopy with biopsies of stomach and duodenum, irrespective of tests results. Of the 115 patients, 45.2% of women were test-positive. The serological results were confirmed by gastroscopy in 100% of those with positive H. pylori antibodies, in 50% of those with positive tTG and in 81.5% of test-negative patients. Sensitivity and specificity were 84.8% and 100% for H. pylori infection, and 80% and 92.8% for tTG, respectively. The gastroscopy compliance rate of test-positive women was significantly increased in comparison with those test-negative (65.4% vs 42.8%; Fisher test P = 0.0239).

This study showed that two simples and widely available tests, such as those for tissue transglutaminase IgA antibodies and anti-H. pylori IgG antibodies, were able to select women with IDA to submit for gastroscopy to identify IDA-related GI causes and to increase the compliance for the invasive procedure. Gastroscopy with biopsies confirmed in the vast majority of IDA women the presence of active H. pylori pangastritis, atrophic gastric body, or celiac disease as possible causes of IDA.

Reference: Vannella L, Gianni D, Lahner E, Amato A, Grossi E, Delle, Fave G, Annibale B. Pre-endoscopic screening for Helicobacter pylori and celiac disease in young anemic women. World J Gastroenterol 2009; 15(22): 2748-2753 http://www.wjgnet.com/1007-9327/15/2748.asp

Waste water treatment plant mud used as 'green' fuel

Catalan scientists have shown that using mud from waste water treatment plants as a partial alternative fuel can enable cement factories to reduce their CO2 emissions and comply with the Kyoto Protocol, as well as posing no risk to human health and being profitable. These are the results of an environmental impact assessment.

Dependency on oil and coal could be coming to an end. Researchers from the Rovira i Virgili University (URV) have analysed the environmental and human health impacts of an alternative fuel that solves various problems simultaneously This is the solid waste from the water treatment plants of large cities.

The scientists have carried out the first study into this method at a cement plant in Vallcarca (Catalonia), which has been producing cement for more than 100 years, and they confirm in the latest issue of the journal Environmental Science and Pollution Research that it is "the best option for getting rid of mud that would have had to be dumped elsewhere, while also powering the plant".

"As this mud is already waste, burning it does not enter into the atmospheric CO2 emissions assigned to each country under the Kyoto Protocol", José Luis Domingo, lead author of the study and director of the Toxicology and Environmental Health Laboratory at the URV, tells SINC.

This would enable plants producing cement, one of the most contaminating industries in terms of CO2 as well as emissions of dioxins, furans and heavy metals, to consume energy in a more environmentally-friendly way. Up to 20% of the fossil fuel energy used at the Catalan plant has now been substituted for the fuel from waste water treatment plant mud.

From an economic point of view, the scientists will not say that cement plants could increase their profits by using this method, but "they will not have to pay anything to exceed their agreed emissions", the researcher points out. The economic benefits of this system also depend on the price of fuel.

One of the most important issues for the URV scientists is the reduction in environmental impact, and consequently the health risks for people living near the plants. The experiment with the mud has led to a 140,000 tonne reduction in CO2 emissions between 2003 and 2006, and will have limited the potential deaths from exposure to chemical pollutants. In addition, the study shows that using this green fuel would reduce the cancer rate by 4.56 per million inhabitants.

The researchers say it is essential to carry out separate studies for each plant because "we still don't know whether this will be positive for the whole cement industry", according to Domingo. However, if the conditions are right, using mud from waste water treatment plants in cement factories is "a very good solution", he concludes.

References: *Nadal, Marti; Schuhmacher, Marta; Domingo, José Luis. "Cost-benefit analysis of using sewage sludge as alternative fuel in a cement plant: a case study" Environmental Science and Pollution Research 16(3):322-328, mayo de 2009.*

Need something? Talk to my right ear!

New research demonstrates humans' right ear preference for listening

We humans prefer to be addressed in our right ear and are more likely to perform a task when we receive the request in our right ear rather than our left. In a series of three studies1, looking at ear preference in communication between humans, Dr. Luca Tommasi and Daniele Marzoli from the University "Gabriele d'Annunzio" in Chieti, Italy, show that a natural side bias, depending on hemispheric asymmetry in the brain, manifests itself in everyday human behavior. Their findings were just published online in Springer's journal Naturwissenschaften.

One of the best known asymmetries in humans is the right ear dominance for listening to verbal stimuli, which is believed to reflect the brain's left hemisphere superiority for processing verbal information. However, until now, the majority of studies looking at ear preference in human communication have been controlled laboratory studies and there is very little published observational evidence of spontaneous ear dominance in everyday human behavior.

Tommasi and Marzoli's three studies specifically observed ear preference during social interactions in noisy night club environments. In the first study, 286 clubbers were observed while they were talking, with loud music in the background. In total, 72 percent of interactions occurred on the right side of the listener. These results are consistent with the right ear preference found in both laboratory studies and questionnaires and they demonstrate that the side bias is spontaneously displayed outside the laboratory.

In the second study, the researchers approached 160 clubbers and mumbled an inaudible, meaningless utterance and waited for the subjects to turn their head and offer either their left of their right ear. They then asked them for a cigarette. Overall, 58 percent offered their right ear for listening and 42 percent their left. Only

women showed a consistent right-ear preference. In this study, there was no link between the number of cigarettes obtained and the ear receiving the request.

In the third study, the researchers intentionally addressed 176 clubbers in either their right or their left ear when asking for a cigarette. They obtained significantly more cigarettes when they spoke to the clubbers' right ear compared with their left.

According to the authors, taken together, these results confirm a right ear/left hemisphere advantage for verbal communication and distinctive specialization of the two halves of the brain for approach and avoidance behavior.

They conclude: "Our studies corroborate the idea of a common ancestry – in humans and other species – of lateralized behavior during social interactions, not only for species-specific vocal communication, but also for affective responses."

Reference *1. Marzoli D & Tommasi L (2009). Side biases in humans (Homo sapiens); three ecological studies on hemispheric asymmetries. Naturwissenschaften. DOI 10.1007/s00114-009-0571-4*

New therapy found to prevent heart failure

A landmark study has successfully demonstrated a 29 percent reduction in heart failure or death in patients with heart disease who received an implanted cardiac resynchronization therapy device with defibrillator (CRT-D) versus patients who received only an implanted cardiac defibrillator (ICD-only).

MADIT-CRT (Multicenter Automatic Defibrillator Implantation Trial with Cardiac Resynchronization Therapy) is a clinical trial that enrolled more than 1,800 patients in the United States, Canada and Europe and followed the patients for up to 4½ years. The results of the trial were released today by the University of Rochester Medical Center and Boston Scientific, the study's sponsor. The MADIT-CRT Executive Committee stopped the trial on June 22, 2009, when the trial achieved its primary end point – significant reduction in heart failure or death with CRT-D versus ICD-only. Cardiologist Arthur Moss, M.D., professor of Medicine at the University of Rochester Medical Center, led the MADIT-CRT trial.

A prior study (MADIT-II) by Moss and associates in 2002 showed the ICD was effective in reducing mortality. The current MADIT-CRT study sought to determine if CRT-D could reduce the risk of mortality and heart failure, which affects 5.7 million Americans, and the results are very positive.

Patients with heart disease have a risk of arrhythmias and heart failure. The new generation of cardiac resynchronization therapy defibrillators (CRT-Ds) was designed to stop dangerous, life-threatening heart rhythms and improve the heart's contraction, thereby enabling the device to improve survival and prevent heart failure.

CRT-D's are approved for use in patients with severe heart failure (New York Heart Association class III/IV), where they have been shown to reduce heart failure symptoms. The findings from the current study indicate that CRT-D therapy improves cardiac function and prevents the development of heart failure in patients who have not previously experienced heart failure.

"Now we can prevent sudden cardiac death and inhibit the development of heart failure, thus improving survival and outcome in patients with heart disease," Moss said. "There is a very large population of patients with heart disease who will benefit from this combined therapy."

Notre Dame study describes evidence of world's oldest known granaries

A new study coauthored by Ian Kuijt, associate professor of anthropology at the University of Notre Dame, describes recent excavations in Jordan that reveal evidence of the world's oldest know granaries. The appearance of the granaries represents a critical evolutionary shift in the relationship between people and plant foods.

Anthropologists consider food storage to be a vital component in the economic and social package that comprises the Neolithic period, contributing to plant domestication, increasingly sedentary lifestyles and new social organizations. It has traditionally been assumed that people only started to store significant amounts of food when plants were domesticated.

However, in a paper appearing in the June 23 edition of the Proceedings of the National Academies of Sciences, Kuijt and Bill Finlayson, director, Council for British Research in the Levant, describe recent excavations at Dhra' near the Dead Sea in Jordan that provide evidence of granaries that precede the emergence of fully domesticated plants and large-scale sedentary communities by at least 1,000 years.

"These granaries reflect new forms of risk reduction, intensification and low-level food production," Kuijt said. "People in the Pre-Pottery Neolithic Age (11,500 to 10,550 B.C.) were not using new food sources, but rather, by developing new storage methods, they altered their relationship with traditionally utilized food resources and created the technological context for later development of domesticated plants and an agro-pastoralist economy.

"Building granaries may, at the same time, have been the single most important feature in increasingly sedentism that required active community participation in new life-ways."

Designed with suspended floors for air circulation and protection from rodents, the granaries are located between residential structures that contain plant-processing instillations.

The new studies are a continuation of earlier research by Kuijt. As a graduate student from 1987-1995, he worked on and directed several field projects in Jordan that focused on the world's first villages during the Neolithic Period. As part of this research, he did several days of excavation at Dhra' with a Jordanian researcher. This was followed by several other field projects and by research from 2000 to 2005 with Finlayson.

"These granaries are a critical fist step, if not the very evolutionary and technological foundation, for the development of large agricultural villages that appear by 9,500 to 9,000 years ago across the Near East," Kuijt said. "In many ways food storage is the missing link that helps us understand how so many people were able to live together. And much to our surprise, it appears that they developed this technology at least a 1,000 years before anyone thought they did."

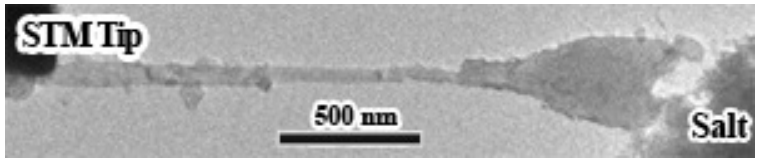
The Dhra' research was funded by grants from Notre Dame, the National Science Foundation and the British Academy.
Kuijt, who joined the Notre Dame faculty in 2001, has worked extensively on Old and New World research projects. His research interests include the emergence of social inequality, prehistoric mortuary practices, the origins of agriculture, paleoenvironmental change and human adaptations, and lithic technology, He is the co-editor of "Complex Hunter Gathers: Evolution and Organization of Prehistoric Communities on the Plateau of Northwestern North America" and "Life in Neolithic Farming Communities: Social Organization, Identity, and Differentiation."

Salt block unexpectedly stretches in Sandia experiments

Nanoscopic discovery may have implications for smog, asthma, cloud formation

Albuquerque, N.M. — To stretch a supply of salt generally means using it sparingly.

But researchers from Sandia National Laboratories and the University of Pittsburgh were startled when they found they had made the solid actually physically stretch.



That's a stretch - Sandia-developed interfacial force microscope (IFM) tip unexpectedly creates a tendril from a block of salt as the tip retreats from the salt surface. The picture was taken by a transmission electron microscope (TEM) at the Sandia/Los Alamos Center for Integrated Nanotechnologies. **(Image by Jianyu Huang)**

"It's not supposed to do that," said Sandia principal investigator Jack Houston. "Unlike, say, gold, which is ductile and deforms under pressure, salt is brittle. Hit it with a hammer, it shatters like glass."

That a block of salt can stretch rather than remain inert might affect world desalination efforts, which involve choosing particular sizes of nanometer-diameter pores to strain salts from brackish water. Understanding unexpected salt deformations also may lead to better understanding of sea salt aerosols, implicated in problems as broad as cloud nucleation, smog formation, ozone destruction and asthma triggers, the researchers write in their paper published in the May Nanoletters.

The serendipitous discovery came about as researchers were examining the mechanical properties of salt in the absence of water. They found unexpectedly that the brittle substance appeared malleable enough to distort over surprisingly long distances by clinging to a special microscope's nanometer-sized tip as it left the surface of the salt.

More intense examination showed that surface salt molecules formed a kind of bubble - a ductile meniscus - with the exploratory tip as it withdrew from penetrating the cube. In this, it resembled the behavior of the surface of water when an object is withdrawn from it. But unlike water, the salt meniscus didn't break from its own weight as the tip was withdrawn. Instead it followed the tip along, slip-sliding away (so to speak) as it thinned and elongated from 580 nanometers (nm) to 2,191 nm in shapes that resembled nanowires.

A possible explanation for salt molecules peeling off the salt block, said Houston, is that "surface molecules don't have buddies." That is, because there's no atomic lattice above them, they're more mobile than the internal body of salt molecules forming the salt block.

Salt showing signs of surface mobility at room temperatures was "totally surprising," said Houston, who had initially intended to study more conventionally interesting characteristics of the one-fourth-inch square, one-eighth-inch-long salt block.

Other researchers on this work include Sandia's Nathan Moore, with Hunhang Luo and Scott Mao from the University of Pittsburgh.

American elderly thrash English at 'brain training' test

American over-65s scored significantly better than their English counterparts at a memory and awareness test. The authors of the research, published in the open access journal BMC Geriatrics, suggest that differences

in relative levels of depression, education, and the aggressiveness of treatment for heart disease may be to blame.

Kenneth Langa, from the University of Michigan, led a team of researchers who used data from the U.S. 'Health and Retirement Study' and the 'English Longitudinal Study of Ageing' to compare the brain health of elderly people from both countries. He said, "The better cognitive performance of U.S. adults was actually quite surprising, since U.S. adults had a higher prevalence of cardiovascular risk factors, which are generally associated with cognitive decline and poorer mental function."

Subjects from both countries took tests of immediate and delayed recall of 10 common nouns like hotel, river, tree, skin, gold, village, baby, and table. They heard the words spoken and were asked to repeat as many as possible immediately, then asked other survey questions and were finally asked to repeat the words again five minutes later. During the interview, participants were also asked what day, date, month, and year it was. Taken together, the answers (10 points for immediate recall, 10 for delayed recall, and 4 for orientation) were used to create 24-point scale of cognitive function.

The average score for the 8,299 American participants was 12.8, while the 5,276 English subjects only averaged 11.4 out of 24. This difference approaches the magnitude associated with about 10 years of aging. In other words, 75-year-olds in the U.S. had memories as good, on average, as 65-year-olds in England. According to Langa, "Higher levels of education and net worth in the U.S. probably accounted for some of the better cognitive performance. Furthermore, U.S. adults reported significantly lower levels of depressive symptoms than English adults".

Transatlantic differences in aggressiveness of cardiovascular disease treatment are also suggested as possible explanations for the English adults' poor showing.

Notes to Editors

1. ***Cognitive health among older adults in the United States and in England*** *Kenneth M Langa, David J Llewellyn, Iain A Lang, David R Weir, Robert B Wallace, Mohammed U Kabeto and Felicia A Huppert BMC Geriatrics (in press)*
During embargo, article available at :http://www.biomedcentral.com/imedia/1088056332514949_article.pdf?random=235621
After the embargo, article available at journal website: http://www.biomedcentral.com/bmcgeriatr/

Hidden cancer threat to wildlife revealed

* 09:00 24 June 2009 **by Catherine Brahic**

Cancer poses a serious threat to wild animals. That is the message of two pathologists working for the Wildlife Conservation Society, in New York, who have for the first time reviewed the impacts of cancer on wildlife around the world.

Conservationists awoke to the problem in the late 1990s when numbers of Tasmanian devils plummeted as a result of the gruesome and disfiguring devil facial tumour disease. The disease causes tumours to form in and around the marsupials' mouth and they eventually die of starvation (see image: may upset some readers).

Tasmanian Devils are perhaps the best known wild animals to suffer from cancer. The contagious devil facial tumour disease could drive the species to extinction, which would make it the first species to be wiped off the planet by cancer. Warning: the last image in this series shows a Tasmanian Devil with facial tumour, and may shock some readers **(Image: KeresH / wiki)**

In 2008, the World Conservation Union listed the Tasmanian devil as endangered. Despite this, "cancer really isn't something that's been on anyone's radar in a conservation sense", says Denise McAloose, chief pathologist for the WCS's global health programme.

Common killer

McAloose and colleague Alisa Newton have gathered together all the known examples of cancer in animals from those published in the scientific literature. Tasmanian devils are by no means the only affected species, and are not the only species to have become endangered because of the disease. Attwater's prairie chickens and western barred bandicoots are also in danger of extinction as a result of cancer.

Worryingly, when conservation biologists created a captive breeding programme for the Attwater's prairie chicken in the 1990s in the hopes of saving the species, they discovered that animals in their programmes harboured the cancer-causing viruses. As a result, reintroducing these animals could now contaminate disease-free wild populations.

Devil Facial Tumour Disease is a contagious form of cancer, which has rapidly spread through Australia's Tasmanian Devil population. It is thought that the disease is spread by bits of skin: for instance, when Tasmanian Devils bite each other **(Image: Public Library of Science)**

The trouble, say the researchers, is that most wild animals live and die in anonymity. "I would guess that there are untold numbers of species that are threatened by cancer," says McAloose. For the vast majority of species, the data simply does not exist to say just how big a problem cancer is.

In instances, where the data does exist, it can be very worrying. Long-term monitoring of the beluga population in the Gulf of St Lawrence in Canada has revealed that 18 per cent of deaths in this particular population are caused by cancer – making it the second leading cause of death (see image). A further 27 per cent of adult animals that were found dead had tumours.

Human interest

The numbers are even more concerning when compared to human figures: cancer is the second leading cause of human death in the US and is responsible for 23 per cent of all deaths.

"Humans and animals aren't all that different," says McAloose. This, she argues, introduces a self-serving reason for monitoring cancer in wild animals. "Anything that affects animals may potentially affect humans." Many animal cancers are triggered or worsened by environmental pollutants. The clean-up of these pollutants benefits humans as well as animals.

And understanding the cancers in animals will help understand them better in humans. The pair list 22 species that suffer from viral cancers. While some of the viruses have only been found in wildlife, others are closely related to human viruses, including papilloma virus, herpes simplex virus and hepatitis virus.

Journal reference: Nature Reviews Cancer (DOI: 10.1038/nrc2665)

Observatory

Reading Pigeons' Brains as They Fly

By HENRY FOUNTAIN

Ever wonder what goes on inside the minds of pigeons? No? Researchers in Europe have.

Alexei L. Vyssotski of the University of Zurich and colleagues have studied the brain activity of homing pigeons as they fly over visual landmarks.

How homing pigeons find their way back to a starting point is not completely known. Studies have shown that the birds variously use the position of the Sun and the Earth's magnetic field as a compass, and sense of smell and visual cues as navigation aids. But the use of visual cues has been difficult to study, because if a bird flies over a landmark and doesn't change its course, it's impossible to know whether the bird has not perceived the cue or is ignoring it.

The researchers developed tiny neurologgers, to record electrical activity in the pigeons' brains as they flew. The birds also carried small global positioning system units to track position. By matching brain activity to location, the researchers could determine the effect of flying over a landmark.

The birds' flights began over water, a relatively featureless environment, and then continued over land to a homing point. This enabled the researchers to determine brain activity as the birds reached the coastline and then flew over other landmarks.

They found that activity in both high- and mid-range frequencies occurred as the birds passed over a landmark. The researchers, who reported their findings in Current Biology, suggest that the mid-range frequencies are linked to the perception of visual information, while the high-frequency activity may be related to cognitive processing - perhaps the recognition of a landmark as something the bird has seen before.

The researchers also observed strong brain activity at two rural locations where there were no significant landmarks. On visiting the two sites, the researchers found that both had colonies of wild pigeons, which was probably what caught the homing pigeons' interest.

First acoustic metamaterial 'superlens' created by U. of I. researchers

CHAMPAIGN, Ill. – A team of researchers at the University of Illinois has created the world's first acoustic "superlens," an innovation that could have practical implications for high-resolution ultrasound imaging, non-destructive structural testing of buildings and bridges, and novel underwater stealth technology.

The team, led by Nicholas X. Fang, a professor of mechanical science and engineering at Illinois, successfully focused ultrasound waves through a flat metamaterial lens on a spot roughly half the width of a wavelength at 60.5 kHz using a network of fluid-filled Helmholtz resonators.

According to the results, published in the May 15 issue of the journal Physical Review Letters, the acoustic system is analogous to an inductor-capacitor circuit. The transmission channels act as a series of inductors, and the Helmholtz resonators, which Fang describes as cavities that house resonating waves and oscillate at certain sonic frequencies almost as a musical instrument would, act as capacitors.

Fang said acoustic imaging is somewhat analogous to optical imaging in that bending sound is similar to bending light. But compared with optical and X-ray imaging, creating an image from sound is "a lot safer, which is why we use sonography on pregnant women," said Shu Zhang, a U. of I. graduate student who along with Leilei Yin, a microscopist at the Beckman Institute, are co-authors of the paper.

Although safer, the resultant image resolution of acoustic imaging is still not as sharp or accurate as conventional optical imaging.

"With acoustic imaging, you can't see anything that's smaller than a few millimeters," said Fang, who also is a researcher at the institute. "The image resolution is getting better and better, but it's still not as convenient or accurate as optical imaging."

The best tool for tumor detection is still the optical imaging, but exposure to certain types of electromagnetic radiation such as X-rays also has its health risks, Fang noted.

"If we wish to detect or screen early stage tumors in the human body using acoustic imaging, then better resolution and higher contrast are equally important," he said. "In the body, tumors are often surrounded by hard tissues with high contrast, so you can't see them clearly, and acoustic imaging may provide more details than optical imaging methods."

Fang said that the application of acoustic imaging technology goes beyond medicine. Eventually, the technology could lead to "a completely new suite of data that previously wasn't available to us using just natural materials," he said.

In the field of non-destructive testing, the structural soundness of a building or a bridge could be checked for hairline cracks with acoustic imaging, as could other deeply embedded flaws invisible to the eye or unable to be detected by optical imaging.

"Acoustic imaging is a different means of detecting and probing things, beyond optical imaging," Fang said.

Fang said acoustic imaging could also lead to better underwater stealth technology, possibly even an "acoustic cloak" that would act as camouflage for submarines. "Right now, the goal is to bring this 'lab science' out of the lab and create a practical device or system that will allow us to use acoustic imaging in a variety of situations," Fang said.

Funding for this research was provided by the Defense Advanced Research Projects Agency, the central research and development agency for the U.S. Department of Defense.

Space shuttle science shows how 1908 Tunguska explosion was caused by a comet

The mysterious 1908 Tunguska explosion that leveled 830 square miles of Siberian forest was almost certainly caused by a comet entering the Earth's atmosphere, says new Cornell University research. The conclusion is supported by an unlikely source: the exhaust plume from the NASA space shuttle launched a century later.

The research, accepted for publication (June 24, 2009) by the journal Geophysical Research Letters, published by the American Geophysical Union, connects the two events by what followed each about a day later: brilliant, night-visible clouds, or noctilucent clouds, that are made up of ice particles and only form at very high altitudes and in extremely cold temperatures.

"It's almost like putting together a 100-year-old murder mystery," said Michael Kelley, the James A. Friend Family Distinguished Professor of Engineering at Cornell who led the research team. "The evidence is pretty strong that the Earth was hit by a comet in 1908." Previous speculation had ranged from comets to meteors.

The researchers contend that the massive amount of water vapor spewed into the atmosphere by the comet's icy nucleus was caught up in swirling eddies with tremendous energy by a process called two-dimensional turbulence, which explains why the noctilucent clouds formed a day later many thousands of miles away.

Noctilucent clouds are the Earth's highest clouds, forming naturally in the mesosphere at about 55 miles over the polar regions during the summer months when the mesosphere is around minus 180 degrees Fahrenheit (minus 117 degrees Celsius).

The space shuttle exhaust plume, the researchers say, resembled the comet's action.

A single space shuttle flight injects 300 metric tons of water vapor into the Earth's thermosphere, and the water particles have been found to travel to the Arctic and Antarctic regions, where they form the clouds after settling into the mesosphere.

Kelley and collaborators saw the noctilucent cloud phenomenon days after the space shuttle Endeavor (STS-118) launched on Aug. 8, 2007. Similar cloud formations had been observed following launches in 1997 and 2003.

Following the 1908 explosion, known as the Tunguska Event, the night skies shone brightly for several days across Europe, particularly Great Britain -- more than 3,000 miles away.

Kelley said he became intrigued by the historical eyewitness accounts of the aftermath, and concluded that the bright skies must have been the result of noctilucent clouds. The comet would have started to break up at about the same altitude as the release of the exhaust plume from the space shuttle following launch. In both cases, water vapor was injected into the atmosphere.

The scientists have attempted to answer how this water vapor traveled so far without scattering and diffusing, as conventional physics would predict.

"There is a mean transport of this material for tens of thousands of kilometers in a very short time, and there is no model that predicts that," Kelley said. "It's totally new and unexpected physics."

This "new" physics, the researchers contend, is tied up in counter-rotating eddies with extreme energy. Once the water vapor got caught up in these eddies, the water traveled very quickly -- close to 300 feet per second.

Scientists have long tried to study the wind structure in these upper regions of the atmosphere, which is difficult to do by such traditional means as sounding rockets, balloon launches and satellites, explained Charlie Seyler, Cornell professor of electrical engineering and paper co-author.

"Our observations show that current understanding of the mesosphere-lower thermosphere region is quite poor," Seyler said. The thermosphere is the layer of the atmosphere above the mesosphere.

The paper is also co-authored by physicist Miguel Larsen, Ph.D. '79, of Clemson University, and former student of Kelley. The work performed at Cornell was funded by the Atmospheric Science Section of the National Science Foundation.

On July 1, Kelley will give a lecture, "Two-dimensional Turbulence, Space Shuttle Plume Transport in the Thermosphere, and a Possible Relation to the Great Siberian Impact Event," at a plenary session of the annual meeting of Coupling, Energetics and Dynamics of Atmospheric Regions in Sante Fe, N.M.

The paper is available at: http://www.agu.org/journals/gl/papersinpress.shtml

Anti-inflammatory drugs may defeat a treatment-resistant type of cancer

Effective drugs for treating a chemotherapy-resistant form of lymphoma might already be on the market according to a study that has pieced together a chemical pathway involved in the disease.

By following the trail of several molecular flags that mark this type of cancer, a team from the University of California, San Diego, the Burnham Institute for Medical Research and the University of Copenhagen Hospital have discovered that anti-inflammatory drugs used to treat arthritis will shrink lymphoma tumors in mice.

Their report, published in the July issue of the journal EMBO Molecular Medicine, also strengthens evidence for a link between inflammation and cancer.

"If this shows promise with early clinical experiments, the treatment would be immediately available," said Michael David, a professor of biology who leads the group at UC San Diego.

The research focused on a type of non-Hodgkin lymphoma called diffuse large B-cell lymphoma. In some patients with the disease, chemotherapy works well. In a recent study of 40 patients more than 75 percent of patients with one form of this type of lymphoma survived five years or longer. But that study also identified a group of patients whose cancer proved difficult to treat. Their tumors failed to respond to chemotherapy, and only 16 percent of patients with this form of lymphoma survived more than five years after they were diagnosed.

Several molecular flags mark this treatment-resistant lymphoma, but the links between them were unknown until now. The new paper reports that tumor cells isolated from these patients have depressed levels of a protein called SHIP1, which was known to suppress tumors. In fact, patients with the lowest levels of SHIP1 are the least likely to survive.

The resistant type of lymphoma cells also have elevated levels of miR-155, a specific example of a type of genetic material called microRNA, the team found. They demonstrated that miR-155 suppresses SHIP1 by sticking to the template for the protein, preventing its manufacture.

This raised the possibility that these patients might respond favorably to a treatment that interrupted that pathway. "It makes sense to block that loop," said Irene Pedersen, a research scientist in the Division of Biological Sciences at UC San Diego and lead author of the paper.

The final clue came from earlier reports that an inflammatory molecule called TNFα could boost levels of miR-155. Additional laboratory work confirmed the observation for this type of lymphoma cell.

"Our study strengthens the scientific link between inflammation and tumor progression," David said. "The prevailing thought is that you need two mutations to get cancer. But it might take just one mutation plus inflammation."

The anti-inflammatory drugs etanercept and infliximab, which are currently used to treat arthritis and inflammatory bowel disease, work by suppressing TNFα, suggesting a new way to curb the malignancy of this type of lymphoma.

The team tested the idea in mice that had been injected with aggressive lymphoma cells and found that nascent tumors shrank in six days. "It's a promising result of this whole translational path," said Pedersen, whose initial training was in cancers of the blood. "To get somewhere we had to study the mouse models and the molecular profiles. I hope it will be beneficial to patients."

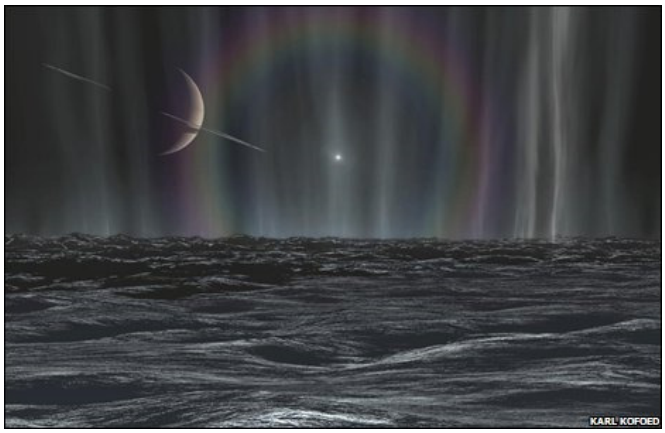
Patients with lymphoma that has not responded to chemotherapy and who are ineligible for a bone-marrow transplant will be the first to receive the new treatment. The team in Copenhagen has begun recruiting patients for an initial clinical study.

Grants from the National Cancer Institute and the Novo Nordisk Foundation supported this research program.

'Misty caverns' on Enceladus moon

By Jonathan Amos Science reporter, BBC News

Nasa's Cassini spacecraft has obtained strong evidence that Saturn's tiny moon Enceladus retains liquid water.



The plumes have been one of the great discoveries of the Cassini mission

The probe has detected sodium salts in the vicinity of the satellite, which appear to spew from its south pole.

Liquid water that is in prolonged contact with rock will leach out sodium - in exactly the same way as Earth's oceans have become salty over time.

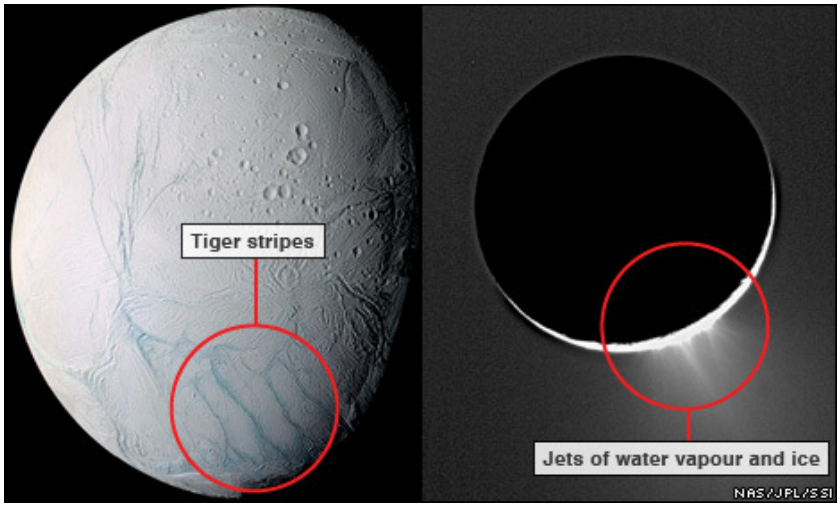
Scientists tell Nature magazine that the liquid water may reside in caverns just below the surface of the moon.

If confirmed, it is a stunning result. It means the Saturnian satellite may be one of the most promising places in the Solar System to search for signs of extraterrestrial life.

"We need three ingredients for life, as far as we know - liquid water, energy and the basic chemical building blocks - and we seem to have all three at Enceladus, including some fairly complex organic molecules," commented John Spencer, a Cassini scientist from the Southwest Research Institute, Boulder, Colorado.

"That's not to say there is life on Enceladus but certainly the 'feedstock' is there for life to use if it does exist," he told BBC News.

ENCELADUS - AN ACTIVE MOON OF SATURN



Enceladus experiences tidal contortions as it orbits its parent planet
This energy is producing a "hotspot" at the satellite's southern pole
Big cracks (L) are 100 degrees warmer than the surrounding ice surface
These tiger stripes are the source of immense plumes (R)

Scientists have been looking for sodium near Enceladus since the discovery in 2005 that this 500km-wide moon was active and hurling water vapour and ice particles into space.

The vapour and ice particles emerge in super-fast jets from a series of "warm" surface cracks referred to as "tiger stripes" because of their resemblance to the big cat's coat markings.

Researchers speculated that the jets could be being fed by a large sub-surface body of liquid water, even an ocean. But the best indicator remained frustratingly elusive.

If it existed, such a mass of water in contact with rock deep within Enceladus would acquire a range of dissolved salts over time and these ought to be detectable in the jets by Earth telescopes.

Indeed, sodium (which in Earth's oceans forms the dominant sea salt, sodium chloride) is one of the easiest elements for observatories to spot in space.

However, even mighty telescopes like the Keck on Mauna Kea in Hawaii could never see sodium when they looked towards Enceladus. The latest Cassini data appears to solve this conundrum.

The Nasa spacecraft has been flying through Saturn's outer E ring which is sustained by the constant stream of material coming up from the tiger stripes.

Using its Cosmic Dust Analyser (CDA), Cassini has analysed thousands of ice grains and directly "tasted" the missing salt - principally sodium chloride and sodium bicarbonate ("baking soda").

The amounts, though, are tiny - less than 2% of the mass of the sampled grains.

The low abundance helps explain why the telescopes had overlooked the salt. The fact that the sodium is bound into the water-ice molecules also effectively hides its light signature from the observatories' instruments.

However, scientists say the Cassini and telescope observations taken together give hints about what the water reservoir on Enceladus might look like.

The popular picture that is now emerging is of a very deep mass of water pressed up against the moon's rocky core and which is dissolving the salts.

Water from this sub-surface sea is then working its way up to shallower reservoirs through a network of faults in Enceladus's ice mantle.

Scientists envisage misty caverns just below the tiger stripes where some of the water vaporises free of sodium and some of it becomes frozen into the small grains detected by Cassini.

"Water droplets are probably lifted by gas bubbles in the water (like the spray you see above sparkling water)," said Nature author Frank Postberg, a CDA scientist with the Max Planck Institute for Nuclear Physics, Heidelberg, Germany.

"These aerosol-droplets shock freeze and conserve the liquid composition. Then they are accelerated upwards through the cracks in the ice crust by the up-streaming vapour."

Critically, the whole process cannot be too energetic otherwise the salt would be blown into space in a way that would be visible to Earth telescopes. A previous suggestion that the jets are geyser-like phenomena is dead.

"This idea of slow evaporation from a deep cavernous ocean is not the dramatic idea that we imagined before, but it is possible given both our results so far," said Professor Nicholas Schneider, whose telescopes team has a companion paper to Postberg's in Nature.

But the Colorado University-Boulder scientist also cautioned that the presence of sub-surface water was not yet proven fact. Several other explanations for the jets were equally plausible, he said.

"It could still be warm ice vaporising away into space. It could even be places where the crust rubs against itself from tidal motions and the friction creates liquid water that would then evaporate into space," he said. "These are all hypotheses but we can't verify any one with the results so far."

The Cassini-Huygens mission is a co-operative project of Nasa, the European Space Agency (Esa) and the Italian space agency (Asi).

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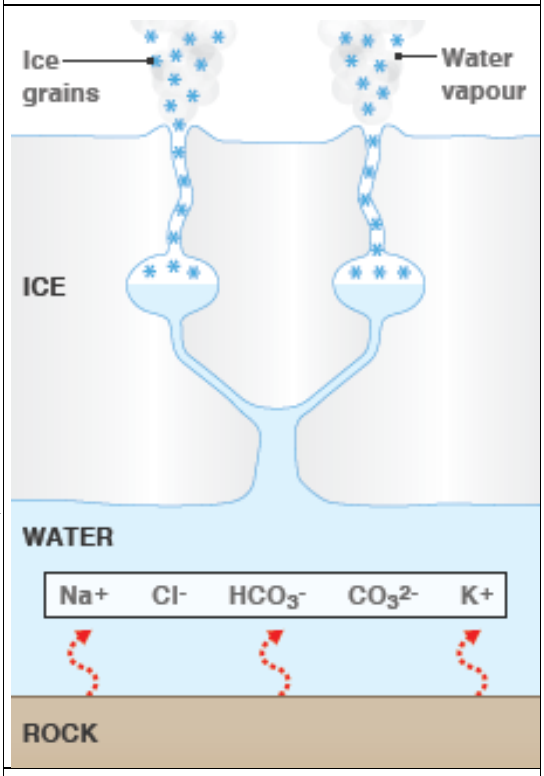
HOW THE 'PLUMBING' MIGHT LOOK



Tidal heating melts ices to produce a large sub-surface sea
Liquid water in contact with the rocky core dissolves minerals
The salty water moves up through the mantle to large caverns
The bubbling reservoirs slowly vaporise and make ice grains
This material is drawn up through cracks and shot out into space

Tiny levels of carbon monoxide damage fetal brain

UCLA study suggests need for tighter regulation of car exhaust, home heaters

A UCLA study has discovered that chronic exposure during pregnancy to miniscule levels of carbon monoxide damages the cells of the fetal brain, resulting in permanent impairment. The journal BMC (BioMed Central) Neuroscience published the findings June 22 in its online edition.

"We expected the placenta to protect fetuses from the mother's exposure to tiny amounts of carbon monoxide," said John Edmond, professor emeritus of biological chemistry at the David Geffen School of Medicine at UCLA. "But we found that not to be the case."

The researchers exposed pregnant rats to 25 parts per million carbon monoxide in the air, an exposure level established as safe by Cal/OSHA, California's division of occupational health and safety.

Dr. Ivan Lopez, UCLA associate professor of head and neck surgery, tested the rats' litters 20 days after birth. Rats born to animals who had inhaled the gas suffered chronic oxidative stress, a harmful condition caused by an excess of harmful free radicals or insufficient antioxidants.

"Oxidative stress damaged the baby rats' brain cells, leading to a drop in proteins essential for proper function," said Lopez. "Oxidative stress is a risk factor linked to many disorders, including autism, cancer, Alzheimer's, Parkinson's, Lou Gehrig's disease, multiple sclerosis and cardiovascular disease. We know that it exacerbates disease. We believe that the minute levels of carbon monoxide in the mother rats' environment made their offspring more vulnerable to illness," added Edmond. "Our findings highlight the need for policy makers to re-examine the regulation of carbon monoxide."

Tobacco smoke, gas heaters, stoves and ovens all emit carbon monoxide, which can rise to high concentrations in well-insulated homes. Infants and children are particularly vulnerable to carbon monoxide exposure because they spend a great deal of time in the home.

No policies exist to regulate the gas in the home. Most commercial home monitors sound an alarm only hours after concentrations reaches 70 parts per million--nearly three times the 25 parts per million limit set by Cal/OSHA.

A grant from the University of California's Tobacco-related Disease Research Program supported the research.

'Stoned wallabies make crop circles'

Australian wallabies are eating opium poppies and creating crop circles as they hop around "as high as a kite", a government official has said.

Lara Giddings, the attorney general for the island state of Tasmania, said the kangaroo-like marsupials were getting into poppy fields grown for medicine.

She was reporting to a parliamentary hearing on security for poppy crops.

Australia supplies about 50% of the world's legally-grown opium used to make morphine and other painkillers.

"The one interesting bit that I found recently in one of my briefs on the poppy industry was that we have a problem with wallabies entering poppy fields, getting as high as a kite and going around in circles," Lara Giddings told the hearing.

"Then they crash," she added. "We see crop circles in the poppy industry from wallabies that are high."

Rick Rockliff, a spokesman for poppy producer Tasmanian Alkaloids, said the wallaby incursions were not very common, but other animals had also been spotted in the poppy fields acting unusually.

"There have been many stories about sheep that have eaten some of the poppies after harvesting and they all walk around in circles," he added.

Retired Tasmanian poppy farmer Lyndley Chopping also said he had seen strange behaviour from wallabies in his fields. "They would just come and eat some poppies and they would go away," he told ABC News.

"They'd come back again and they would do their circle work in the paddock."

Some people believe the mysterious circles that appear in fields in a number of countries are created by aliens. Others put them down to a human hoax.

Flutes Offer Clues to Stone-Age Music

By JOHN NOBLE WILFORD

At least 35,000 years ago, in the depths of the last ice age, the sound of music filled a cave in what is now southwestern Germany, the same place and time early Homo sapiens were also carving the oldest known examples of figurative art in the world.

Music and sculpture - expressions of artistic creativity, it seems - were emerging in tandem among some of the first modern humans when they began spreading through Europe or soon thereafter.

Nicholas J. Conard of the University of Tübingen, in Germany, showed a thin bird-bone flute carved some 35,000 years ago. **Daniel Maurer/Associated Press**

Archaeologists Wednesday reported the discovery last fall of a bone flute and two fragments of ivory flutes that they said represented the earliest known flowering of music-making in Stone Age culture. They said the bone flute with five finger holes, found at Hohle Fels Cave in the hills west of Ulm, was “by far the most complete of the musical instruments so far recovered from the caves” in a region where pieces of other flutes have been turning up in recent years.

A three-hole flute carved from mammoth ivory was uncovered a few years ago at another cave, as well as two flutes made from the wing bones of a mute swan. In the same cave, archaeologists also found beautiful carvings of animals.

But until now the artifacts appeared to be too rare and were not dated precisely enough to support wider interpretations of the early rise of music. The earliest solid evidence of musical instruments previously came from France and Austria, but dated much more recently than 30,000 years ago.

In an article published online by the journal Nature, Nicholas J. Conard of the University of Tübingen, in Germany, and colleagues wrote, “These finds demonstrate the presence of a well-established musical tradition at the time when modern humans colonized Europe.”

Although radiocarbon dates earlier than 30,000 years ago can be imprecise, samples from the bones and associated material were tested independently by two laboratories, in England and Germany, using different methods. Scientists said the data agreed on ages of at least 35,000 years.

Dr. Conard, a professor of archaeology, said in an e-mail message from Germany that “the new flutes must be very close to 40,000 calendar years old and certainly date to the initial settlement of the region.”

Dr. Conard’s team said an abundance of stone and ivory artifacts, flint-knapping debris and bones of hunted animals had been found in the sediments with the flutes. Many people appeared to have lived and worked there

soon after their arrival in Europe, assumed to be around 40,000 years ago and 10,000 years before the native Neanderthals became extinct.

The Neanderthals, close human relatives, apparently left no firm evidence of having been musical.

The most significant of the new artifacts, the archaeologists said, was a flute made from a hollow bone from a griffon vulture; griffon skeletons are often found in these caves. The preserved portion is about 8.5 inches long and includes the end of the instrument into which the musician blew. The maker carved two deep, V-shaped notches there, and four fine lines near the finger holes. The other end appears to have been broken off; judging by the typical length of these bird bones, two or three inches are missing.

Dr. Conard's discovery in 2004 of the seven-inch three-hole ivory flute at the Geissenklösterle cave, also near Ulm, inspired him to widen his search of caves, saying at the time that southern Germany "may have been one of the places where human culture originated."

Friedrich Seeberger, a German specialist in ancient music, reproduced the ivory flute in wood. Experimenting with the replica, he found that the ancient flute produced a range of notes comparable in many ways to modern flutes. "The tones are quite harmonic," he said.

A replica has yet to be made of the recent discovery, but the archaeologists said they expected the five-hole flute with its larger diameter to "provide a comparable, or perhaps greater, range of notes and musical possibilities."

This week, Dr. Conard began a new season of exploration at Hohle Fels Cave. "We'll see how it goes," he said by e-mail. "I never have expectations. One never finds what one is looking for, but one normally finds something interesting."

Archaeologists and other scholars can only speculate as to what moved these early Europeans to make music.

It so happens that the Hohle Fels flute was uncovered in sediments a few feet away from the carved figurine of a busty, nude woman, also around 35,000 years old, noted Dr. Conard and his co-authors, Susanne C. Münzel of Tübingen and Maria Malina of the Heidelberg Academy of Sciences and Humanities. That discovery was announced in May by Dr. Conard.

Was this evidence of happy hours after the hunt? Fertility rites or social bonding? The German archaeologists suggested that music in the Stone Age "could have contributed to the maintenance of larger social networks, and thereby perhaps have helped facilitate the demographic and territorial expansion of modern humans."

Artificial liver for drug tests

This release is available in **German**.

If you have hay fever, headaches or a cold, it's only a short way to the nearest chemist. The drugs, on the other hand, can take eight to ten years to develop. Until now animal experiments have been an essential step, yet they continue to raise ethical issues. "Our artificial organ systems are aimed at offering an alternative to animal experiments," says Professor Heike Mertsching of the Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB in Stuttgart. "Particularly as humans and animals have different metabolisms. 30 per cent of all side effects come to light in clinical trials." The test system, which Professor Mertsching has developed jointly with Dr. Johanna Schanz, should in future give pharmaceutical companies greater security and shorten the path to new drugs. Both researchers received the "Human-centered Technology" prize for their work.

"The special feature, in our liver model for example, is a functioning system of blood vessels," says Dr. Schanz. "This creates a natural environment for cells." Traditional models do not have this, and the cells become inactive. "We don't build artificial blood vessels for this, but use existing ones – from a piece of pig's intestine." All of the pig cells are removed, but the blood vessels are preserved. Human cells are then seeded onto this structure – hepatocytes, which, as in the body, are responsible for transforming and breaking down drugs, and endothelial cells, which act as a barrier between blood and tissue cells. In order to simulate blood and circulation, the researchers put the model into a computer-controlled bioreactor with flexible tube pump, developed by the IGB. This enables the nutrient solution to be fed in and carried away in the same way as in veins and arteries in humans. "The cells were active for up to three weeks," says Dr. Schanz. "This time was sufficient to analyze and evaluate the functions. A longer period of activity is possible, however." The researchers established that the cells work in a similar way to those in the body. They detoxify, break down drugs and build up proteins. These are important pre-conditions for drug tests or transplants, as the effect of a substance can change when transformed or broken down – many drugs are only metabolized into their therapeutic active form in the liver, while others can develop poisonous substances. The researchers have demonstrated the basic possibilities for use of the tissue models – liver, skin, intestine and windpipe. At the

moment, the test system is being examined. Within two years it could provide a safer alternative to animal experiments.

New Research Shows Dinosaurs May Have Been Smaller Than We Thought

FAIRFAX, Va. – For millions of years, dinosaurs have been considered the largest creatures ever to walk on land. While they still maintain this status, a new study suggests that some dinosaurs may actually have weighed as little as half as much as previously thought.

In the study, published this week in the Journal of Zoology, Geoffrey Birchard, associate professor of environmental science and policy at George Mason University, was part of a team which uncovered a problem with the statistical model used by some scientists in the dinosaur community to estimate the mass of dinosaurs.

"The original equation used by scientists produces fairly accurate results when determining the mass of smaller animals, but when used on larger animals our research shows that many errors have occurred," says Birchard. "The new equation shows that dinosaurs are much smaller than we thought, but there is no mistaking that they were indeed huge animals."

Developed in 1985, the results of the original equation have been used by scientists to estimate or evaluate a variety of parameters, including brain size and egg size. The problem occurs as a result of transforming the data, which changes the properties of the original data, and creates biases that can affect the predictive results obtained from the equation.

Birchard and his colleagues realized there was an error when they used the equation to determine the weight of living animals such as a hippopotamus and an elephant and discovered that the equation greatly overestimated the weight of these animals.

The researchers developed a new equation for calculating dinosaur mass based on bone dimensions. This equation doesn't require the transformation of data that the original equation uses.

"The best way to understand the new equation is to think about a building that is built on pillars,"says Birchard. "The bigger the building, the larger the pillars must be to support the weight of the building. In the same way, the legs of an animal are the pillars supporting its body."

According to Birchard, this new research suggests that some dinosaurs were much more slender than had been thought. It also changes many of the factors scientists have already determined about dinosaurs such as the amount of muscle required to use their bodies and how much they ate and breathed.

Editor's note: *For a copy of the paper titled "Allometric equations for predicting body mass of dinosaurs" published in the Journal of Zoology, contact Catherine Ferraro at 703-993-8813 or cferraro@gmu.edu.*

Solar X-rays may create DNA building blocks on Titan

* Updated 15:40 26 June 2009 **by Lisa Grossman**

Blasting the atmosphere of Saturn's moon Titan with X-rays can produce a base component of DNA, a new laboratory study suggests. While the effect may only occur periodically, when meteoroid impacts deliver water to the moon's surface, the finding adds to evidence that Titan may be ripe for life.

In some ways, Titan is more like Earth than any other body in the solar system. It has continents, lakes, clouds, and perhaps even rain – but where Earth has rock and water, Titan has ice and methane. It may also harbour an ocean of liquid water beneath its icy surface that could host life. With its nitrogen-rich atmosphere and abundance of organic material, Titan seems like a model of the early Earth.

But how did life on Earth get started, and might a similar process have a chance on Titan? For decades, researchers have been trying to recreate life's appearance on the early Earth by zapping materials thought to be present there with electricity or high-energy photons. The first such trial, called the Miller-Urey experiment, was performed in the early 1950s and produced amino acids, the building blocks of proteins.

DNA base

In the 50 years since, dozens of teams have expanded on Stanley Miller and Harold Urey's original setup, using a wide variety of energy sources and gases that modelled conditions not only on Earth, but on interstellar dust grains and on Titan.

In 1984, a team that included Carl Sagan created adenine, one of five base components of DNA and RNA, in Titan-like conditions, using a spark of electricity meant to simulate lightning.

But so far no evidence of lightning has been found on Titan. And until now studies hitting Titan-like atmospheres with photons, like those it receives from the sun, have produced only organic compounds like benzene – and none of the components of DNA.

Now, researchers led by Sergio Pilling of the Catholic University of Rio de Janeiro in Brazil have produced the base adenine using photons for the first time.

Ancient impacts

Instead of using ultraviolet (UV) radiation as in previous studies, however, they used low-energy, or "soft", X-rays. "Soft X-rays can penetrate deeper in Titan's atmosphere and reach denser regions [than UV]," Pilling told New Scientist, adding that X-rays set off different chemical reactions in Titan's atmosphere.

They modelled Titan's current atmosphere using a mixture of nitrogen and methane gas, and added water to it to simulate the conditions when the moon is bombarded with water-bearing comets or asteroids – a situation that occurred much more frequently in the early solar system.

A frozen sheet of salty water ice lay below this 'atmosphere' and caused the gas to condense into liquid droplets, like dew settling onto Titan's icy surface.

Extra heat

Then the researchers bombarded the setup with X-rays for up to three days, representing the radiation that Titan would get from the sun over a period of about 7 million years. Afterwards, the still-frozen surface contained some organic compounds, but nothing that could be called the building blocks of life.

But when they heated the samples to room temperature, adenine appeared.

That means Titan's saucepan of proto-life would need a source of extra heat to activate. If there was a warm period in Titan's history, perhaps prompted by volcanic activity or meteoroid impacts, "a primitive life could have had a chance to flourish there", the researchers write.

And Titan is due to be heated up in the next few billion years, when the sun bloats into a red giant star, expanding to the present orbit of Earth, they say.

One molecule

Chris McKay, an astrobiologist at NASA, says the work is interesting, but adds that it may be difficult for life to get started on the moon's surface most of the time. "Adenine synthesis is important, but because Titan lacks water and essentially lacks any molecule that includes oxygen, prebiotic synthesis cannot get very far," he told New Scientist.

But if impacts sometimes allow water to exist on the moon's surface, "then things might happen", he says. "It is interesting to see how far the chemistry can go."

Jonathan Lunine of the University of Arizona agrees. "This is interesting but not seminal," he told New Scientist. He points out that adenine is just one of many molecules used by life on Earth, so its creation in the experiment does not mean Titan has all the elements needed to create life as we know it.

Some researchers have speculated that microbes on Titan might breathe hydrogen, eat organic molecules drifting down from the upper atmosphere and excrete methane. But so far there is no evidence of life on the moon, and if any does exist, it may use entirely different building blocks from that on Earth (see Life - but not as we know it). Journal reference: Journal of Physical Chemistry A (DOI: 10.1021/jp902824v)

If an adolescent has a lump in her breast, does she really need a biopsy?

Loyola Study Suggests Ultrasounds May be Sufficient in Many Cases

MAYWOOD -- If a lump is found in the breast of an adolescent girl, she often will undergo an excisional biopsy.

However, breast cancer is rare in adolescents, and the vast majority of teenage breast lumps turn out to be benign masses that are related to hormones.

A recent Loyola University Health System study published in the American Journal of Roentgenology suggests that a breast ultrasound examination might eliminate the need for biopsy in many cases.

Loyola radiologists performed ultrasound examinations on 20 girls ages 13 to 19 who had lumps in their breasts, including one girl who had a lump in each breast. The ultrasound studies indicated that 15 of the 21 lumps appeared to be benign, while and six were suspicious.

Follow-up biopsies or clinical examinations found that all 21 lumps were benign. These findings suggest that if a breast ultrasound finds nothing suspicious, the patient likely does not need to have an excisional biopsy, said lead author Dr. Aruna Vade, a professor in the Department of Radiology at Loyola University Chicago Stritch School of Medicine.

In an excisional biopsy, the surgeon makes an incision along the contour of the breast and removes the lump. However, this procedure can be painful, change the shape of the breast and leave a small scar.

Vade and her colleagues indicated that excisional biopsies should be reserved for solid breast masses that are suspicious or show progressive growth or masses that are found in patients who are known to have a primary malignant tumor or family history of cancer. Their study is published in the September, 2008 issue of the American Journal of Roentgenology.

Among girls younger than 19, there are fewer than 25 cases of breast cancer per 100,000 per year, according to the National Cancer Institute.

The vast majority of breast lumps in adolescents are benign and tend to wax and wane. Over time, many disappear. Many teenage girls undergo biopsy of breast lumps because of parental anxiety and surgeons' concerns, Vade said.

Vade and colleagues wrote that for adolescents who present with solid masses that appear benign on ultrasound examination, "we conclude that excisional biopsy may not always be necessary."

Vade's co-authors are Dr. Kathleen Ward, medical director of Women's Health Imaging, Loyola University Health System; Dr. Jennifer Lim-Dunham, clinical associate professor in the Department of Radiology, Loyola University Chicago Stritch School of Medicine; Dr. Davide Bova, assistant professor of radiology at Stritch and Dr. Vaishali Lafita, a radiology resident at Loyola University Medical Center.

U-M study finds voice box can be preserved, even with the largest cancers

Chemotherapy, radiation an option for select laryngeal cancer patients

ANN ARBOR, Mich. — Some patients with large tumors on their larynx can preserve their speech by opting for chemotherapy and radiation over surgery to remove the voice box.

A new study from the University of Michigan Comprehensive Cancer Center found that a single round of chemotherapy could identify those patients most likely to benefit from this approach.

"Organ preservation studies have excluded these patients because their tumors are so large. We found that if a patient's tumor does not respond to chemotherapy, the patient can be instantly referred for a laryngectomy, which is the standard of care. But if the tumor responded to the drugs, perhaps some of those people could survive the cancer with their voice box intact," says lead study author Francis P. Worden, M.D., associate professor of internal medicine at the U-M Medical School.

Researchers reviewed data from two U-M studies of advanced laryngeal cancer patients, looking specifically at patients who had the largest tumors, called T4. In addition to being large, T4 tumors have often invaded the nearby cartilage, making them particularly difficult to treat.

Study participants were given one round of induction chemotherapy, an initial dose designed to see if the cancer responds. If the tumor shrank by more than 50 percent after that first round, study participants were given three more rounds of chemotherapy, combined with daily radiation therapy.

Those whose tumors did not respond to the induction chemotherapy were referred for surgery.

Thirty-six people with T4 disease were enrolled in the two studies. Eighty-one percent responded to the induction chemotherapy and many saw their tumors shrink completely. After three years, 78 percent of the T4 study participants were still alive, and 58 percent still had an intact larynx.

Results of the study appear online in the journal Laryngoscope.

While chemotherapy and radiation come with unpleasant and serious side effects, avoiding surgery allows patients to retain their voice. The study found that people who preserved their larynx reported better quality of life and less depression than those who had surgery. Few people required a feeding tube or tracheostomy.

"If the patient failed chemotherapy up front, he or she could go straight to surgery and avoid the side effects of chemo-radiation," Worden says. "Meanwhile, a large group of patients get to preserve their voice box by avoiding laryngectomy."

"We saw no survival difference between the smallest and the largest tumors, which suggests that organ preservation is a viable alternative to surgery for some of the largest laryngeal cancers," he adds.

Laryngeal cancer statistics: 12,290 Americans will be diagnosed with laryngeal cancer this year and 3,660 will die from the disease, according to the National Cancer Institute

Additional authors: Jeffrey Moyer, M.D.; Julia S. Lee; Jeremy M.G. Taylor, Ph.D.; Susan G. Urba, M.D.; Avraham Eisbruch, M.D.; Theodoros N. Teknos, M.D.; Douglas B. Chepeha, M.D.; Mark E. Prince, M.D.; Norman Hogikyan, M.D.; Amy Anne D. Lassig, M.D.; Kevin Emerick, M.D.; Suresh Mukherji, M.D.; Lubomir Hadjiski, Ph.D.; Christina I. Tsien, M.D.; Tamara H. Miller; Nancy E. Wallace; Heidi L. Mason, N.P.; Carol R. Bradford, M.D.; and Gregory T. Wolf, M.D.

Funding: National Institutes of Health, U-M Head and Neck Cancer SPORE grant, U-M Comprehensive Cancer Center support grant

Reference: Laryngoscope, DOI: 10.1002/lary.20294

Partner issues significantly influence women's sexual activity in later years, UCSF study shows

As a woman gets older, physical problems are less likely to influence whether she is sexually active than her partner's health or interest in sex, according to a new study by researchers at the University of California, San Francisco and Kaiser Permanente.

The study also showed significant differences in the frequency of sexual activity, as well as sexual desire and satisfaction, among racial groups of middle-aged and elderly women. Study results appear in the June 24, 2009 online version of the "Journal of the American Geriatrics Society."

In the study of nearly 2,000 women, aged 45 to 80 years old, 43 percent reported at least moderate sexual desire, and 60 percent had been sexually active in the previous three months. Half of all sexually active participants described their overall sexual satisfaction as moderate to high. More than one quarter of women aged 65 years or older remained moderately or highly interested in sex, and more than one third of women in this age group had been sexually active in the past three months.

Among sexually inactive women in the entire group, the most common reason was lack of interest in sex (39 percent), followed by lack of a partner (36 percent), physical problem of partner (23 percent) and lack of interest by partner (11 percent). Only nine percent were inactive from personal physical problems.

Sexual activity was defined as any activity that was arousing, including masturbation.

"Our findings indicate that a substantial portion of women are interested and engaged in sexual activity as they age," said lead author Alison Huang, MD, assistant professor in internal medicine at the University of California, San Francisco. "Clinicians should consider a woman's overall health when addressing concerns about sexual inactivity. However, treatment directed solely at improving women's sexual functioning, such as medications, may not substantially affect their activity if partner issues also are not addressed."

The U.S. population is becoming increasingly diverse and older, as the first wave of baby boomers is turning 65 years old. Researchers evaluated multiple dimensions of sexual functioning among a racially and ethnically diverse group of middle-aged and older women who self–identified demographic characteristics, medical history, medication use and health habits. More than half the women in the overall study were of non-white ethnicity -- 20 percent were African American, 18 percent were Latina, and 19 percent were Asian – and over two-thirds of participants were married or living as married.

African American women were more likely than white women to report at least moderate desire but less likely to report weekly sexual activity, and sexually active Latinas were more likely than white women to report at least moderate sexual satisfaction.

"To date, research has focused rather narrowly on the physical factors that contribute to women's sexual response, and very little analysis has explored sexual function among racially and ethnically diverse women. Further work is needed to understand the differences in self-reported sexual functioning by race, and how they change as women age. Ultimately, this information should help guide clinicians in discussing sexual problems with women of diverse backgrounds," said Huang.

To ensure confidentiality, participants completed questions in private and submitted them to study personnel in sealed envelopes.

Co-authors of the study are Leslee L. Subak, MD, David H. Thom, MD, Miriam Kuppermann, PhD, and Jeanette S. Brown, MD, all from UCSF; Stephen K. Van Den Eden, PhD and Arona I. Ragins, MA, from Kaiser Permanente; and Hui Shen, MS from UCSF and the San Francisco Veterans Affairs Medical Center.

A Penny for Your Prions

North Carolina State University researchers have discovered a link between copper and the normal functioning of prion proteins, which are associated with transmissible spongiform encephalopathy diseases such as Creutzfeldt-Jakob in humans or "mad cow" disease in cattle. Their work could have implications for patients suffering from these diseases, as well as from other prion-related diseases such as Alzheimer’s or Parkinson's.

Prion proteins, or PrPs, are commonly found in brain tissue and throughout the central nervous system. In humans or animals with prion diseases, these proteins deform and aggregate, creating clumps of PrPs that interfere with the nervous system's ability to function normally. A team of NC State physicists, led by Miroslav Hodak and Jerry Bernholc, has found that when PrPs bind with copper in the human body, their structure becomes more stable and less likely to misfold or aggregate.

"We believe that a prion protein's normal function is to serve as a copper buffer in the human body, binding with copper ions and keeping those ions from damaging human tissue," Hodak says. "We wanted to determine whether this was the normal function of the prion, and then look at how that binding affected the prion's structure."

The researchers created a 3-D model of the PrP using supercomputers at Oak Ridge National Laboratories. With the model, they determined that PrPs can bind up to four copper ions apiece, depending on the concentration of copper present. They also found that when the PrPs bind to the copper ions, the structure of the protein changes, becoming more stable.

Their results are published online this week in Proceedings of the National Academy of Sciences.

"Prion proteins are unusual in that half of the protein has a well-defined structure, but the other half of it - where the binding occurs - is a flexible, random tangle," Hodak says. "When we looked at the so-called 'random' portion of the PrP where that binding occurs, we found that the copper ions lend stability to the overall protein. This stability may play a role in preventing PrPs from misfolding or aggregating - which indicates that with prion diseases, copper binding may be beneficial."

Note to editors: An abstract of the paper follows."Cu2+ Binding to the Prion Protein: Functional Implications and the Role of Copper"

Legless frogs mystery solved

Matt Walker Editor, Earth News

Scientists think they have resolved one of the most controversial environmental issues of the past decade: the curious case of the missing frogs' legs.

Around the world, frogs are found with missing or misshaped limbs, a striking deformity that many researchers believe is caused by chemical pollution. However, tests on frogs and toads have revealed a more natural, benign cause.

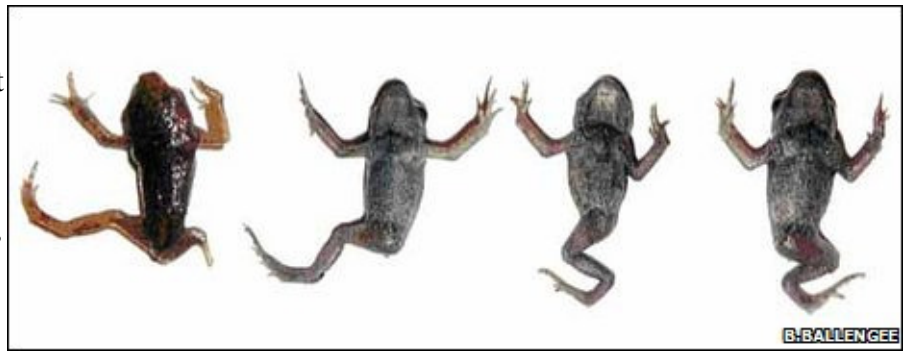
The deformed frogs are actually victims of the predatory habits of dragonfly nymphs, which eat the legs of tadpoles.

In the late 1980s and early 1990s, researchers started getting reports of numerous wild frogs or toads being found with extra legs or arms, or with limbs that were partly formed or missing completely.

The cause of these deformities soon became a hotly contested issue.

Some researchers believed they might be caused naturally, by predators or parasites.

Others thought that was highly unlikely, fearing that chemical pollution, or UV-B radiation caused by the thinning of the ozone layer, was triggering the deformations.



Deformed toads, each a product of 'selective predation'

"Deformed frogs became one of the most contentious environmental issues of all time, with the parasite researchers on one side, and the 'chemical company' as I call them, on the other," says Stanley Sessions, an amphibian specialist and professor of biology at Hartwick College, in Oneonta, New York.

"There was a veritable media firestorm, with millions of dollars of grant money at stake."

After a long period of research, Sessions and other researchers established that many amphibians with extra limbs were actually infected by small parasitic flatworms called Riberoria trematodes.

These creatures burrow into the hindquarters of tadpoles where they physically rearrange the limb bud cells and thereby interfere with limb development.

"But that was not end of the story," says Sessions.

"Frogs with extra limbs may have been the most dramatic-looking deformities, but they are by far the least common deformities found," he explains.

"The most commonly found deformities are frogs or toads found with missing or truncated limbs, and although parasites occasionally cause limblessness in a frog, these deformities are almost never associated with the trematode species known to cause extra limbs."

Missing legs

The mystery of what causes frogs to have missing or deformed limbs remained unsolved until Sessions teamed up with colleague Brandon Ballengee of the University of Plymouth, UK. They report their findings in the Journal of Experimental Zoology Part B: Molecular and Developmental Evolution.

For a decade, Ballengee and Sessions have collaborated on a series of art and science projects that image amphibians' bodies to show the detail within, the most recent of which is funded by the Arts Catalyst organisation, based in London.

As part of this work, Ballengee and Richard Sunter, the official Recorder of Reptiles and Amphibians in Yorkshire, spent time during the summers of 2006 to 2008 surveying the occurrence of deformities in wild amphibians at three ponds in the county.

In all, they found that between 1.2% and 9.8% of tadpoles or metamorphosed toads at each location had hind limb deformities. Three had missing eyes.

"We were very surprised when we found so many metamorphic toads with abnormal limbs, as it was thought to be a North American phenomenon," says Ballengee.

While surveying, Ballengee also discovered a range of natural predators he suspected could be to blame, including stickleback fish, newts, diving beetles, water scorpions and predatory dragonfly nymphs.

So Ballengee and Sessions decide to test how each predator preyed upon the tadpoles, by placing them together in fish tanks in the lab. None did, except three species of dragonfly nymph.

Crucially though, the nymphs rarely ate the tadpoles whole. More often than not, they would grab the tadpole and chew at a hind limb, often removing it altogether.

"Once they grab the tadpole, they use their front legs to turn it around, searching for the tender bits, in this case the hind limb buds, which they then snip off with their mandibles," says Sessions.

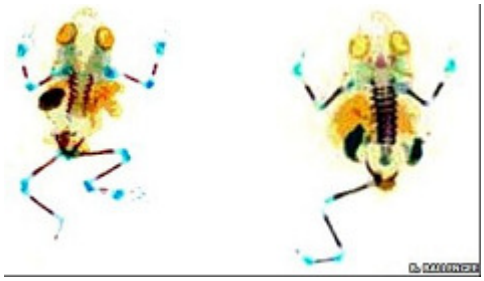
Stunted growth

Remarkably, many tadpoles survive this ordeal.

"Often the tadpole is released and is able to swim away to live for another day," says Sessions. "If it survives it metamorphoses into a toad with missing or deformed hind limbs, depending on the developmental stage of the tadpole."

If tadpoles are attacked when they are very young, they can often regenerate their leg completely, but this ability diminishes as they grow older.

The researchers confirmed this by surgically removing the hind limbs of some tadpoles and watching them grow. These tadpoles developed in an identical way to those whose limbs had been removed by dragonflies, confirming that losing a limb at a certain stage of a tadpole's development can lead to missing or deformed limbs in adulthood.



A normal and a legless toad stained to reveal details of the skeletal deformities (bones purple, cartilage blue, soft tissues transparent).

Adult amphibians with one hind limb appear able to live for quite a long time, Sessions says, explaining why so many deformed frogs and toads are discovered.

Why do the dragonflies like to eat the hind legs only?

As toad tadpoles mature, they develop poison glands in their skin much earlier than those in their hind legs, which could make the hind legs a far more palatable meal.

The front legs of tadpoles also develop within the gill chamber, where they are protected.

Sessions is careful to say that he doesn't completely rule out chemicals as the cause of some missing limbs. But 'selective predation' by dragonfly nymphs is now by far the leading explanation, he says.

"Are parasites sufficient to cause extra limbs?," he asks. "Yes. Is selective predation by dragonfly nymphs sufficient to cause loss or reduction of limbs. Yes. Are chemical pollutants necessary to understand either of these phenomena? No."

Pigeons make the grade at art appreciation

12:18 26 June 2009 **by Ewen Callaway**

Parents may praise their children's artwork as if each piece were a da Vinci or a Rembrandt ? but pigeons, new research suggests, are somewhat more discerning.

Several birds have successfully learned to tell the difference between well-executed and crude paintings ? all created by 9 to 11-year-olds at a Tokyo elementary school.

No, the city hasn't devised a plot to simultaneously rid its streets of pigeons and employ art teachers that work for peanuts ? or, rather, grain. Instead, the experiments were set up to see if other animals, provided with enough training, could grasp the human concept of beauty, says Shigeru Watanabe, a psychologist at Keio University in Tokyo, who led the study.

A wild scene of dinosaurs was considered 'bad' art by both birds and panel (Image: Shigeru Watanabe)

Peck for a prize

This isn't Watanabe's first efforts to teach art appreciation to pigeons. In 1995, he and two colleagues published a paper showing that pigeons could learn to discriminate Picasso paintings from Monets' work that earned him that year's Ig Nobel prize. New Scientist plays no role in selecting winners, but Watanabe's latest study make a strong case for another award.

He trained four birds ? on loan from the Japanese Society for Racing Pigeons ? to appreciate children's art by linking correct assessments of paintings with food. Works deemed good (see image) had earned As in art class, while bad paintings (see image) garnered Cs or Ds. Watanabe also put the paintings to a jury of 10 adults, and pigeons viewed only works unanimously declared good or bad by the panel.

After a series of training sessions consisting of 22 paintings on average, Watanabe presented the birds with 10 paintings they hadn't seen before: 5 bad, 5 good.

The birds had been trained to peck at a button for good paintings and do nothing in response to bad works. With never-seen works, pigeons picked good paintings twice as often as bad paintings, a statistically significant difference.

Colour, please

However, their accuracy dropped off significantly if Watanabe presented pictures in greyscale or those modified to be highly pixelated, suggesting that colour and detail helped pigeons discern the paintings. The size of the painting, on the other hand, made no difference.

In separate experiments, Watanabe found that pigeons could also learn to distinguish between pastel paintings and watercolours, suggesting that texture is another important cue for the birds.

But does this mean that humans and pigeons have a similar sense of aesthetics? Not quite, Watanabe says. "The experiments demonstrated the ability of discrimination, not the ability to enjoy painting."

A more conservative but well-executed panda scene was deemed 'good' art (Image: Shigeru Watanabe)

Journal reference: Animal Cognition (DOI: 10.1007/s10071-009-0246-8)

Europeans' sweet tooth may have been survival trait

12:08 26 June 2009 **by Ewen Callaway**

Sweet-toothed Brits have one less excuse for taking their morning tea with several spoons of sugar. They and other Europeans are among the most sugar-sensitive people in the world, a new genetic analysis concludes.

The vast majority of people in the UK, France, Italy and Russia boast a tandem of genetic variations in a sugar-sensing gene that allows them to detect trace levels of sweetness.

Around the world, populations that live at northern latitudes carry these genetic variations at far higher frequencies than tropical-living peoples, says Dennis Drayna, a geneticist at the National Institute on Deafness and Other Communication Disorders in Bethesda, Maryland.

His team presented 144 Europeans, Asians and Africans with nine solutions containing varying amounts of table sugar ? sucrose ? in amounts varying from 0 to 4 per cent. "Four-per-cent sucrose is very sweet to everyone, and to me it's intensely sweet," Drayna says. "Imagine some cloyingly sweet desert."

Gene surprise

Volunteers arranged the solutions in order of their perceived sweetness numerous times, and from these, Drayna's team calculated a sucrose sensitivity score for each person.

When the researchers correlated the scores with variations in two sugar-sensing genes, TAS1R3 and TAS1R2, they found two variants just outside of the TAS1R3 gene that seemed to predict their volunteer's scores.

This puzzled Drayna because TAS1R2 is chock-full of single DNA letter differences between people, and research on bitter taste genes suggested that such mutations ? which change the shape of the receptor ? underlie these differences.

Instead, the two variations near TAS1R3 probably determine how much of a receptor protein is produced by the taste buds, Drayna says. Tests showed that the variations most common in Europeans crank up the expression of TAS1R3.

Sugar-rich regions

Although the gene variants were commonest in Europeans, they were also widespread in Japanese, Palestinian, Han Chinese and other Middle Eastern and Asian populations. Low-sensitivity variations were most prevalent among the several different African populations that the team examined.

The researchers could not estimate when the high-sensitivity mutations evolved. But since other great apes appear to have the low sensitivity version, the changes probably occurred sometime after the common ancestor of humans and chimpanzees split, roughly six million years ago.

An even bigger puzzle is why the low-sensitivity variations are more common among Africans. "The straight answer is we don't know, but there are some tantalising possibilities," Drayna says.

For instance, a dearth of sweet fruits and vegetables beyond the tropics might have favoured increased sugar sensitivity to help find energy rich carbohydrates in local food plants.

"All these things that have really high sugar stores are largely tropical in origin," Drayna says. "When you get into the higher latitudes, you don't find plants like that. We think people needed to turn up the [volume], so to speak."

Food test

Paul Breslin, a biologist at Monell Chemical Senses Center in Philadelphia, Pennsylvania, says that theory makes sense. "Maybe someone who couldn't detect sweetness very well would never realise that a carrot or a parsnip was something that was nutritious or yummy to eat because it wouldn't taste very good."

Alternatively, increased sensitivity to sugar could make starchy foods more palatable. When an enzyme called salivary amylase breaks down starch, it eventually produces a sugar called maltose. "It could be a way of finding starchy foods in the world," Breslin says.

A 2007 study led by Nate Dominyat the University of California, Santa Cruz, found that Japanese and European-American populations that load up on starchy foods tend to produce more salivary amylase than African populations that traditionally skimp on carbs.

Journal reference: Current Biology (DOI: 10.1016/j.cub.2009.06.015)

Africa alone could feed the world

DOOM-MONGERS have got it wrong - there is enough space in the world to produce the extra food needed to feed a growing population. And contrary to expectation, most of it can be grown in Africa, say two international reports published this week.

The first, projecting 10 years into the future from last year's food crisis, which saw the price of food soar, says that there is plenty of unused, fertile land available to grow more crops.

"Some 1.6 billion hectares could be added to the current 1.4 billion hectares of crop land [in the world], and over half of the additionally available land is found in Africa and Latin America," concludes the report, compiled by the Organization for Economic Cooperation and Development and the UN Food and Agriculture Organization (FAO).

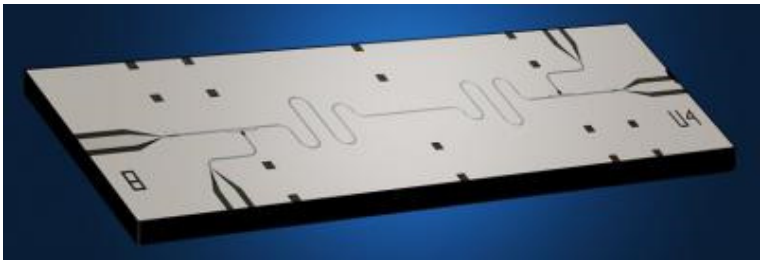
If further evidence were needed, it comes in a second report, launched jointly by the FAO and the World Bank. It concludes that 400 million hectares, straddling 25 African countries, are suitable for farming.

Models for producing new crop land already exist in Thailand, where land originally deemed agriculturally unpromising, due to irrigation problems and infertile soil, has been transformed into a cornucopia by smallholder farmers.

As in Thailand, future success will come by using agriculture to lift Africa's smallholder farmers out of poverty, aided by strong government measures to guarantee their rights to land, say both reports.

Scientists create first electronic quantum processor

New Haven, Conn.-A team led by Yale University researchers has created the first rudimentary solid-state quantum processor, taking another step toward the ultimate dream of building a quantum computer.



The two-qubit processor is the first solid-state quantum processor that resembles a conventional computer chip and is able to run simple algorithms. **Credit: Blake Johnson/Yale University**

They also used the two-qubit superconducting chip to successfully run elementary algorithms, such as a simple search, demonstrating quantum information processing with a solid-state device for the first time. Their findings will appear in Nature's advanced online publication June 28.

"Our processor can perform only a few very simple quantum tasks, which have been demonstrated before with single nuclei, atoms and photons," said Robert Schoelkopf, the William A. Norton Professor of Applied Physics & Physics at Yale. "But this is the first time they've been possible in an all-electronic device that looks and feels much more like a regular microprocessor."

Working with a group of theoretical physicists led by Steven Girvin, the Eugene Higgins Professor of Physics & Applied Physics, the team manufactured two artificial atoms, or qubits ("quantum bits"). While each qubit is actually made up of a billion aluminum atoms, it acts like a single atom that can occupy two different energy states. These states are akin to the "1" and "0" or "on" and "off" states of regular bits employed by conventional computers. Because of the counterintuitive laws of quantum mechanics, however, scientists can effectively place qubits in a "superposition" of multiple states at the same time, allowing for greater information storage and processing power.

For example, imagine having four phone numbers, including one for a friend, but not knowing which number belonged to that friend. You would typically have to try two to three numbers before you dialed the right one. A quantum processor, on the other hand, can find the right number in only one try.

"Instead of having to place a phone call to one number, then another number, you use quantum mechanics to speed up the process," Schoelkopf said. "It's like being able to place one phone call that simultaneously tests all four numbers, but only goes through to the right one."

These sorts of computations, though simple, have not been possible using solid-state qubits until now in part because scientists could not get the qubits to last long enough. While the first qubits of a decade ago were able to maintain specific quantum states for about a nanosecond, Schoelkopf and his team are now able to maintain

theirs for a microsecond—a thousand times longer, which is enough to run the simple algorithms. To perform their operations, the qubits communicate with one another using a "quantum bus" - photons that transmit information through wires connecting the qubits - previously developed by the Yale group.

The key that made the two-qubit processor possible was getting the qubits to switch "on" and "off" abruptly, so that they exchanged information quickly and only when the researchers wanted them to, said Leonardo DiCarlo, a postdoctoral associate in applied physics at Yale's School of Engineering & Applied Science and lead author of the paper.

Next, the team will work to increase the amount of time the qubits maintain their quantum states so they can run more complex algorithms. They will also work to connect more qubits to the quantum bus. The processing power increases exponentially with each qubit added, Schoelkopf said, so the potential for more advanced quantum computing is enormous. But he cautions it will still be some time before quantum computers are being used to solve complex problems.

"We're still far away from building a practical quantum computer, but this is a major step forward."

Authors of the paper include Leonardo DiCarlo, Jerry M. Chow, Lev S. Bishop, Blake Johnson, David Schuster, Luigi Frunzio, Steven Girvin and Robert Schoelkopf (all of Yale University), Jay M. Gambetta (University of Waterloo), Johannes Majer (Atominstitut der Österreichischen Universitäten) and Alexandre Blais (Université de Sherbrooke).

***Citation**: 10.1038/nature08121*

New trigger for chronic inflammation in rheumatoid arthritis discovered

A signal molecule made by the human body that triggers the immune system into action may be important in rheumatoid arthritis, according to new research published today in Nature Medicine. The authors of the study, from Imperial College London, say that if scientists could block this signal, it may be possible to develop more effective arthritis treatments.

Rheumatoid arthritis is the most common autoimmune disease, affecting around 1 in 100 people. It causes painful and persistent swelling in the joints that can result in damage to the bone and cartilage. Around half of all patients do not respond to one or more of the treatments currently available, and even these can become less successful over time. The researchers behind the new study say stopping the disease closer to the root of the problem could be the best way to treat it, and their results suggest a new target for therapies.

When a microbe infects the body, the body responds by turning on a molecular switch to set the immune system into action and protect the body from disease. Today's findings show that a signal molecule called tenascin-C can trigger the same molecular switch and also activate the immune system. High levels of tenascin-C present in joints therefore may cause the activated immune system to attack the joint leading to the persistent inflammation of rheumatoid arthritis.

The molecular switch is called TLR4, and is found on the surface of immune cells. Previous research has shown that mice without TLR4 do not show chronic joint inflammation. The researchers hope scientists can develop new treatments that target the interaction between tenascin-C and TLR4, which may help to combat rheumatoid arthritis.

Dr Kim Midwood, lead author of the study from the Kennedy Institute of Rheumatology at Imperial College London, said: "Rheumatoid arthritis is a debilitating and painful disease and, unfortunately, there is no cure. Furthermore, current treatments are not effective for many patients."

"We have uncovered one way that the immune system may be triggered to attack the joints in patients with rheumatoid arthritis. We hope our new findings can be used to develop new therapies that interfere with tenascin-C activation of the immune system and that these will reduce the painful inflammation that is a hallmark of this condition," added Dr Midwood.

The researchers reached their conclusions by carrying out five studies. One study suggested that tenascin-C was needed to sustain inflammation. The researchers induced joint inflammation in mice with and without the gene for tenascin-C. They found the mice that could produce tenascin-C had severe joint swelling with bone and cartilage destruction, but the mice that could not produce tenascin-C had no swelling or tissue destruction at all.

In a subsequent study, the researchers injected the active part of the tenascin-C molecule into mice joints. They found it caused the joints of the mice to become inflamed and that this reaction was more intense with higher doses.

Another experiment demonstrated that tenascin-C causes swelling in the joints by increasing levels of molecules that cause inflammation. The researchers took human immune cells called macrophages and cells called fibroblasts from the swollen joint of patients with rheumatoid arthritis and added tenascin-C. After the tenascin-C was added, the cells produced more molecules that cause inflammation.

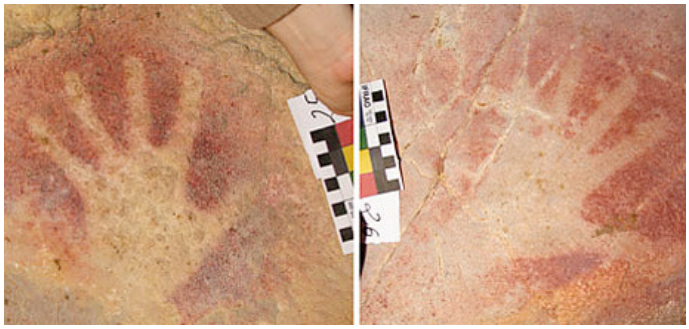
The authors plan to work out the precise mechanism by which tenascin-C increases these levels of inflammatory molecules in the human joint and try to find ways to inhibit this action.

This work was funded by the Arthritis Research Campaign, The Kennedy Institute of Rheumatology Trustees and an MRC New Investigators Research Grant awarded to K. M. The researchers are also grateful for support from the NIHR Biomedical Research Centre funding scheme.

PICTURES: Prehistoric European Cave Artists Were Female

June 16, 2009--Inside France's 25,000-year-old Pech Merle cave, hand stencils surround the famed "Spotted Horses" mural.

For about as long as humans have created works of art, they've also left behind handprints. People began stenciling, painting, or chipping imprints of their hands onto rock walls at least 30,000 years ago.



Until recently, most scientists assumed these prehistoric handprints were male. But "even a superficial examination of published photos suggested to me that there were lots of female hands there," Pennsylvania State University archaeologist Dean Snow said of European cave art.

By measuring and analyzing the Pech Merle hand stencils, Snow found that many were indeed female--including those pictured here.

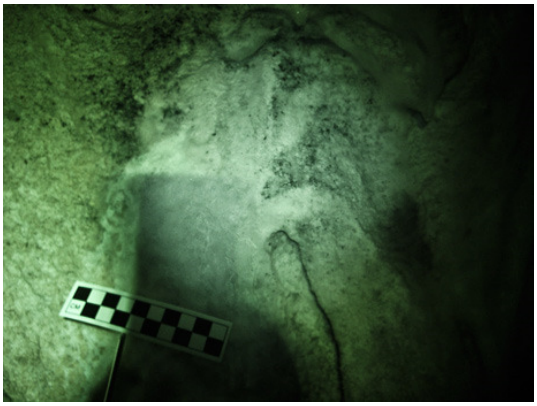
–Photograph courtesy Dean Snow **** PICTURES: Hand Stencils Through Time***

Analyzing hand stencils dating back some 28,000 years in Spain's El Castillo cave, archaeologist Dean Snow concluded many of El Castillo's artists had been female.

"The very long ring finger on the left is a dead giveaway for male hands," he said. "The one on the right has a long index finger and a short pinky--thus very feminine."

His findings suggest women's role in prehistoric culture may have been greater than previously thought.

Just as in prehistoric times, visitors today can leave behind handprints at Spain's Maltravieso cave, a Paleolithic site dating back more than 20,000 years. "Elena's hand [pictured] was typical for little girls," said Snow.



Hand proportions vary across populations. To assess prehistoric handprints from Europe, Snow used modern hands for comparison.

"I had access to lots of people of European descent who were willing to let me scan their hands as reference data," said Snow, whose research was supported by the National Geographic Society's Committee for Research and Exploration. (The National Geographic Society owns National Geographic News.)

In France's Gargas cave, a late Paleolithic left-hand stencil glows green from a night vision camera. Archaeologist Dean Snow concluded the hand was female.

"We don't know what the roles of artists were in Upper Paleolithic society [roughly 40,000 to 20,000 years ago] generally," he said. "But it's a step forward to be able to say that a strong majority of them were women."

Snow's research was limited to Europe, but he hopes others will do similar studies at prehistoric sites elsewhere.

Rome catacomb reveals "oldest" image of St Paul

ROME (Reuters) - Vatican archaeologists using laser technology have discovered what they believe is the oldest image in existence of St Paul the Apostle, dating from the late 4th century, on the walls of catacomb beneath Rome.

Vatican newspaper Osservatore Romano, revealing the find on Sunday, published a picture of a frescoed image of the face of a man with a pointed black beard on a red background, inside a bright yellow halo. The high forehead is furrowed.

Experts of the Ponitifical Commission for Sacred Archaeology made the discovery on June 19 in the Catacomb of Santa Tecla in Rome and describe it as the "oldest icon in history dedicated to the cult of the Apostle," according to the Vatican newspaper.

The discovery, which involved removing layers of clay and limestone using lasers, was announced a day before Rome observes a religious holiday for the Feasts of St Peter and St Paul.

Peter and Paul are revered by Christians as the greatest early missionaries. Converting on the road to Damascus following a blinding vision of Jesus, Paul took the Gospel to pagan Greeks and Romans and met his martyrdom in Rome in about 65 AD.

Early Christians in Rome buried their dead in catacombs dug into the soft rock under the city and decorated the underground walls with devotional images, often in the Pompeian style.

(Writing by Stephen Brown; Editing by Sophie Hares)

Pope Says Tests 'Seem to Conclude' Bones Are the Apostle Paul's

By THE ASSOCIATED PRESS

ROME (AP) — The first scientific tests on what are believed to be the remains of the Apostle Paul, the Roman Catholic saint, "seem to conclude" that they belong to him, Pope Benedict XVI said Sunday.

Archaeologists recently unearthed and opened the white marble sarcophagus located under the Basilica of St. Paul Outside the Walls in Rome, which for some 2,000 years has been believed by the faithful to be the tomb of Paul.

Benedict said scientists had conducted carbon dating tests on bone fragments found inside the sarcophagus and confirmed that they date from the first or second century.

"This seems to confirm the unanimous and uncontested tradition that they are the mortal remains of the Apostle Paul," Benedict said, announcing the findings at a service in the basilica to mark the end of the Vatican's Pauline year, in honor of Paul.

Paul and Peter are the two main figures known for spreading the Christian faith after the death of Christ.

According to tradition, Paul, also known as the apostle to the Gentiles, was beheaded in Rome in the first century during the persecution of early Christians by Roman emperors. Popular belief holds that bone fragments from his head are in another Rome basilica, St. John Lateran, with his other remains inside the sarcophagus.

The pope said that when archaeologists opened the sarcophagus, they discovered alongside the bone fragments some grains of incense, a "precious" piece of purple linen with gold sequins and a blue fabric with linen filaments.

Vatican archaeologists in 2002 began excavating the eight-foot coffin, which dates from at least 390 and was buried under the basilica's main altar. The decision to unearth it was made after pilgrims who came to Rome during the Roman Catholic Church's 2000 Jubilee year expressed disappointment at finding that Paul's tomb — buried under layers of plaster and further hidden by an iron grate — could not be visited or touched.

The top of the coffin has small openings, subsequently covered with mortar, because in ancient times, Christians would insert offerings or try to touch the remains.

The basilica stands at the site of two fourth-century churches, including one destroyed by a fire in 1823 that had left the tomb visible, first above ground and later in a crypt. After the fire, the crypt was filled with earth and covered by a new altar. A slab of cracked marble with the words "Paul apostle martyr" in Latin was also found embedded in the floor above the tomb.

Monday is the feast of Saints Peter and Paul, a major feast day for the Catholic Church, during which the pope will bestow a woolen pallium, or scarf, on all of the archbishops he has recently appointed. The pallium is a band of white wool decorated with black crosses that is a sign of pastoral authority and a symbol of the archbishops' bond with the pope.

At the end of Sunday's service in the warm basilica, Benedict, 82, lost his balance slightly as he slipped on a step on the altar and was steadied by one of his assistants who was by his side.