Keep working 'to avoid dementia'

Keeping the brain active by working later in life may be an effective way to ward off Alzheimer's disease, research suggests. Researchers analysed data from 1,320 dementia patients, including 382 men.

They found that for the men, continuing to work late in life helped keep the brain sharp enough to delay dementia taking hold. The study was carried out by the Institute of Psychiatry at King's College London.

It features in the International Journal of Geriatric Psychiatry.

Around 700,000 people in the UK currently have dementia and experts have estimated that by 2051, the number could stand at 1.7m. It is estimated that the condition already costs the UK economy £17bn a year.

Brain connections

Dementia is caused by the mass loss of cells in the brain, and experts believe one way to guard against it is to build up as many connections between cells as possible by being mentally active throughout life. This is known as a "cognitive reserve".

There is evidence to suggest a good education is associated with a reduced dementia risk. And the latest study suggests there can also be a positive effect of mental stimulation continued into our later years.

Those people who retired late developed Alzheimer's at a later stage than those who opted not to work on.

Each additional year of employment was associated with around a six week later age of onset.

Researcher Dr John Powell said: "The possibility that a person's cognitive reserve could still be modified later in life adds weight to the "use it or lose it" concept where keeping active later in life has important health benefits, including reducing dementia risk."

The researchers also admit that the nature of retirement is changing, and that for some people it may now be as intellectually stimulating as work.

Key threshold

Researcher Professor Simon Lovestone said: "The intellectual stimulation that older people gain from the workplace may prevent a decline in mental abilities, thus keeping people above the threshold for dementia for longer." However, he added: "Much more research is needed if we are to understand how to effectively delay, or even prevent, dementia."

Rebecca Wood, chief executive of the Alzheimer's Research Trust, which funded the study, said: "More people than ever retire later in life to avert financial hardship, but there may be a silver lining - lower dementia risk."

However, Dr Susanne Sorensen, head of research at the Alzheimer's Society, said the small sample size of the study made it difficult to draw firm conclusions.

She said: "There could be a number of reasons why later retirement in men is linked with later onset of dementia. "Men who retire early often do so because of health conditions, such as hypertension or diabetes, which increase your risk of dementia. "It could also be that working helps keep your mind and body active, which we know reduces risk of dementia."

A spokesperson for the Department for Work and Pensions said it had carried out work showing that working beyond pension age had many positive effects.

"Not only can it mean more income, but also social networking and increased activity.

"We also find that many of today's older workers are choosing rejecting the cliff edge between work and retirement in favour of a gradual step down. And employers should help them to do this."

New vaccine strategy might offer protection against pandemic influenza strains

A novel vaccine strategy using virus-like particles (VLPs) could provide stronger and longer-lasting influenza vaccines with a significantly shorter development and production time than current ones, allowing public health authorities to react more quickly in the event of a potential pandemic.

Ted Ross, Ph.D., an assistant professor at the University of Pittsburgh's Center for Vaccine Research, will present his laboratory's latest data on the efficacy of VLP vaccines for potential pandemic strains, such as H5N1 and 1918 influenza, today at the 109th General Meeting of the American Society for Microbiology in Philadelphia.

"Virus-like particles look just like a live virus, but they are hollow shells without a genome inside and they cannot reproduce," Ross explained. "Because they look like the virus, they evoke a more robust immune response against the real thing."

Ross and his colleagues have already made VLP vaccines that have been tested in early clinical trials and appear to provide complete protection against both the H5N1 avian influenza virus and the 1918 Spanish influenza virus.

"There is a debate in the influenza community about priming the human population for potential pandemic strains such as H5N1 or 1918," Ross said. "Some researchers advocate adding these strains to the annual flu vaccine. They might not match the next pandemic flu strain exactly, but could provide some of protection."

Others contend that it might be premature, as well as costly, to vaccinate people against a virus that may never emerge, he said.

The current injectable vaccine for seasonal influenza is a trivalent, inactivated vaccine. It consists of three different influenza strains that are grown in eggs and then inactivated, or killed, by chemicals that break them into tiny pieces. Because they no longer look like the circulating virus, conventionally made vaccines strains do not elicit as strong an immune response as VLP vaccines. Because it is made with live, attenuated virus, the inhaled, mist-based vaccine can elicit a strong immune response but can also increase the risk of side effects.

VLPs can be quickly and easily produced in several ways, including growing them in cell cultures or in plants. Also, if the genes in the disease virus are identified, then researchers can generate particles for a vaccine without an actual sample of the agent.

"The sequence for the recent H1N1 'swine flu' virus was online and available to scientists long before physical samples could be delivered," Dr. Ross noted. "It would have been possible to produce VLPs in quantity in as little as 12 weeks while conventional vaccines require physical samples of the virus and production can take approximately nine months."

One VLP-based vaccine already is on the market, namely the human papilloma virus (HPV) vaccine.

University of Florida study provides insight into evolution of first flowers

Gainesville, Fla. --- Charles Darwin described the sudden origin of flowering plants about 130 million years ago as an abominable mystery, one that scientists have yet to solve.

But a new University of Florida study, set to appear next week in the online edition of the Proceedings of the National Academy of Sciences, is helping shed light on the mystery with information about what the first flowers looked like and how they evolved from nonflowering plants.

"There was nothing like them before and nothing like them since," said Andre Chanderbali, lead author of the study and a postdoctoral associate at UF's Florida Museum of Natural History. "The origin of the flower is the key to the origin of the angiosperms (flowering plants)."

The goal of this research is to understand the original regulatory program, or set of genetic switches, that produced the first flower in the common ancestor of all living flowering plants, said Pam Soltis, study co-author and curator of molecular systematics and evolutionary genetics at the Florida Museum. Better understanding of these genetic switches could one day help scientists in other disciplines such as medicine or agriculture, including help in growing plants used to fight disease or developing more drought-resistant crops.

The flower is one of the key innovations of evolution, responsible for a massive burst of evolution that has resulted in perhaps as many as 400,000 angiosperm species. Before flowering plants emerged, the seed-bearing plant world was dominated by gymnosperms, which have cone-like structures instead of flowers and include pine trees, sago palms and ginkgos. Gymnosperms first appeared in the fossil record about 360 million years ago.

The new study provides insight into how the first flowering plants evolved from pre-existing genetic programs found in gymnosperms and then developed into the diversity of flowering plants we see today.

The study compares the genetic structure of two vastly different flowering plants to see whether differences exist in the set of circuits that create each species' flower. Researchers examined the genetic circuitry of Arabidopsis thaliana, a small flowering plant commonly used as a model organism in plant genetics research, and the avocado tree Persea americana, which belongs to an older lineage of so-called basal angiosperms.

"What we found is that the flower of Persea is a genetic fossil, still carrying genetic instructions that would have allowed for the transformation of cones into flowers," Chanderbali said.

Advanced angiosperms have four organ types: female organs (carpels), male organs (stamens), petals (typically colorful) and sepals (typically green). Basal angiosperms have three: carpels, stamens and tepals, which are typically petal-like structures. The researchers expected each type of organ found in Persea's flowers would have a unique set of genetic instructions. Instead they found significant overlap among the three organ types.

"Although the organs are developing to ultimately become different things, from a genetic developmental perspective, they share much more than you would expect," Chanderbali said. "As you go back in time, the borders fade to a blur."

"With these facts established, we can now think about the vast space open to natural selection to establish ever more rigid borders," said Virginia Walbot, a biology professor at Stanford University who is familiar with the research. The selection process arrived at a "narrow solution in terms of four discrete organs but with fantastic diversity of organ numbers, shapes and colors that provide the defining phenotypes of each flowering plant species."

Researchers don't know exactly which gymnosperms gave rise to flowering plants, but previous research suggests some genetic program in the gymnosperms was modified to make the first flower, Soltis said. A pine tree produces pine cones that are either male or female, unlike flowers, which contain both male and female parts. But a male pine cone has almost everything that a flower has in terms of its genetic wiring.

Douglas Soltis, chairman of the UF botany department, emphasized that the study highlights the importance of studying primitive flowering plants such as the avocado to gain insight into the early history of the flower. Survivors of ancient lineages represent a crucial link to the first flowers and provide insight that cannot be obtained by studying highly derived models such as Arabidopsis, he said.

The first evidence of pre-industrial mercury pollution in the Andes

The study of ancient lake sediment from high altitude lakes in the Andes has revealed for the first time that mercury pollution occurred long before the start of the Industrial Revolution.

University of Alberta Earth and Atmospheric Sciences PhD student Colin Cooke's results from two seasons of field work in Peru have now provided the first unambiguous records of pre-industrial mercury pollution from anywhere in the world and will be published in the May 18th Early Edition of the Proceedings of the National Academy of Sciences (PNAS).

"The idea that mercury pollution was happening before the industrial revolution has long been hypothesised on the basis of historical records, but never proven," said Cooke whose research was funded by the National Geographic Society.

Cooke and his team recovered sediment cores from high elevation lakes located around Huancavelica, which is the New World's largest mercury deposit. By measuring the amount of mercury preserved in the cores back through time, they were able to reconstruct the history of mercury mining and pollution in the region.

"We found that mercury mining, smelting and emissions go back as far as 1400 BC," said Cooke. "More surprisingly, mining appears to have began before the rise of any complex or highly stratified society. This represents a departure from current thinking, which suggests mining only arose after these societies emerged," said Cooke.

Initially, mercury pollution was in the form of mine dust, largely resulting from the production of the red pigment vermillion. "Vermillion is buried with kings and nobles, and was a paint covering gold objects buried with Andean kings and nobles," said Cooke. However, following Inca control of the mine in 1450 AD, mercury vapour began to be emitted.

"This change is significant because it means that mercury pollution could be transported over much greater distances, and could have been converted into methylmercury, which is highly toxic," said Cooke.

"All of these results confirm long-standing questions about the existence and magnitude pre-industrial mercury pollution, and have implications for our understanding of how mining and metallurgy evolved in the Andes," said Cooke.

Cooke is an interdisciplinary scientist researching human impacts on the environment. His research combines paleolimnology (the study of ancient lake sediments) with the fields of archaeology, and geochemistry. The research team included Prentiss Balcom from the University of Connecticut (USA), Harald Biester from the University of Braunschweig (Germany), and Alexander Wolfe from the University of Alberta

Komodo even more deadly than thought: Research

The carnivorous reptiles (Varanus komodoensis) are known to bite prey and release them, leaving them to bleed to death from their wounds: the victims are reported to go into shock before the dragons kill and eat them.

Some researchers believe that prey are killed by pathogenic bacteria in the dragons' mouths but the new research – published in the latest issue of Proceedings of the National Academy of Sciences – shows that the combination of the reptiles' teeth and venom likely accounts for their hunting prowess.

"The view that the Komodo routinely kills using dirty oral bacteria is wrong," says research co-author, Dr Stephen Wroe from the University of New South Wales, Australia. "The dragon is truly poisonous. It has modified salivary glands that deliver both hypertensive and anti-blood-clotting agents, which, in combination with lightweight but sophisticated cranial and dental adaptations, allows it to kill large animals through rapid blood loss."

The researchers used computer modeling to analyse the Komodo dragon bite and found that dragons have much weaker bites than crocodiles of a similar size. However, magnetic resonance imaging revealed the dragons have complex venom glands as well.

After surgically excising the glands from a terminally ill dragon in a zoo, the researchers used mass spectrometry to obtain a profile of the venom, finding that the toxin was similar to that of the Gila monster and many snakes. The venom causes a severe loss in blood pressure by preventing blood clotting and widening blood vessels, thus inducing shock in a victim.

The researchers also examined fossils of the giant extinct dragon relative Varanus megalania and determined that this seven-metre-long lizard was one of the largest venomous animals to have ever lived.

A member of the goanna family with ancestors dating back more than 100 million years, the Komodo dragon is the world's largest living lizard and inhabits the central Indonesian islands of Komodo, Rinca, Flores, Gili Motang and Gili Dasami. It grows to an average length of two to three metres and weighs around 70 kilograms. The reptile's unusual size is attributed to a phenomenon known as island gigantism, since there are no other carnivorous mammals to fill the niche on the islands where they live.

The lizards are apex predators and dominate the ecosystems in which they live. Although Komodo dragons eat carrion, they also hunt and ambush prey including invertebrates, birds, and mammals.

The dragon's large size and fearsome reputation has made it a popular zoo exhibit since Western scientists first brought it to world attention in 1910. In the wild its total population is estimated at 4,000 to 5,000. Its range has contracted due to human activities and it is listed as vulnerable by the International Union for Conservation of Nature.

Quick test for prostate cancer

A new 3-minute test could help in diagnosing prostate cancer, the most common cancer in men in the UK, according to scientists.

Researchers have developed the test by using light energy to measure the level of citrate in fluid samples from the prostate gland. The technique could provide the basis of a rapid means of detecting prostate cancer in the future. Almost a quarter of male cancers in the UK are diagnosed as prostate cancer and more than 10,000 men die from the disease each year.

Scientists, led by Prof David Parker from Durham University's Chemistry Department, have worked with experts from the University of Maryland, USA to develop the technique that measures the wavelength of light as it is shone through diluted samples of body fluids.

The research team, funded by the North East Proof of Concept Fund and the EPSRC, believe that the technique which can measure, with speed and accuracy, how citrate levels fall in the prostate gland as cancer develops, could also find use for the diagnosis of other medical conditions, associated with poor kidney function.

Prof Parker said: "Citrate provides a significant biomarker for disease that may provide a reliable method for screening and detecting prostate cancer, and for the monitoring of people with the disease. This technique could form the basis of a simple screening procedure for prostate cancer that could be used in outpatient departments at local hospitals."

His team have shone light into over 100 different chemical structures to see how they function and respond to the presence of certain important bioactive species. They have looked particularly closely at how citrate and lactate bind to luminescent structures within fluids. Citrate and lactate are vital for our bodies' metabolism for normal function. Citrate provides energy for cells and the amount found in the prostate varies considerably due to an enzyme called m-aconitase which transforms it. This enzyme is very sensitive to zinc and, in prostate cancer sufferers, zinc levels are depressed and the enzyme switches on again.

Prof Leslie Costello from the University of Maryland said: "Citrate is formed in cell metabolism processes which alter as cancers grow. The analysis of the citrate concentration of prostatic fluid can provide an accurate way to screen and diagnose prostate cancer. Since citrate concentrations decrease markedly early in malignancy, this technique makes it possible to analyse what's happening quickly in the early and treatable stage of prostate cancer. It shows much promise as a clinical tool."

The new test requires only a microlitre of fluid and the sample can be easily measured in an optical instrument. Using samples from male volunteers, the researchers have developed a portable instrument that can give results in 3 minutes.

The team's challenge has been how to accurately measure changes in the amount of citrate or lactate in fluid samples using the technique. The early results are promising and the team intends to look at the analysis of other body fluids. A possible way forward is to examine the citrate levels in seminal fluid samples, which are made up of 50% prostate fluid.

The University has launched a spin-out company called FScan Ltd to develop the technique and to seek commercial backing. The team has looked at 20 samples so far and verified the analysis in every case. The next stage is to work with a local hospital and examine samples from 200 volunteers to see whether the first Durham results correlate.

Prof Parker says: "It's been a complex process to develop the technique but we're very optimistic about it. Ultimately, this could provide an accurate method of screening for prostate cancer in men that could be carried out in 3-minutes once a biopsy has been obtained from the patient at a hospital outpatient department."

The discovery follows the invention in 2006 by Durham University Professor Douglas Newton of a Urine Flow Meter. The UFlow Meter helps men to assess if they have a restricted rate of urine flow - one of the warning signs of prostate problems.

The establishment of FScan Ltd is part of the University's aim to enhance the exploitation of the Intellectual Property generated by high quality research activities.

Tim Hammond, Head of Technology Transfer at Durham University, said: '"We quickly realised the potential of this research and have worked closely with Professor Parker and his team to secure initial proof of concept funding through NorthStar Equity Investors and the North East Proof of Concept Fund and to establish FScan Limited as the vehicle to validate and commercialise the technology."

Process for testing:

1. ***Sample of prostatic fluid taken from patient in hospital using local anaesthetic***
2. ***200 fold dilution of 1 microlitre of sample with a buffer solution into pre-coated disposable cuvettes.***
3. ***Optical spectroscopy on the sample, using a versatile bench top instrument with easy to use software.***
4. ***Reading of results after 3 min measurement cycle directly reading out actual citrate concentration.***

The sample is taken from the prostate gland - this is part of the biopsy procedure during clinical analysis in urology.

Turmeric extract suppresses fat tissue growth in rodent models

BOSTON Curcumin, the major polyphenol found in turmeric, appears to reduce weight gain in mice and suppress the growth of fat tissue in mice and cell models. Researchers at the Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts University (USDA HNRCA) studied mice fed high fat diets supplemented with curcumin and cell cultures incubated with curcumin.

"Weight gain is the result of the growth and expansion of fat tissue, which cannot happen unless new blood vessels form, a process known as angiogenesis." said senior author Mohsen Meydani, DVM, PhD, director of the Vascular Biology Laboratory at the USDA HNRCA. "Based on our data, curcumin appears to suppress angiogenic activity in the fat tissue of mice fed high fat diets."

Meydani continued, "It is important to note, we don't know whether these results can be replicated in humans because, to our knowledge, no studies have been done."

Turmeric is known for providing flavor to curry. One of its components is curcumin, a type of phytochemical known as a polyphenol. Research findings suggest that phytochemicals, which are the chemicals found in plants, appear to help prevent disease. As the bioactive component of turmeric, curcumin is readily absorbed for use by the body.

Meydani and colleagues studied mice fed high fat diets for 12 weeks. The high fat diet of one group was supplemented with 500 mg of curcumin/ kg diet; the other group consumed no curcumin. Both groups ate the same amount of food, indicating curcumin did not affect appetite, but mice fed the curcumin supplemented diet did not gain as much weight as mice that were not fed curcumin.

"Curcumin appeared to be responsible for total lower body fat in the group that received supplementation," said Meydani, who is also a professor at the Friedman School of Nutrition Science and Policy at Tufts. "In those mice, we observed a suppression of microvessel density in fat tissue, a sign of less blood vessel growth and thus less expansion of fat. We also found lower blood cholesterol levels and fat in the liver of those mice. In general, angiogenesis and an accumulation of lipids in fat cells contribute to fat tissue growth."

Writing in the May 2009 issue of the Journal of Nutrition, the authors note similar results in cell cultures. Additionally, curcumin appeared to interfere with expression of two genes, which contributed to angiogenesis progression in both cell and rodent models.

"Again, based on this data, we have no way of telling whether curcumin could prevent fat tissue growth in humans." Meydani said. "The mechanism or mechanisms by which curcumin appears to affect fat tissue must be investigated in a randomized, clinical trial involving humans."

This study was funded by a grant from the United States Department of Agriculture. Asma Ejaz, a graduate student who worked on this project received a scholarship grant from the Higher Education Commission of Pakistan.
Ejaz A, Wu, D, Kwan P, and Meydani M. Journal of Nutrition. May 2009; 139 (5): 1042-1048. "Curcumin Inhibits Adipogenesis in 3T3-L1 Adipocytes and Angiogenesis and Obesity in C57/BL Mice. 919-925."

Study: Potential criminals deterred by longer sentences

Deterrence is often a stated goal of criminal sentencing guidelines, but there is debate about whether the threat of punishment actually discourages people from committing crimes. A new study published in the Journal of Political Economy sheds some empirical light on the question of deterrence. Using a recently passed Italian law as a natural experiment, the study found that former prisoners are less likely to return to jail if they expect longer sentences for future crimes.

"This paper contributes to the literature providing evidence that potential criminals do respond to a change in prison sentences," write study authors Francesco Drago (University of Naples Parthenope), Roberto Galbiati (Centre National de la Recherche Scientifique, Paris) and Pietro Vertova (University of Bergamo).

Passed in 2006, Italy's Collective Clemency Bill presents a unique opportunity to study the deterrent effect of prison sentences, the authors say. Crime rates often drop when criminal penalties are increased. But it's often hard to tell if the rates go down because the threat of longer sentences deters potential criminals, or if the drop happens because actual criminals are physically removed from the street for longer periods. This study of the clemency law's effects eliminates the latter scenario, measuring only deterrent effect.

When the clemency bill was passed, it immediately released thousands of prisoners who had three years or less left on their sentences. The remainder of each prisoner's sentence was suspended, but not forgiven. The law stipulated that a former inmate who commits a new crime within five years will have the suspended portion of his sentence reinstated and added to the sentence for the new crime. As a result, a repeat offender can expect extra jail time equal to the suspended portion of his sentence - anywhere from one month to three years.

Using government data, the researchers looked at the recidivism rates of these former inmates for the first seven months after their release. They found that those with longer suspended sentences - and therefore longer expected sentences for new crimes - were less likely to be re-arrested than those with shorter suspended sentences.

"These results corroborate the general theory of deterrence," the authors write. According to their calculations, "increasing the expected sentence by 50 percent should reduce recidivism rates by about 35 percent in seven months."

But even a small increase in the expected sentence was enough to deter recidivism at least a little, the team found. The data suggest that a one month increase in expected sentence resulted in a 1.3 percent lower probability of returning to prison. The deterrent effect was consistent across age groups, and among men and women, though 95 percent of the sample was male.

"This means that a policy a commuting actual sentences in expected sentences significantly reduces recidivism," Dr. Vertova says. "A mass release of prisoners can be effective in reducing their propensity of re-committing crimes if, when a released individual gets convicted of a new crime, his normal sentence is increased by the time that was pardoned because of the early release."

There was one important exception to the deterrent effect, however. Recidivism rates among those whose original crime was more serious were essentially unaffected by the length of their suspended sentence. That finding suggests that "more dangerous inmates are not deterred," the authors write.

The researchers also caution that their results only measure deterrence on those who have already served time in jail. "Indeed, it is not clear whether these results can be to individuals who have never received prison treatment."

Despite the limitations, however, the study does provide real-world evidence that "individuals vary their criminal activity in response to a change in prison sentences," the authors write.

Francesco Drago, Roberto Galbiati, and Pietro Vertova, "The Deterrent Effects of Prison: Evidence from a Natural Experiment," Journal of Political Economy, 117:2.

Dolphins seen trying to kill calf

Adult tucuxi dolphins have been seen trying to kill a newborn calf of their own species.

Matt Walker Editor, Earth News

It is the first record of these dolphins attempting infanticide.

Although common in many mammal species, infanticide is rarely recorded among cetaceans, the group of animals that includes whales and dolphins.

Until now, the behaviour has only been reported twice in bottlenose dolphins; but the new episode suggests it may be more widespread than was thought.

Tucuxi dolphins (Sotalia guianensis) live either in the freshwater of the Amazonian basin, or in the ocean off the coast of Brazil to Nicaragua. Adult male marine tucuxis are known to be aggressive to one another during the breeding season, but they had never been seen being aggressive or violent towards younger members of their species.

We believe the injuries the newborn calf received from this encounter were fatal

That is until Mariana Nery, of the Southern University of Chile in Valdivia, and Sheila Simao, of the Federal Rural University of Rio de Janeiro, Brazil, were surveying the dolphins in Sepetiba Bay, Brazil.

On the morning of 5 December 2006, when the sea was calm, they saw a group of six adult tucuxi dolphins approach a mother with her newborn calf.

Two adults separated the baby from its mother. The female began to take evasive action, swimming to try to avoid the interlopers. But the other four adults herded her, hitting her body with their flukes and ramming her.

Any attempt by the mother to escape towards her offspring was prevented by the herding pack, which chased her and blocked her path.

The female dolphin frequently exposed her belly at the water surface, either as a passive behaviour or to signal that she would be sexually receptive to the males.

Four metres away, the two remaining adults rammed the calf and held it underwater. They then threw it in the air and again pushed it underwater. Afterwards the calf was disorientated and swam with difficulty. Although the researchers saw the mother a few days later, they never again saw the calf.

"We believe the injuries the newborn calf received from this encounter were fatal," the researchers report in the journal Marine Mammal Science.

"This is the first time we've seen this type of aggression," explained Ms Nery. "It is difficult to say if they really attempted to kill the calf or if it was playful behaviour that went too far. But they clearly looked to separate the calf from the mother."

They believe the incidence adds to growing evidence that wild dolphins may practise infanticide.

In other animals, males often kill babies they did not father to induce their mother to become sexually receptive once more.

"Female dolphins become sexually receptive within a few days of losing a calf," says Ms Nery. That, combined with the sexual interest shown by the group in the mother, suggests they killed the calf for similar reasons.

Fish Poisoning May Be Why Polynesians Left Paradise

ScienceDaily - Ciguatera poisoning, the food-borne disease that can come from eating large, carnivorous reef fish, causes vomiting, headaches, and a burning sensation upon contact with cold surfaces. An early morning walk on cool beach sand can become a painful stroll on fiery coals to a ciguatera victim. But is this common toxin poisoning also the key to a larger mystery? That is, the storied migrations of the Polynesian natives who colonized New Zealand, Easter Island and, possibly, Hawaii in the 11th to 15th centuries? Could ciguatera be the reason masses of people left paradise?

Teina Rongo, a Cook Island Maori from Rarotonga and a Ph.D. student at the Florida Institute of Technology, and his faculty advisers Professors Robert van Woesik and Mark Bush, propose this intriguing theory in an upcoming issue of the Journal of Biogeography. Based on archeological evidence, paleoclimatic data and modern reports of ciguatera poisoning, they theorize that ciguatera outbreaks were linked to climate and that the consequent outbreaks prompted historical migrations of Polynesians.

Why would historic populations of Cook Islanders take the chance of voyaging? A journey beyond the horizon was risky and favorable landfalls were uncertain. It is known that this population was heavily reliant on fish as a source of protein, and the scientists suggest that once their fish resources became inedible, voyaging became a necessity.

Modern Cook Islanders, though surrounded by an ocean teeming with fish, don't eat fish as a regular part of their diet but instead eat processed, imported foods. In the late 1990s, lower-income families who could not afford processed foods emigrated to New Zealand and Australia. The researchers suggest that past migrations had similar roots. The heightened voyaging from A.D. 1000 to 1450 in eastern Polynesia was likely prompted by ciguatera fish poisoning. There were few options but to leave once the staple diet of an island nation became poisonous.

"Our approach brings us a step closer to solving the mysteries of ciguatera and the storied Polynesian native migrations. We hope it will lead to better forecasting and planning for ciguatera outbreaks" says van Woesik.

Adapted from materials provided by Florida Institute of Technology, via EurekAlert!, a service of AAAS.

First heartbeats trigger blood formation

* 19 May 2009 **by Andy Coghlan**

WHEN the embryonic heart begins to beat, it kick-starts the production of blood from cells lining the growing aorta, two independent research teams have shown.

As the heart starts pumping a primitive blood-like fluid around the body of an embryo, the change in pressure from the flowing liquid is the cue for cells lining the aorta to change first into blood stem cells, then into all blood-cell types in the body. As they multiply and mature, these rapidly replace the initial embryonic "blood", which is composed of embryonic red blood cells in a nutrient-rich serum.

Leonard Zon of the Howard Hughes Medical Institute in Boston and his colleagues demonstrated that the pressure of the embryonic fluid is what switches on the production of adult blood in zebra fish and mouse embryos. "The finding answers an age-old question as to why the aorta makes blood stem cells at all," says Zon,

whose findings appear in Cell (DOI: 10.1016/j.cell.2009.04.023). "The answer is that there must be a cue to start making adult blood cells, and that cue is the onset of circulation and blood flow," he says.

The discovery could lead to a source of blood for people with leukaemia who need a transplant but don't have a matched donor, by exposing stem cells to flowing liquid, says Zon.

In a separate study, George Daley of the Children's Hospital Boston and colleagues found that blood cells form more readily in cultures of embryonic stem cells if they're exposed to fluids mimicking the usual flow and pressure of blood (Nature, DOI: 10.1038/nature08073). They also showed the phenomenon in embryonic aortic tissue from mice embryos engineered to have no heartbeat or circulation. Left alone, the aortic tissue made little blood, but blood production soared when Daley exposed the tissue to flowing fluid.

"The discovery underscores the critical importance of mechanical forces play in the development of blood and other functional tissue," says Robert Lanza, chief scientist at Advanced Cell Technology of Worcester, Massachusetts.

Really?

The Claim: Don't Mix Blood Thinners and Cranberry Juice

By ANAHAD O'CONNOR

Leif Parsons

THE FACTS Most people know that cranberry juice can help lower the risk of urinary infections, at least in some cases. But in 2003, doctors found what appeared to be a less beneficial side effect.

A handful of people taking the popular anticoagulant warfarin complained that drinking large amounts of cranberry juice seemed to heighten the drug's effects, causing unusual bleeding. Soon, other reports of cranberry complications came to light, and investigators theorized that compounds in the fruit might deactivate an enzyme that normally breaks down warfarin, prompting British health officials to issue warnings. But many experts now suspect that the cases were coincidental.

A clinical study by researchers at Tufts, for example, found no evidence that cranberry juice enhanced warfarin's effects. Nor did a separate study in 2007 that tested the effects of drinking about seven ounces of cranberry juice a day in people taking warfarin.

Dr. Jack Ansell, chairman of the department of medicine at Lenox Hill Hospital, and some colleagues found in a randomized, double-blind study that patients on warfarin who drank up to eight ounces of cranberry juice a day had no greater risk of bleeding than those given a placebo.

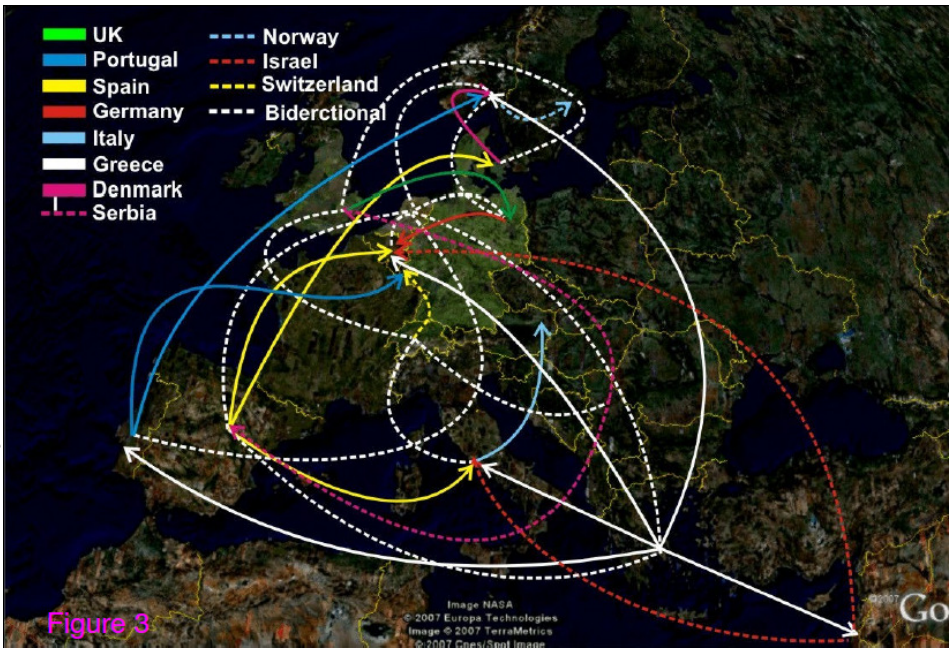
"My recommendation to patients on warfarin therapy is that they should feel free to drink cranberry juice in moderation," Dr. Ansell said.

THE BOTTOM LINE Cranberry juice, in moderation, appears to be safe for anticoagulant users.

HIV's march around Europe mapped

Those travelling abroad should take seriously advice to pack their condoms and keep their needles to themselves: research published today in the open access journal Retrovirology shows that tourists, travellers and migrants from Greece, Portugal, Serbia and Spain actively export HIV-1 subtype B to other European nations.

An international team of scientists used samples from 17 European countries to construct a viral phylogeography – a geographic pattern of genetic information taken from viruses at a number of locations that can be used to track how and when it spread (this technique has recently been applied to the bird flu virus H5N1.) HIV-1 subtype B is the most prevalent form of the HIV virus circulating in Europe today.



This map depicts the spread of HIV in Europe. **Paraskevis et al, Retrovirology 2009**

The results showed that for three countries (Austria, Poland and Luxembourg) no significant exporting migration was observed. Whereas Greece, Portugal, Serbia and Spain were a source of subtype B to other countries. Notably, the virus spread widely from Greece and Spain to seven and five target countries respectively. Other countries had narrower targets, with Italy exporting HIV to Austria, and Portugal passing the virus primarily to Luxembourg (some 13% of Luxembourg's population is Portuguese). Other nations such as Austria, Belgium, Denmark, Germany and Luxembourg showed only limited export of HIV-1 subtype B, while for Italy, Israel, Norway, the Netherlands, Sweden, Switzerland and the UK the authors inferred significant bidirectional migration. For Poland no significant migration was found.

According to the first author, Dimitrios Paraskevis, 'Popular tourist destinations like Greece, Portugal and Spain probably spread HIV with tourists infected during their holidays. To a large extent HIV spread within Poland is due to injecting drug users, who make up around half of the HIV-infected population. Viruses move around with travellers – thus health programmes within countries should not only target the national populations, prevention efforts must also be aimed at migrants, travellers and tourists – who are both major sources and targets of HIV.'

Notes to Editors

*1. Article:**Tracing the HIV-1 subtype B mobility in Europe: a phylogeographic approach***

Dimitrios Paraskevis, Oliver Pybus, Gkikas Magiorkinis, Angelos Hatzakis, Annemarie MJ Wensing, David A van de Vijver, Jan Albert, Guiseppe Angarano, Birgitta Äsjö, Claudia Balotta, Enzo Boeri, Ricardo Camacho, Marie-Laure Chaix, Suzie Coughlan, Dominique Costagliola, Andrea DeLuca, Carlos de Mendoza, Inge Derdelinckx, Zehava Grossman, Osama Hamouda, I M Hoepelman, Andrzej Horban, Klaus Korn, Claudia Kuecherer, Thomas Leitner, Clive Loveday, Eilidh Macrae, I Maljkovic, Laurence Meyer, Claus Nielsen, Eline LM Op de Coul, Vidar Ormaasen, Luc Perrin, Elisabeth Puchhammer-Stöckl, Lidia Ruiz, Mika Salminen, Jean-Claude Schmit, Rob Schuurman, Vincent Soriano, J Stanczak, Maja Stanojevic, Daniel Struck, Kristel Van Laethem, M Violin, Sabine Yerly, Maurizio Zazzi, Charles A Boucher and Anne-Mieke Vandamme

Retrovirology (in press) During the embargo, article available here:

http://www.retrovirology.com/imedia/2030333120219308_article.pdf?random=809348

Scientists discover area of brain that makes a 'people person'

Same region linked to processing of pleasures such as sweet tastes and sexual stimuli

Cambridge University researchers have discovered that whether someone is a 'people-person' may depend on the structure of their brain: the greater the concentration of brain tissue in certain parts of the brain, the more likely they are to be a warm, sentimental person.

Why is it that some of us really enjoy the company of others while some people are detached and independent? In an effort to explore these questions, Maël Lebreton and colleagues from the Cambridge Department of Psychiatry, in collaboration with Oulu University, Finland, examined the relationship between personality and brain structure in 41 male volunteers.

The volunteers underwent a brain scan using Magnetic Resonance Imaging (MRI). They also completed a questionnaire that asked them to rate themselves on items such as 'I make a warm personal connection with most people', or 'I like to please other people as much as I can'. The answers to the questionnaire provide an overall measure of emotional warmth and sociability called social reward dependence.

The researchers then analysed the relationship between social reward dependence and the concentration of grey matter (brain-cell containing tissue) in different brain regions. They found that the greater the concentration of tissue in the orbitofrontal cortex (the outer strip of the brain just above the eyes), and in the ventral striatum (a deep structure in the centre of the brain), the higher they tended to score on the social reward dependence measure. The research is published in the European Journal of Neuroscience.

Dr Graham Murray, who is funded by the Medical Research Council and who led the research, said: "Sociability and emotional warmth are very complex features of our personality. This research helps us understand at a biological level why people differ in the degrees to which we express those traits." But he cautioned, "As this research is only correlational and cross-sectional, it cannot prove that brain structure determines personality. It could even be that your personality, through experience, helps in part to determine your brain structure."

Interestingly, the orbitofrontal cortex and ventral striatum have previously been shown to be important for the brain's processing of much simpler rewards like sweet tastes or sexual stimuli.

Dr Murray explained: "It's interesting that the degree to which we find social interaction rewarding relates to the structure of our brains in regions that are important for very simple biological drives such as food, sweet liquids and sex. Perhaps this gives us a clue to how complex features like sentimentality and affection evolved from structures that in lower animals originally were only important for basic biological survival processes."

The research could also lead to new insights into psychiatric disorders where difficulties in social interaction are prominent, such as autism or schizophrenia.

"Patients with certain psychiatric conditions often experience difficulties in feeling emotional closeness, and this can have a big impact on their life. It could be that the cause of these difficulties is at least partly due to brain structural features of those disorders," said Dr Murray.

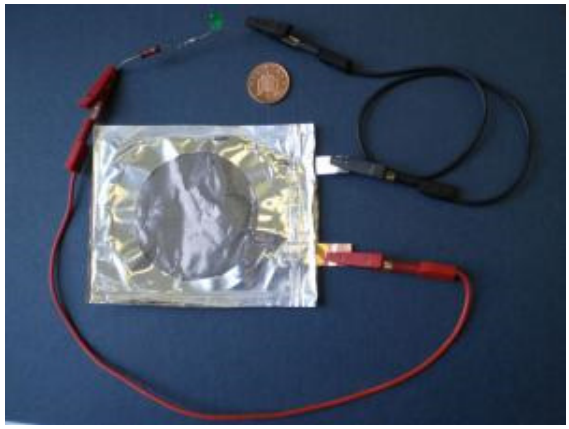
Breathing batteries could store 10 times the energy

* 12:57 19 May 2009 **by Colin Barras**

The lithium ion batteries used in laptops and cellphones, and tipped for future use in electric cars, are approaching their technological limits. But chemists in the UK say that there's a way to break through the looming energy capacity barrier – let the batteries "breathe" oxygen from the air.

A standard lithium ion battery contains a negative electrode of graphite, a positive electrode of lithium cobalt oxide, and a lithium salt-containing electrolyte. Lithium ions shuttle between the two electrodes during charging and discharging, sending electrons around the external circuit to power a gadget in the process.

The problem with that design, says Peter Bruce at the University of St Andrews, is that the lithium cobalt oxide is bulky and heavy. "The major barrier to increasing the energy density of these batteries is the positive electrode," he says. "Everyone wants to find a way to push up the amount of lithium stored there, which would raise the capacity."



An early demonstration model of the St Andrews air cell. Air enters and leaves via the porous circular membrane in the centre **(Image: Peter Bruce/EPSRC)**

Breath of fresh air

The answer, he thinks, is to borrow an idea from the zinc-air batteries used in hearing aids, which get their power reacting zinc with oxygen from air. So, working with colleagues at the Universities of Strathclyde and Newcastle, Bruce has begun designing a lithium-air battery.

The new battery has a higher energy density than existing lithium ion batteries because it no longer contains dense lithium cobalt oxide. Instead, the positive electrode is made from lightweight porous carbon, and the lithium ions are packed into the electrolyte which floods into the spongy material.

When the battery is discharged, oxygen from the air also floods through a membrane (see image, top) into the porous carbon, where it reacts with lithium ions in the electrolyte and electrons from the external circuit to form a solid lithium oxide.

Reversible process

The solid lithium oxide gradually fills the pore spaces inside the carbon electrode as the battery discharges. But when the battery is recharged the lithium oxide decomposes again, releasing lithium ions again and freeing up pore space in the carbon. The oxygen is released back to the atmosphere.

Most batteries have all the chemicals they need built in from the start. "By using oxygen from the environment instead you save weight and volume because you don't have to carry the reagents around inside the battery – you just need the carbon scaffold," says Bruce.

The new design is like a battery-fuel cell hybrid, says Bruce. Like a fuel cell it uses reactants from outside the system, while like a battery it also has internal reactants.

Power boost

The team's prototype device has a capacity-to-weight ratio of 4000 milliamp hours per gram – eight times that of a cellphone battery. Even a 10-fold improvement is possible, but tweaking conventional lithium-ion designs will likely offer only a doubling in capacity, Bruce estimates.

Chemist Saiful Islam researches batteries at the University of Bath, and was not involved in the new design. "My understanding is that the lithium-air battery indeed has the potential to deliver an eight-to-10-fold increase in energy density," he told New Scientist.

However, work is still needed to fully understand the processes taking place in the novel battery, he adds. That should help optimise the technology so it can become a commercially viable product.

Bruce and colleagues are now working to transform their proof-of-principle version into a small working battery like those used in mobile electronic devices. "But the technology could be just as important for electric and hybrid vehicles in future," Bruce points out.

New Drugs Have Allure, Not Track Record

By RICHARD A. FRIEDMAN, M.D.

Recently, one of my residents told me about a patient with bipolar disorder whose psychiatrist had prescribed an exotic cocktail of drugs - a sedative, a new mood stabilizer and the latest antipsychotic medication.

I was puzzled - not by her case, which the resident described as textbook manic depression, but by what was left out. This patient, it seems, was never offered lithium, the single most effective treatment for bipolar disorder.

When I met with my residents in their weekly seminar, I decided to make a big deal of this case. “What do you think about her treatment?” I asked them.

There was a long silence. “What’s wrong with it?” one resident replied. Finally, a resident offered that he knew the right answer was lithium, but that newer treatments were more popular.

Now I got it. Never mind that lithium has proved its safety and efficacy over decades of use; it’s passé - eclipsed by all the new and sexy blockbuster drugs.

Lithium salts have been used to counter bipolar disorder since the 1950s, when it was discovered that they greatly reduced the intensity and frequency of mood swings in about 70 percent of patients with the disorder. While lithium must be taken with care — it is therapeutic in a narrow range of blood levels, and overdoses can be toxic — it is also the only psychotropic drug that has ever been shown to have specific antisuicidal effects. That makes it especially valuable, given the high risk of suicide associated with mood disorders.

But lithium is cheap and unpatented, so drug companies have little interest in it. Instead, they have made a new generation of mood stabilizers, some more tolerable than lithium, but none more effective.

And lithium is hardly the only unsexy but effective drug to fall by the wayside. New medical treatments are a bit like the proverbial new kid on the block: they have an allure that is hard to resist.

Doctors and patients alike are inundated by drug company marketing. The companies like to say they are interested in educating the public and physicians about various illnesses, though I have yet to meet a single patient who learned anything informative about any disease from an advertisement.

Instead, I have seen scores of patients in my office, eager to get the latest antidepressant or mood stabilizer that promised them tranquility on their TV screens.

No wonder: drug company spending on consumer advertising skyrocketed 330 percent from 1996 to 2005, according to a 2007 study in The New England Journal of Medicine.

Unlike the public, physicians continue to believe that they are immune to the influence of drug companies, despite strong evidence to the contrary. Studies have shown that doctors with ties to industry are more likely to prescribe a brand-name drug over a cheaper generic version than doctors without such ties.

This is not to say that all influence is bad. If a new drug actually proves to be safer or more effective than its predecessors, then of course it should be prescribed for those whom it will benefit.

All too often, though, the new panacea is nothing more than a “me too” drug — a minor modification of an available drug, offering little or no advantage in safety or efficacy.

Not long ago I saw a patient who told me she had treatment-resistant depression. She had failed to respond to multiple trials of five new antidepressants, including two from the same class of drugs.

I called her psychiatrist, a smart young doctor whom I know, to ask if she had ever been given one of the older antidepressants, like a tricylic or a MAOI (for monoamine oxidase inhibitor). He had little experience with these highly effective older drugs, so he hadn’t thought to use them.

I suggested that she try an MAOI. After six weeks, she improved remarkably.

Now it’s true that the newer antidepressants are generally safer and more tolerable than older ones, which is an important advantage, but they are no more effective than older antidepressants.

My younger colleague had been trained recently and had tremendous knowledge about the latest research and drugs. But his training failed to provide him with the larger context in which to place all these exciting developments.

Specifically, how do all these new drugs stack up against older ones? That is not something that we know enough about. And it is not something drug companies have any interest in discovering. To earn approval from the Food and Drug Administration, a new drug just has to beat a placebo, not a standard drug, in two clinical trials.

But patients and doctors need to know not just whether a new drug outperforms a placebo, but whether it’s a real advance on what is already on the market. For that, we need head-to-head trials comparing new and standard treatments.

That is precisely the goal of comparative-effectiveness research, President Obama's ambitious initiative to help determine which treatments really work. As you might expect, it has provoked strong resistance from the makers of drugs and devices who fear that their fancy new products may not be any better than current ones.

I don't know about you, but I'd opt for an old drug with a known track record of efficacy and safety over an expensive newcomer with no added benefit — any day of the week.

Richard A. Friedman is a professor of psychiatry at Weill Cornell Medical College.

Fire and water reveal new archaeological dating method

Scientists at The University of Manchester have developed a new way of dating archaeological objects – using fire and water to unlock their 'internal clocks'. The simple method promises to be as significant a technique for dating ceramic materials as radiocarbon dating has become for organic materials such as bone or wood.

A team from The University of Manchester and The University of Edinburgh has discovered a new technique which they call 'rehydroxylation dating' that can be used on fired clay ceramics like bricks, tile and pottery.

Working with The Museum of London, the team has been able to date brick samples from Roman, medieval and modern periods with remarkable accuracy. They have established that their technique can be used to determine the age of objects up to 2,000 years old – but believe it has the potential to be used to date objects around 10,000 years old. The exciting new findings have been published online today (20 May 2009) by the Proceedings of the Royal Society A.

The method relies on the fact that fired clay ceramic material will start to chemically react with atmospheric moisture as soon as it is removed from the kiln after firing. This continues over its lifetime causing it to increase in weight – the older the material, the greater the weight gain.

In 2003 the Manchester and Edinburgh team discovered a new law that precisely defines how the rate of reaction between ceramic and water varies over time.

The application of this law underpins the new dating method because the amount of water that is chemically combined with a ceramic provides an 'internal clock' that can be accessed to determine its age.

The technique involves measuring the mass of a sample of ceramic and then heating it to around 500 degrees Celsius in a furnace, which removes the water. The sample is then monitored in a super-accurate measuring device known as a microbalance, to determine the precise rate at which the ceramic will combine with water over time.

Using the time law, it is possible to extrapolate the information collected to calculate the time it will take to regain the mass lost on heating – revealing the sample's age.

Lead author Dr Moira Wilson, Senior Lecturer in the School of Mechanical, Aerospace and Civil Engineering (MACE), said: "These findings come after many years of hard work. We are extremely excited by the potential of this new technique, which could become an established way of determining the age of ceramic artefacts of archaeological interest.

"The method could also be turned on its head and used to establish the mean temperature of a material over its lifetime, if a precise date of firing were known. This could potentially be useful in climate change studies.

"As well as the new dating method, there are also more wide-ranging applications of the work, such as the detection of forged ceramic."

The three-year £100,000 project was funded by the Leverhulme Trust, with the microbalance - which measures mass to 1/10th of a millionth of a gram – funded by a £66,000 grant from the Engineering and Physical Science Research Council (EPSRC).

Researchers are now planning to look at whether the new dating technique can be applied to earthenware, bone china and porcelain.

Notes to editors *For more information please contact Alex Waddington, Media Relations Officer, the University of Manchester, 0161 275 8387 / 07717 881569.*

Study calls for 'as soon as possible' treatment standard for heart attack patients

Research: Association of door-to-balloon time and mortality in patients admitted to hospital with ST elevation myocardial infarction: National cohort study, BMJ online

Once in hospital, heart attack patients should be treated without delay to cut their risk of death, ideally within even less than the 90 minutes currently recommended by clinical guidelines, say researchers in a paper published on bmj.com today.

After a heart attack, patients often undergo a procedure using a balloon-tipped catheter that is inserted into a main artery, pushed into the narrowed coronary artery, and inflated to clear the blockage. This is called primary percutaneous coronary intervention, or more simply balloon angioplasty.

The time between a patient's arrival at hospital and first balloon inflation is known as the "door-to-balloon time." The current target is 90 minutes, but the benefits of reducing this time even further is still unclear.

So researchers based in the United States set out to investigate the association between door-to-balloon time and deaths in hospital among patients undergoing balloon angioplasty after a heart attack.

They analysed data for 43,801 patients from the American College of Cardiology National Cardiovascular Data Registry. All patients underwent balloon angioplasty within 12 hours of a heart attack at a United States acute care hospital between 2005 and 2006.

Average door-to-balloon time was 83 minutes, with over half of patients (58%) treated within 90 minutes of admission. Overall in-hospital mortality was 4.6%. A greater proportion of patients who had longer door-to-balloon times were women, non-white, and, on average, older than patients with shorter door-to-balloon times. They also had more comorbidities (other disorders, such as diabetes and high blood pressure) than patients with shorter door-to-balloon times.

After adjusting for factors that may have affected the results, longer door-to-balloon times were associated with a higher risk of in-hospital mortality. For example, 3% of patients with door-to-balloon times of 30 minutes died in hospital, while 4.3% of patients with door-to-balloon times of 90 minutes died. The highest mortality rate (10.3%) was for patients with door-to-balloon times of 270 minutes.

These results indicate that any delay in door-to-balloon time for heart attack patients undergoing balloon angioplasty is associated with higher mortality, even among patients treated within 90 minutes of admission, say the authors.

"Rather than accepting the 90 minute door-to-balloon time benchmark, our data support calls for an 'as soon as possible' standard for patients undergoing primary percutaneous coronary intervention. Such an approach, using necessary safeguards against inappropriate treatment, offers the potential for notable mortality reduction," they conclude.

Tying education to future goals may boost grades more than helping with homework

WASHINGTON – Helping middle school students with their homework may not be the best way to get them on the honor roll. But telling them how important academic performance is to their future job prospects and providing specific strategies to study and learn might clinch the grades, according to a research review.

"Instilling the value of education and linking school work to future goals is what this age group needs to excel in school, more than parents' helping with homework or showing up at school," said lead researcher Nancy E. Hill, PhD, of Harvard University. She examined 50 studies with more than 50,000 students over a 26-year period looking at what kinds of parent involvement helped children's academic achievement.

These findings are reported in the May issue of Developmental Psychology, published by the American Psychological Association.

"Middle school is the time when grades and interest in school decline," said Hill. "Entering puberty, hanging out with friends, wanting distance from parents and longing to make one's own decisions win over listening to parents and studying."

But adolescence is also a time when analytic thinking, problem-solving, planning and decision-making skills start to increase, Hill said. At this age, "teens are starting to internalize goals, beliefs and motivations and use these to make decisions. Although they may want to make their own decisions, they need guidance from parents to help provide the link between school and their aspirations for future work."

This type of parental involvement works for middle school students because it is not dependent on teacher relationships, like in elementary school. Middle school students have different teachers for each subject so it is much more difficult for parents to develop relationships with teachers and to influence their teenagers through their teachers, Hill said.

Parents' involvement in school events still had a positive effect on adolescents' achievement, Hill said, but not as much as parents' conveying the importance of academic performance, relating educational goals to occupational aspirations and discussing learning strategies.

Helping with homework had mixed results. Some students felt that parents were interfering with their independence or putting too much pressure on them. Some found that their parents' help was confusing because they didn't use the same strategies as their teachers. Still others felt that parents helped them complete or understand their homework, said Hill and co-author Diana F. Tyson, PhD, of Duke University.

Another possible explanation for the negative return on homework, said Hill, "was that those students who needed help with their homework were already doing poorly in school and this showed up as being associated with lower levels of achievement."

The review did not rule out ethnic and socioeconomic influences. Findings showed no difference between whites and blacks in which types of parental involvements influenced achievement but the same interventions did not necessarily produce the same results for Hispanics and Asian-Americans. Some of the studies showed

that parental involvement had different meanings across different ethnic groups, which could be the result of differences in economic resources.

"Lack of guidance is the chief reason that academically able students do not go to college," said Hill. "So communicating the value of education and offering curriculum advice about what to focus on helps these students plan their long-term goals."

Article: *"Parental Involvement in Middle School: A Meta-Analytic Assessment of the Strategies That Promote Achievement," Nancy E. Hill, PhD, Graduate School of Education, Harvard University, and Diana F. Tyson, PhD, Duke University; Developmental Psychology, Vol. 45, No. 3.*
(Full text of the article is available from the APA Public Affairs Office and at http://www.apa.org/journals/releases/dev453740.pdf)

Capsules encapsulated

Enzyme-equipped liposomes embedded in polymer capsules as a novel biomedical transport system

When cells cannot carry out the tasks required of them by our bodies, the result is disease. Nanobiotechnology researchers are looking for ways to allow synthetic systems take over simple cellular activities when they are absent from the cell. This requires transport systems that can encapsulate medications and other substances and release them in a controlled fashion at the right moment. The transporter must be able to interact with the surroundings in order to receive the signal to unload its cargo. A team led by Frank Caruso at the University of Melbourne has now developed a microcontainer that can hold thousands of individual "carrier units"—a "capsosome". As they report in the journal Angewandte Chemie, these are polymer capsules in which liposomes have been embedded to form subcompartments.

Currently, the primary type of nanotransporter used for drugs is the capsule: Polymer capsules form stable containers that are semipermeable, which allows for communication with the surrounding medium. However, these are not suitable for the transport of small molecules because they can escape. Liposomes are good at protecting small drug molecules; however, they are often unstable and impermeable to substances from the environment. The Australian researchers have now combined the advantages of both systems in their capsosomes.

Capsosomes are produced by several steps. First, a layer of polymer is deposited onto small silica spheres. This polymer contains building blocks modified with cholesterol. Liposomes that have been loaded with an enzyme can be securely anchored to the cholesterol units and thus attached to the polymer film. Subsequently, more polymer layers are added and then cross-linked by disulfide bridges into a gel by means of a specially developed, very gentle cross-linking reaction. In the final step, the silica core is etched away without damaging the sensitive cargo.

Experiments with an enzyme as model cargo demonstrated that the liposomes remain intact and the cargo does not escape. Addition of a detergent releases the enzyme in a functional state. By means of the enzymatic reaction, which causes a color change of the solution, it was possible to determine the number of liposome compartments to be about 8000 per polymer capsule.

"Because the capsosomes are biodegradable and nontoxic", says Brigitte Staedler, a senior researcher in the group, "they would also be suitable for use as resorbable synthetic cell organelles and for the transport of drugs." In addition, the scientists are planning to encapsulate liposomes filled with different enzymes together and to equip them with specific "receivers" which would allow the individual cargo to be released in a targeted fashion. This would make it possible to use enzymatic reaction cascades for catalytic reaction processes.

Author: Frank Caruso, University of Melbourne (Australia), http://www.chemeng.unimelb.edu.au/people/staff/caruso.html
Title: A Microreactor with Thousands of Subcompartments: Enzyme-Loaded Liposomes within Polymer Capsules
Angewandte Chemie International Edition 2009, 48, No. 24, 4359-4362, doi: 10.1002/anie.200900386
Copy free of charge. We would appreciate a transcript of your article or a reference to it.

Observatory

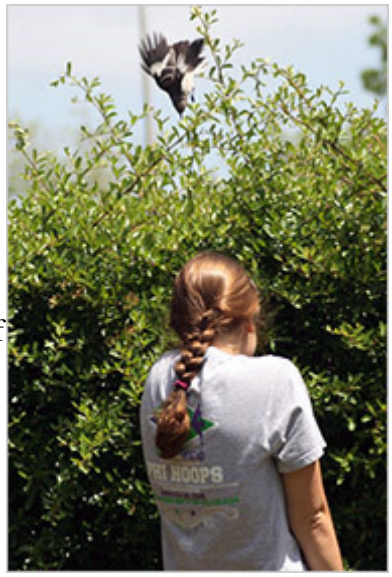
A Bird Quickly Learns to Tell Urban Friend From Foe

By HENRY FOUNTAIN

It’s hard to make it in the city. That’s true for people, but it applies to other species as well. Some animals thrive in urban settings, amid reduced habitat and increased predation, while others don’t. Scientists don’t know why, although it’s thought that certain species are more receptive to their environment and better at adapting themselves to it.

In a study at the University of Florida, Douglas J. Levey, an evolutionary ecologist, and his colleagues show that mockingbirds quickly learn to recognize humans who are perceived as threats.

Dr. Levey said the study grew out of the experiences of a graduate student and co-author, Christine M. Stracey, who while studying the birds for other reasons noticed that they would attack her when she approached their nests, which are common on the campus. The researchers set up experiments in which a person approached and touched a nest briefly once a day for four days, wearing different clothing each day. After the second day, the birds would react to the person's approach by increasing alarm calls, flying away from the nest and in some cases dive-bombing the person. On the fifth day, a different person approached the nest, and the birds' reaction was the same as on the first day — that is, no reaction at all. The findings appear this week in The Proceedings of the National Academy of Sciences.



"It's not that these animals have evolved a special ability to respond to humans," Dr. Levey said, because people and mockingbirds have not been in close contact long enough. Rather, he said, the study demonstrated that the birds were "naturally perceptive about their environment."

That talent presumably helps them thrive in urban environments against real predators like cats. "Other species don't have it and don't make it," he said.

A mockingbird preparing to dive-bomb a perceived threat. **Louis Guillette**

Plastic that grows on trees, part two

One-step process derives raw material for fuels and plastic from plants rather than crude oil

RICHLAND, Wash. -- Some researchers hope to turn plants into a renewable, nonpolluting replacement for crude oil. To achieve this, scientists have to learn how to convert plant biomass into a building block for plastics and fuels cheaply and efficiently. In new research, chemists have successfully converted cellulose -- the most common plant carbohydrate -- directly into the building block called HMF in one step.

The result builds upon earlier work by researchers at the Department of Energy's Pacific Northwest National Laboratory. In that work<http://www.pnl.gov/news/release.asp?id=255>, scientists produced HMF from simple sugars derived from cellulose. In this new work, researchers developed a way to bypass the sugar-forming step and go straight from cellulose to HMF. This simple process generates a high yield of HMF and allows the use of raw cellulose as feed material, the researchers report in an upcoming issue of Applied Catalysis A.

"In biomass like wood, corn stover and switchgrass, cellulose is the most abundant polymer that researchers are trying to convert to biofuels and plastics," said chemist Z. Conrad Zhang, who led the work while at PNNL's Institute for Interfacial Catalysis.

HMF, also known as 5-hydroxymethylfurfural, can be used as a building block for plastics and "biofuels" such as gasoline and diesel, essentially the same fuels processed from crude oil. In previous work, PNNL researchers used a chemical and a solvent known as an ionic liquid to convert the simple sugars into HMF.

The chemical, a metal chloride known as chromium chloride, converted sugar into highly pure HMF. But to be able to feed cellulosic biomass directly from nature, the team still needed to break down cellulose into simple sugars -- Zhang and colleagues wanted to learn how to skip that step.

The ionic liquid has the added benefit of being able to dissolve cellulose, which as anyone who's boiled leafy vegetables knows can be stringy and hard to dissolve. Compounds called catalysts speed up the conversion of cellulose to HMF. After trying different metal chloride catalysts in the ionic solvent, they found a pair of catalysts that worked well: A combination of copper chloride and chromium chloride under 120 degrees Celsius broke down the cellulose without creating a lot of unwanted byproducts.

In additional experiments, the team tested how well their method compared to acid, a common way to break down cellulose. The metal chlorides-ionic liquid system worked ten times faster than the acid and at much lower temperatures. In addition, the paired metal chloride catalysts allowed Zhang's research team to avoid using another compound under investigation, a mineral acid, that is known to degrade HMF.

Optimizing their method, the team found that they could consistently achieve a high yield of HMF -- the method converted about 57 percent of the sugar content in the cellulose feedstock to HMF through this single step process. The team recovered more than 90% of the HMF formed, and the final product from the process was 96% pure.

In addition, the metal chlorides and ionic liquid could be reused multiple times without losing their effectiveness. Being able to recycle the materials will lower the cost of HMF production.

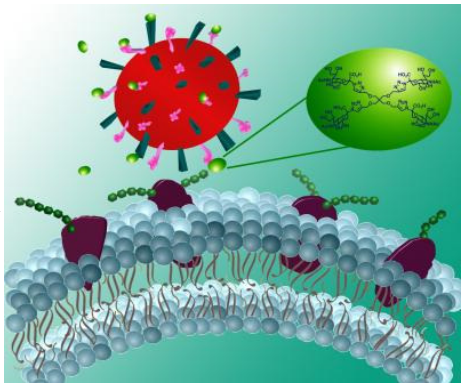
"This paper is a tremendous breakthrough. By combining the cellulose-breakdown and sugar-conversion steps, we are very close to a single-step method of converting raw biomass into a new platform chemical -- a chemical you can readily turn into a transportation fuel or for synthesis of plastics and other useful materials,"

said PNNL geochemist and study coauthor Jim Amonette. "Advances like this can help reduce our dependence on fossil fuels."

***Reference**: Y. Su, H.M. Brown, X. Huang, X.-d. Zhou, J.E. Amonette, Z.C. Zhang, Single-Step Conversion of Cellulose to 5-Hydroxymethylfurfural (HMF), a Versatile Platform Chemical, Applied Catalysis A, General, doi:10.1016/j.apcata.2009.04.002 <http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6TF5-4W1JW05-1&_user=2741876&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000058656&_version=1&_urlVersion=0&_userid=2741876&md5=4ce20ab011765a9d2f7d16b7eb1e51ea>*

A new way of treating the flu

Approach targets both the H and N portions of the virus



Troy, N.Y. — What happens if the next big influenza mutation proves resistant to the available anti-viral drugs? This question is presenting itself right now to scientists and health officials this week at the World Health Assembly in Geneva, Switzerland, as they continue to do battle with H1N1, the so-called swine flu, and prepare for the next iteration of the ever-changing flu virus.

Promising new research announced by Rensselaer Polytechnic Institute could provide an entirely new tool to combat the flu. The discovery is a one-two punch against the illness that targets the illness on two fronts, going one critical step further than any currently available flu drug.

***Dr. Robert Linhardt's new compound (green spheres) blocks both the N (pink spikes) and H (blue spikes) portion of the flu virus. The compound prevents the infection of the cell and the spread of the flu to other cell like no other compound before.* Credit: Melissa Kemp/Rensselaer Polytechnic Institute**

"We have been fortunate with H1N1 because it has been responding well to available drugs. But if the virus mutates substantially, the currently available drugs might be ineffective because they only target one portion of the virus," said Robert Linhardt, the Ann and John H. Broadbent Jr. '59 Senior Constellation Professor of Biocatalysis and Metabolic Engineering at Rensselaer. "By targeting both portions of the virus, the H and the N, we can interfere with both the initial attachment to the cell that is being infected and the release of the budding virus from the cell that has been affected."

The findings of the team, which have broad implications for future flu drugs, will be featured on the cover of the June edition of European Journal of Organic Chemistry.

The influenza A virus is classified based on the form of two of its outer proteins, hemagglutinin (H) and neuraminidase (N). Each classification – for example H5NI "bird flu" or H1N1 "swine flu" – represents a different mutation of hemagglutinin and neuraminidase or H and N.

Flu drugs currently on the market target only the neuraminidase proteins, and disrupt the ability of the virus to escape an infected cell and move elsewhere to infect other healthy cells. The new process developed by Linhardt is already showing strong binding potential to hemagglutinin, which binds to sialic acid on the surface of a healthy cell, allowing the virus to entire the cell.

"We are seeing promising preliminary results that the chemistry of this approach will be effective in blocking the hemagglutinin portion of the disease that is currently not targeted by any drug on the market," he said.

In addition, Linhardt and his team have shown their compound to be just as effective at targeting neuraminidase as the most popular drugs on the market, according to Linhardt.

The approach can also be modified to specifically target the neuraminidase or the hemagglutinin, or both, depending on the type of mutation that is present in the current version of the flu, according to Linhardt.

In the next steps of his research, Linhardt will look at how their compounds bind to hemagglutinin, and he will test the ability to block the virus first in cell cultures and then in infected animal models.

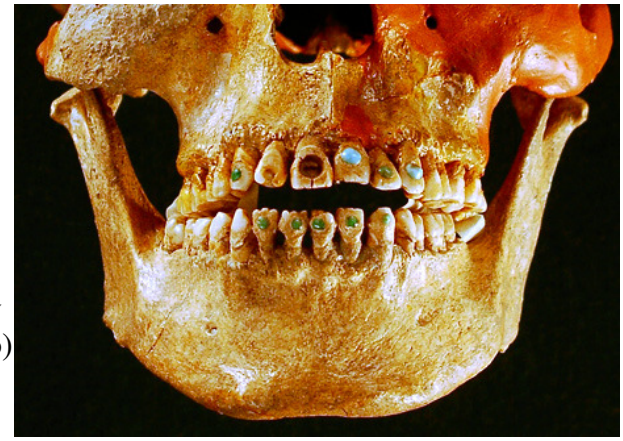
"It is still early in the process," he said. "We are several steps away from a new drug, but this technique is allowing us to move very quickly in creating and testing these compounds."

The technique that Linhardt used is the increasingly popular technique of "click chemistry." Linhardt is among the first researchers in the world to utilize the technique to create new anti-viral agents. The process allows chemists to join small units of a substance together quickly to create a new, full substance.

In this case, Linhardt used the technique to quickly build a new derivative of sialic acid. Because it is chemically very similar to the sialic acid found on the surface of a cell, the virus could mistake the compound as the real sialic acid and bind to it instead of the cell, eliminating the connections to hemagglutinin and neuraminidase that are required for initial infection and spread of the infection in the body. The currently available drugs are translation-state inhibitors whose chemical structure allows them to only effectively target the neuraminidase.

The research was funded by the National Institutes of Health. Linhardt was joined in the research by Michel Weïwer, Chi-Chang Chen, and Melissa Kemp of Rensselaer.

Ancient Gem-Studded Teeth Show Skill of Early Dentists



Jeweled teeth (grills) **Photograph courtesy José C. Jiménez López**

The glittering "grills" of some hip-hop stars aren't exactly unprecedented. Sophisticated dentistry allowed Native Americans to add bling to their teeth as far back as 2,500 years ago, a new study says.

Ancient peoples of southern North America went to "dentists" - among the earliest known - to beautify their chompers with notches, grooves, and semiprecious gems, according to a recent analysis of thousands of teeth examined from collections in Mexico's National Institute of Anthropology and History (such as the skull above, found in Chiapas, Mexico).

Scientists don't know the origin of most of the teeth in the collections, which belonged to people living throughout the region, called Mesoamerica, before the Spanish conquests of the 1500s.

But it's clear that people - mostly men - from nearly all walks of life opted for the look, noted José Concepción Jiménez, an anthropologist at the institute, which recently announced the findings. "They were not marks of social class" but instead meant for pure decoration, he commented in an e-mail interview conducted in Spanish.

In fact, the royals of the day - such as the Red Queen, a Maya mummy found in a temple at Palenque in what is now Mexico - don't have teeth decorations, Jiménez said.

Other evidence of early Mesoamerican dentistry - including a person who had received a ceremonial denture - has also been found.

Knowledgeable Dentists

The early dentists used a drill-like device with a hard stone such as obsidian, which is capable of puncturing bone.

"It's possible some type of [herb based] anesthetic was applied prior to drilling to blunt any pain," Jiménez said.

The ornamental stones - including jade - were attached with an adhesive made out of natural resins, such as plant sap, which was mixed with other chemicals and crushed bones, Jiménez said.

The dentists likely had a sophisticated knowledge of tooth anatomy, Jiménez added. For example, they knew how to drill into teeth without hitting the pulp inside, he said.

"They didn't want to generate an infection or provoke the loss of a tooth or break a tooth." **–John Roach**

'Super-recognizers,' with extraordinary face recognition ability, never forget a face

Research suggests that face recognition may vary more than previously understood

CAMBRIDGE, Mass. - Some people say they never forget a face, a claim now bolstered by psychologists at Harvard University who've discovered a group they call "super-recognizers": those who can easily recognize someone they met in passing, even many years later.

The new study suggests that skill in facial recognition might vary widely among humans. Previous research has identified as much as 2 percent of the population as having "face-blindness," or prosopagnosia, a condition characterized by great difficulty in recognizing faces. For the first time, this new research shows that others excel in face recognition, indicating that the trait could be on a spectrum, with prosopagnosics on the low end and super-recognizers at the high end.

The research is published in Psychonomic Bulletin & Review, and was led by Richard Russell, a postdoctoral researcher in the Department of Psychology at Harvard, with co-authors Ken Nakayama, Edgar Pierce Professor of Psychology at Harvard, and Brad Duchaine of the University College London.

The research involved administering standardized face recognition tests. The super-recognizers scored far above average on these tests - higher than any of the normal control subjects.

"There has been a default assumption that there is either normal face recognition, or there is disordered face recognition," says Russell. "This suggests that's not the case, that there is actually a very wide range of ability. It suggests a different model - a different way of thinking about face recognition ability, and possibly even other aspects of perception, in terms of a spectrum of abilities, rather than there being normal and disordered ability."

Super-recognizers report that they recognize other people far more often than they are recognized. For this reason, says Russell, they often compensate by pretending not to recognize someone they met in passing, so as to avoid appearing to attribute undue importance to a fleeting encounter.

"Super-recognizers have these extreme stories of recognizing people," says Russell. "They recognize a person who was shopping in the same store with them two months ago, for example, even if they didn't speak to

the person. It doesn't have to be a significant interaction; they really stand out in terms of their ability to remember the people who were actually less significant."

One woman in the study said she had identified another woman on the street who served as her as a waitress five years earlier in a different city. Critically, she was able to confirm that the other woman had in fact been a waitress in the different city. Often, super-recognizers are able to recognize another person despite significant changes in appearance, such as aging or a different hair color.

If face recognition abilities do vary, testing for this may be important for assessing eyewitness testimony, or for interviewing for some jobs, such as security or those checking identification.

Russell theorizes that super-recognizers and those with face-blindness may only be distinguishable today because our communities differ from how they existed thousands of years ago.

"Until recently, most humans lived in much smaller communities, with many fewer people interacting on a regular basis within a group," says Russell. "It may be a fairly new phenomenon that there's even a need to recognize large numbers of people."

The research was funded by the U.S. National Eye Institute and the U.K. Economic and Social Research Council.

A Long Search for a Universal Flu Vaccine

By ANDREW POLLACK

Two shots of measles vaccine given during childhood protect a person for life. Four shots of polio vaccine do the same. But flu shots must be taken every year. And even so, they provide less than complete protection.

The reason is that the influenza virus mutates much more rapidly than most other viruses. A person who develops immunity to one strain of the virus is not well protected from a different strain.

That is shaping up to be a major problem as the world prepares for a possible pandemic this fall from the new strain of swine flu. It is impossible to know how many people might die before a vaccine matched to that strain can be manufactured.

But scientists and vaccine manufacturers are hard at work on a so-called universal flu vaccine that would work against all types of flu. The goal is to provide protection for years, if not a whole lifetime, against all seasonal flu strains and pandemic strains, making flu inoculation much more like that for measles and polio.

“The universal would completely change the way flu vaccination would be done,” said Sarah C. Gilbert, a vaccine expert at the University of Oxford. “The sooner we have a universal vaccine the better because we can stop worrying about what the next pandemic will be.”

Such a one-shot-fits-all vaccine would also end the guessing game that now occurs at the beginning of each year as scientists decide which strains should be included in the seasonal vaccine for the following winter. If they guess wrong, the vaccine is less effective.

And it would make flu immunization practical for countries that now cannot afford a yearly effort. Seasonal flu is estimated to contribute to an average of 36,000 deaths in the United States and as many as half a million worldwide each year.

Unfortunately, a universal vaccine will not be ready soon enough to combat a possible pandemic from the new strain of swine flu that has already sickened thousands of people. The most advanced of the vaccines have been tested only in small clinical trials. It is likely to take several more years to show if the vaccines really work.

Indeed, the universal vaccines developed so far do not totally prevent infection, as the strain-specific vaccines can do. Rather, they limit severity and spread of the disease. Some experts say that would be sufficient, but others have their doubts.

“It wouldn’t replace the seasonal flu vaccine,” said Dr. Robert Belshe, director of the center for vaccine development at Saint Louis University. “I think it would be considered a supplement to it.”

Some experts say booster shots might still be needed every 10 years or so. It is also not clear if the vaccines would be able to provide protection against all strains, including animal-derived viruses like the new swine flu. Most of the universal vaccines under development do not even try to provide protection against influenza type B. They focus on type A, which tends to cause more severe disease and pandemics.

When someone is vaccinated or infected, the immune system makes antibodies that mostly attack a protein on the surface of the virus called hemagglutinin. But that protein is the fastest-changing part of the virus, so antibodies to one strain might not recognize another.

A universal vaccine would have to spur an immune system attack on part of the influenza virus that does not vary from strain to strain.

If that were easy to do, skeptics say, the immune system would have figured it out and people would have lasting protection. Vaccine researchers counter that some people might have immunity lasting at least a few years. And a vaccine can teach the immune system to do things it might not be able to do on its own.

"I don't see any reason it should be impossible," said Suzanne Epstein, a researcher at the Food and Drug Administration. "It works quite well in animals."

The big problem is that most of the flu virus proteins that do not vary much are on the inside of the virus, out of reach of antibodies. But there is one internal protein, called M2, that protrudes a bit from the virus. This external piece is not much of a target for antibodies, but it is the main focus of universal vaccine research.

"The trick is you've got to have a system that will raise a robust immune response against this puny little protein that's not present in any abundance," said Alan Shaw, president of VaxInnate, a small company trying to develop a universal vaccine that combines the external part of M2 with a bacterial protein that stimulates the immune system.

VaxInnate, Merck and Acambis, which is owned by Sanofi-Aventis, have each run a small test of their M2 vaccines on healthy volunteers. Vaccinated people do make antibodies to M2. But those antibodies do not totally prevent infection. It will take much larger tests to see if vaccines actually work to ameliorate disease during a real flu season.

Another issue is that the M2 protein in animal influenza viruses can be somewhat different from that in human viruses. That raises questions about how well an M2 vaccine might work, say, against the new swine flu, which is known formally as H1N1. "The new H1N1 virus could throw a little bit of a wrench into things," said Andrew Pekosz, an associate professor of molecular microbiology and immunology at Johns Hopkins University.

Earlier this year, two teams of researchers reported independently that there might be another nonvarying region on the outside of the virus. It is in the stick of the lollipop-shaped hemagglutinin protein rather than the constantly changing head.

One of the groups showed that antibodies isolated from human blood that bound to this part of the stick protected mice against many strains of flu, including the 1918 pandemic Spanish flu and the H5N1 bird flu.

But experts say it will be very difficult to isolate this part of the protein from the virus to use in a vaccine, or to manufacture it using genetic engineering. "My first thought was, 'Oh, you have to make the vaccine,' " said Dr. Hildegund C. J. Ertl, a universal vaccine researcher at the Wistar Institute in Philadelphia who was not involved in the discovery. "But then when I looked at the sequence, it wasn't straightforward at all."

An alternative would be to use the antibodies themselves as a medicine, though antibodies are expensive to manufacture and time-consuming to infuse into patients.

With constant regions outside the virus hard to find, some efforts aim at nonchanging proteins inside the virus, like one called nucleoprotein. Antibodies cannot get at these proteins to prevent an infection. So the idea is to spur other soldiers of the immune system called T cells to quickly kill the infected cells before they could make new viruses. That would limit disease severity.

Dr. Epstein of the F.D.A. said a vaccine based on a nucleoprotein from a human H1N1 virus was able to protect animals from a lethal dose of the H5N1 bird flu, the virus which stoked pandemic fears a few years ago. Oxford University has tested a T cell vaccine in 28 healthy adults and found it did increase T cell responses.

Ultimately, the best results might come from combining the techniques. Dynavax, a California biotechnology company, hopes to begin trials next year of a vaccine designed to spur antibodies against M2 and T cells against nucleoprotein.

Dr. Epstein said expectations for a universal vaccine must be realistic. "It's not intended to totally block infection," she said. "But what it can do is greatly reduce disease and spread and symptoms."

Old Stain in a New Combination

Methylene blue can curb the spread of malaria parasites when administered together with new malaria medication / Heidelberg researchers publish in PLoS One

New combinations of agents based on the oldest synthetic malaria drug, the methylene blue stain, can curb the spread of malaria parasites and make a significant contribution to the long-term eradication called for by the international "Roll Back Malaria Initiative." In a study on 160 children with malaria in Burkina Faso, specialists in tropical medicine from the Heidelberg University Hospital have shown that in combination with newer malaria drugs, methylene blue prevents the malaria pathogen in infected persons from being re-ingested by mosquitoes and then transmitted to others and is thus twice as effective as the standard therapy. The results of the study were published in May 2009 in the online journal PLoS One.

Malaria is still one of the deadliest tropical diseases. Every year, 300 million people are infected with malaria and more than one million of them die or suffer severe brain damage. Children under five years are particularly susceptible.

Malaria pathogens need humans and mosquitoes

When the Anopheles mosquito bites, the malaria parasites (plasmodia) in the saliva of the mosquito enter the human body, reproduce in liver cells and then attack the red blood cells. This causes severe symptoms such as high fever or anemia; children in particular can even fall into a coma. During reproduction in the human body, some parasites develop into special reproductive cells, gametocytes. If they are ingested by an Anopheles mosquito, they continue to reproduce in the mosquito. The cycle is complete.

The gametocytes are the key for the spread of malaria by the Anopheles mosquito. Common malaria drugs known as artemisinins block reproduction of the parasites in the human body and reduce the number of gametocytes in blood by half. This makes the transmission of the parasite to the mosquito more difficult but does not completely prevent it. “We urgently need alternative therapies that are effective against the gametocytes and thus improve the control of malaria,” states Professor Dr. Olaf Müller, Project Head in the Department of Tropical Medicine and Public Health of the Hygiene Institute at the University of Heidelberg.

Methylene blue prevents transmission to mosquitoes

The appropriate component for such an alternative is a proven agent – the methylene blue stain which has been given to malaria patients since the end of the 19th century has proven to be safe, well tolerated, and effective in combination with various malaria medications.

In the current study in Burkina Faso with 160 malaria patients between the ages of six and ten the Heidelberg scientists tested the effect of combination therapies with artemisinins and methylene blue on gametocytes in the blood. One group of the children received the standard treatment, consisting of a combination of artesunate and amodiaquine. Two other groups received methylene blue combined with one of the two drugs respectively. The physicians checked the number of gametocytes in blood samples three, seven, and fourteen days after the start of therapy.

Combination therapy is twice as effective as standard therapy

It was shown that both combination therapies are twice as effective against gametocytes as the standard therapy – these parasites had almost completely disappeared in the first few days. “Methylene blue not only inhibits the formation of the reproductive forms, but also destroys already existing cells,” explains Professor Müller. “In this way, the profiles of methylene blue and artemisinins, which quickly and effectively eliminate the parasites in the red blood cells, complement each other.” Since the study group from Heidelberg has used methylene blue in Western Africa for years, it has already been adequately clinically tested – severe or frequent side effects did not occur. Especially important is that the combination makes it more difficult for resistance to artemisinins to develop.

The study is a project in the special research area SFB 544 “Control of Tropical Infectious Diseases” of the German Research Association, to which scientists and physicians from the university hospital and other Heidelberg research centers belong.

More Information: *www.klinikum.uni-heidelberg.de/Tropenhygiene-und-oeffentliches-Gesundheitswesen.1213.0.html*
www.hyg.uni-heidelberg.de/sfb544

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Protein from algae shows promise for stopping SARS

ATS 2009, SAN DIEGO— A protein from algae may have what it takes to stop Severe Acute Respiratory Syndrome (SARS) infections, according to new research. A recent study has found that mice treated with the protein, Griffithsin (GRFT), had a 100 percent survival rate after exposure to the SARS coronavirus (SARS-CoV), as compared to a 30 percent survival for untreated mice.

The research will be presented at the American Thoracic Society's 105th International Conference in San Diego on Wednesday, May 20.

Despite its dramatic entrance into the domain of worldwide public health threats in 2002, little headway has been made therapeutically toward preventing or treating SARS after infection. But GRFT, a lectin protein derived from algae, offers a new possible hope. GRFT is thought to exert its anti-viral effects by altering the shape of the sugar molecules that line the virus' envelope, allowing it to attach to and invade human cells, where it takes over the cells' reproductive machinery to replicate itself. Without that crucial ability, the virus is unable to cause disease.

"While preliminary, these results are very exciting and indicate a possible therapeutic approach to future SARS or other coronaviral outbreaks," stated Christine Wohlford-Lenane, senior research assistant at the department of pediatrics University of Iowa and the lead author of the study.

Researchers treated experimental mice with GRFT or a sham treatment and then inoculated them with the SARS virus. They analyzed the antiviral activity of GRFT and the extent to which the virus was able to invade and replicate in the mice at two, four and 10 days after infection. They found that mice who had not been treated with GRFT showed 20 times more plaque-forming units of virus than treated mice. They also noted that the lungs of untreated infected mice showed extensive necrotizing bronchitis and prominent edema, while mice treated with GRFT showed evidence of significantly less severe lung damage. Additionally, mice treated with GRFT did not experience the drastic weight loss of untreated mice, which lost 35 percent of their body mass.

"This indicates that not only did the GRFT stop the virus from replicating, but also prevented secondary outcomes, such as weight loss, that are associated with infection," said Ms. Wohlford-Lenane.

"We are planning future studies to investigate prophylaxis, versus treatment interventions with GRFT, in the SARS mouse model in collaboration with Barry O'Keefe at the National Cancer Institute," she concluded. "In addition, we want to learn whether mice protected from SARS by GRFT develop protective immunity against future infection."

How to fit 300 DVDs on one disc

A new optical recording method could pave the way for data discs with 300 times the storage capacity of standard DVDs, Nature journal reports.

The researchers say this could see a whopping 1.6 terabytes of information fit on a DVD-sized disc. They describe their method as "five-dimensional" optical recording and say it could be commercialised.

The technique employs nanometre-scale particles of gold as a recording medium.

Researchers at Swinburne University of Technology in Australia have exploited the particular properties of these gold "nano-rods" by manipulating the light pointed at them.

The team members described what they did as adding three "dimensions" to the two spatial dimensions that DVD and CD discs already have.

They say they were able to introduce a spectral - or colour - dimension and a polarisation dimension, as well as recording information in 10 layers of the nano-rod films, adding a third spatial dimension.

The different colours and polarisations of light access different images

The scientists used the nanoparticles to record information in a range of different colour wavelengths on the same physical disc location. This is a major improvement over traditional DVDs, which are recorded in a single colour wavelength with a laser. Also, the amount of incoming laser light absorbed by the nanoparticles depends on its polarisation. This allowed the researchers to record different layers of information at different angles.

The researchers thus refer to the approach as 5-D recording. Previous research has demonstrated recording techniques based on colour or polarisation, but this is the first work that shows the integration of both.

As a result, the scientists say they have achieved unprecedented data density.

Their approach used 10-layer stacks composed of thin glass plates as the recording medium. If scaled up to a DVD-sized disk, the team would be able to record 1.6 terabytes - that is, 1,600 gigabytes - or over 300 times the quantity stored on a standard DVD.

Significant improvements could be made by thinning the spacer layers and using more than two polarisation angles - pushing the limits to 10 terabytes per disc and beyond, the researchers say.

Bit by bit

Recent efforts based on holography have shown that up to 500 Gb could potentially be stored on standard DVD-sized disks.

Holographic methods take all of the information to be recorded and encode it in the form of a graph showing how often certain frequencies arise in it. That means that the recording process is a complex, all-at-once, all-or-nothing approach that would be difficult to implement on an industrial scale.

By contrast, 5-D recording is "bit-by-bit", like current CD and DVD writing processes in that each piece of information is read sequentially. That is likely to mean that recording and read speeds would be comparatively slow, but the approach would be easier to integrate with existing technology.

"The optical system to record and read 5-D is very similar to the current DVD system," says James Chon, a co-author on the research. "Therefore, industrial scale production of the compact system is possible."

Now that the method has been demonstrated in custom-made multi-layer stacks, the team is working in conjunction with Samsung to develop a drive that can record and read onto a DVD-sized disc.

Dr Chon says that the material cost of a disc would be less than $0.05 (£0.03), but there are a number of advantages in moving to silver nano-rods that would bring that cost down by a factor of 100.

For optical data storage expert Tom Milster, at the University of Arizona, the beauty of the approach is in its simplicity. "It's not just elegant - there are a lot of experiments that are elegant - it's relatively straightforward," he told BBC News.

For the moment, Dr Milster says, the equipment needed to write the data would make a commercial system expensive. However, that has not stopped the development of optical storage solutions in the past.

"For example, a Blu-ray player is not an easy system to realise; they've got some wonderful optics in there," Dr Milster said. "People thought that would be pretty difficult to do, but others managed to do it."

Why do people with Down syndrome have less cancer?

Research in mice and human stem cells suggests new therapeutic targets

Most cancers are rare in people with Down syndrome, whose overall cancer mortality is below 10 percent of that in the general population. Since they have an extra copy of chromosome 21, it's been proposed that people with Down syndrome may be getting an extra dose of one or more cancer-protective genes. The late cancer researcher Judah Folkman, MD, founder of the Vascular Biology Program at Children's Hospital Boston, popularized the notion that they might be benefiting from a gene that blocks angiogenesis, the development of blood vessels essential for cancer's growth, since their incidence of other angiogenesis-related diseases like macular degeneration is also lower. A study from Children's confirms this idea in mice and human cells and identifies specific new therapeutic targets for treating cancer.

Publishing online May 20 in the journal Nature, cancer researcher Sandra Ryeom, PhD, and colleagues from Children's Vascular Biology Program show that a single extra copy of Dscr1 (one of the 231 genes on chromosome 21 affected by trisomy, with three copies rather than two) is sufficient to significantly suppress angiogenesis and tumor growth in mice, as well as angiogenesis in human cells. The team also found its protein, DSCR1, to be elevated in tissues from people with Down syndrome and in a mouse model of the disease.

Further study confirmed that DSCR1 acts by suppressing signaling by the angiogenesis-promoting protein vascular endothelial growth factor (VEGF). In a mouse model of Down syndrome, endothelial cells (which make up blood vessel walls) showed a decreased growth response to VEGF when they had an extra copy of Dscr1. An extra copy of another chromosome 21 gene, Dyrk1A, also appeared to decrease cells' response to VEGF.

Finally, Ryeom and colleagues showed that these extra genes suppress VEGF signaling via a specific signaling pathway inside endothelial cells -- the calcineurin pathway. Until now, Ryeom says, little has been known about the internal pathways VEGF activates once it binds to cellular receptors; most existing anti-VEGF drugs work by simply binding to VEGF (like Avastin) or blocking its ability to bind to its cellular receptors.

"We're now moving further downstream by going inside the cell," Ryeom says. "When we targeted calcineurin, we suppressed the ability of endothelial cells to grow and form vessels. While it's likely not the only pathway that's involved, if you take it out, VEGF is only half as effective."

Ryeom and her group next validated the mouse findings in human cells. In collaboration with George Daley, MD, PhD, and colleagues in the Stem Cell program at Children's, she worked with induced pluripotent stem cells (iPS cells) created from skin cells from a patient with Down syndrome -- one of 10 disease-specific lines recently developed in Daley's lab.

Knowing that iPS cells tend to induce tumors known as teratomas when inserted into mice, Ryeom guessed that teratomas grown from iPS cells with an extra chromosome 21 would have far fewer blood vessels than teratomas from iPS cells with the normal number of chromosomes. She was right: blood vessels budded in the Down teratomas, but never fully formed.

"The studies in the iPS cells helped validate and confirm that the suppression of angiogenesis that we saw in mouse models also holds true in humans," says Ryeom. "It suggests that these two genes might point to a viable cancer therapy."

Ryeom's group has identified which part of the DSCR1 protein blocks calcineurin and is testing to see whether that fragment can be delivered specifically to endothelial cells, to prevent them from forming new blood vessels, without affecting calcineurin pathways in other cells and causing side effects.
"Immunosuppressive drugs also target calcineurin in T-cells," Ryeom notes. "We think that Dscr1 blocks calcineurin specifically in endothelial cells, without affecting T-cells, but we need to check."

Folkman's interest in why patients with Down syndrome have such a reduced risk for cancer focused on endostatin, an anti-angiogenic compound made by the body. Discovered in the Folkman lab, endostatin is a fragment of collagen 18 -- whose gene is also on chromosome 21. People with Down syndrome reportedly have almost doubled levels of endostatin because of the extra copy of the gene.

"I think there may be four or five genes on chromosome 21 that are necessary for angiogenesis suppression," says Ryeom. "In huge databases of cancer patients with solid tumors, there are very few with Down syndrome. This suggests that protection from chromosome 21 genes is pretty complete."

The study was funded by the Howard Hughes Medical Institute, the Harvard Stem Cell Institute and the NIH Director's Pioneer Award (supporting George Daley, MD, PhD); as well as the Smith Family Medical Foundation, the Garrett B. Smith Foundation and Annie's Fun Foundation (supporting Sandra Ryeom, PhD). Kwan-Hyuck Baek, PhD, of Children's Vascular Biology program was the paper's first author.

Anti-inflammatory effect of 'rotten eggs' gas

A new slow-release hydrogen sulfide donating molecule may hold the key to the development of new anti-inflammatory drugs

Researchers from the Peninsula Medical School in Exeter have synthesized a new molecule which releases hydrogen sulfide (H2S) - the gas that gives rotten eggs their characteristic smell and which has recently been found to be produced naturally in the body - and discovered that it could in time lead to a range of new, safer and effective anti-inflammatory drugs for human use.

The study has been published in respected journal Free Radical Biology and Medicine.

The new molecule can generate H2S slowly, which is a major breakthrough. Until now, H2S could only be delivered in one go via a gas cylinder or through the use of sulfide salts. Both of which are administered as a large bolus to generate instant H2S and are generally highly toxic, in addition to being foul smelling.

The research team investigated the role of H2S in endotoxic shock, which causes a fatal loss of blood pressure and extensive tissue inflammation. They discovered that when H2S is delivered in a slow and sustained manner, a potent anti-inflammatory effect is produced. Cell signalling molecules that drive inflammation, such as TNFα, IL-1, IL-6 and prostaglandins, were reduced while levels of the body's own anti-inflammatory molecules (i.e. IL-10) were increased. Using H2S donating molecules to control H2S delivery in the body could pave the way for the development of novel approaches to the treatment of inflammatory disorders.

Dr. Matt Whiteman from the Peninsula Medical School, Exeter commented: "We have known for a few years that H2S levels in tissue and blood are markedly elevated during inflammation. It was assumed that this was a bad thing. However, our research is suggesting that H2S could be elevated as part of the body's way to limit inflammation."

He added: "Although traditional anti-inflammatory drugs are very potent and safe, they can sometimes damage the stomach lining in some individuals leading to further complications. Generating H2S in a controlled and sustained manner offers the potential for the development of a new group of anti-inflammatory drugs or lead to the modification of existing drugs so they also release H2S and hopefully come with less gastrointestinal side-effects."

Dr. Whiteman is highly enthusiastic about the future, adding: "The next step is to secure further funding to expand our work into the clinical setting. We strongly believe that this new and innovative area of research could hold the key to a range of applications for human health. Indeed, we have already shown that the use of H2S and this new H2S donor is beneficial in models of high blood pressure. We are only just starting to unravel the role of H2S has in the body in health and disease."

The research was funded by the Northcott Devon Medical Foundation.

Asteroid attack 3.9 billion years ago may have enhanced early life on Earth, says CU-Boulder study

The bombardment of Earth nearly 4 billion years ago by asteroids as large as Kansas would not have had the firepower to extinguish potential early life on the planet and may even have given it a boost, says a new University of Colorado at Boulder study.

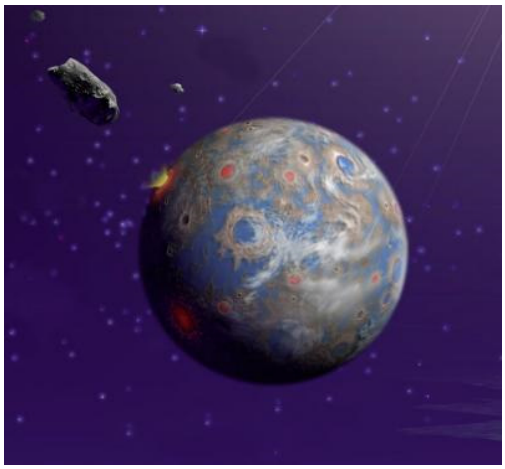
Impact evidence from lunar samples, meteorites and the pockmarked surfaces of the inner planets paints a picture of a violent environment in the solar system during the Hadean Eon 4.5 to 3.8 billion years ago, particularly through a cataclysmic event known as the Late Heavy Bombardment about 3.9 million years ago. Although many believe the bombardment would have sterilized Earth, the new study shows it would have melted only a fraction of Earth's crust, and that microbes could well have survived in subsurface habitats, insulated from the destruction.

"These new results push back the possible beginnings of life on Earth to well before the bombardment period 3.9 billion years ago," said CU-Boulder Research Associate Oleg Abramov. "It opens up the possibility

that life emerged as far back as 4.4 billion years ago, about the time the first oceans are thought to have formed."

A paper on the subject by Abramov and CU-Boulder geological sciences Professor Stephen Mojzsis appears in the May 21 issue of Nature.

Because physical evidence of Earth's early bombardment has been erased by weathering and plate tectonics over the eons, the researchers used data from Apollo moon rocks, impact records from the moon, Mars and Mercury, and previous theoretical studies to build three-dimensional computer models that replicate the bombardment. Abramov and Mojzsis plugged in asteroid size, frequency and distribution estimates into their simulations to chart the damage to the Earth during the Late Heavy Bombardment, which is thought to have lasted for 20 million to 200 million years.



The 3-D models allowed Abramov and Mojzsis to monitor temperatures beneath individual craters to assess heating and cooling of the crust following large impacts in order to evaluate habitability, said Abramov. The study indicated that less than 25 percent of Earth's crust would have melted during such a bombardment.

The bombardment of Earth by asteroids 3.9 billion years ago may have enhanced early life, according to a new University of Colorado study. **NASA/JPL**

The CU-Boulder researchers even cranked up the intensity of the asteroid barrage in their simulations by 10-fold -- an event that could have vaporized Earth's oceans. "Even under the most extreme conditions we imposed, Earth would not have been completely sterilized by the bombardment," said Abramov.

Instead, hydrothermal vents may have provided sanctuaries for extreme, heat-loving microbes known as "hyperthermophilic bacteria" following bombardments, said Mojzsis. Even if life had not emerged by 3.9 billion years ago, such underground havens could still have provided a "crucible" for life's origin on Earth, Mojzsis said.

The researchers concluded subterranean microbes living at temperatures ranging from 175 degrees to 230 degrees Fahrenheit would have flourished during the Late Heavy Bombardment. The models indicate that underground habitats for such microbes increased in volume and duration as a result of the massive impacts. Some extreme microbial species on Earth today -- including so-called "unboilable bugs" discovered in hydrothermal vents in Yellowstone National Park -- thrive at 250 F.

Geologic evidence suggests that life on Earth was present at least 3.83 billion years ago, said Mojzsis. "So it is not unreasonable to suggest there was life on Earth before 3.9 billion years ago. We know from the geochemical record that our planet was eminently habitable by that time, and this new study sews up a major problem in origins of life studies by sweeping away the necessity for multiple origins of life on Earth."

Most planetary scientists believe a rogue planet as large as Mars smacked Earth with a glancing blow 4.5 billion years ago, vaporizing itself and part of Earth. The collision would have created an immense vapor cloud from which moonlets, and later our moon, coalesced, Mojzsis said. "That event, which preceded the Late Heavy Bombardment by at least 500 million years, would have effectively hit Earth's re-set button," he said.

"But our results strongly suggest that no events since the moon formation were capable of destroying Earth's crust and wiping out any biosphere that was present," Mojzsis said. "Instead of chopping down the tree of life, our view is that the bombardment pruned it."

The results also support the potential for microbial life on other planets like Mars and perhaps even rocky, Earth-like planets in other solar systems that may have been resurfaced by impacts, said Abramov.

"Exactly when life originated on Earth is a hotly debated topic," says NASA's Astrobiology Discipline Scientist Michael H. New, manager of the Exobiology and Evolutionary Biology program. "These findings are significant because they indicate life could have begun well before the LHB, during the so-called Hadean Eon of Earth's history 3.8 billion to 4.5 billion years ago."

The research by Abramov and Mojzsis is sponsored by NASA Astrobiology Program's Exobiology and Evolutionary Biology Department and the NASA Postdoctoral Program. The Exobiology and Evolutionary Biology Program supports research into the origin, evolution and distribution of life on Earth and the potential for life elsewhere. Mojzsis is a member of the new NASA Lunar Science Institute through the Center for Lunar Origin and Evolution.

For more information on CU-Boulder's Early Earth and Planetary Geology Group visit http://isotope.colorado.edu. For more information on the NASA Lunar Science Institute Program visit http://lunarscience.arc.nasa.gov/. For more information on the NASA Astrobiology Institute visit http://astrobiology.nasa.gov/nai/.

Early identification of dementia increasingly difficult

If grandma seems to forget things, will she end up demented? These days, memory loss is one of the very few symptoms that may signal which 70-year-olds risk developing dementia. This is shown in a doctoral thesis at the Sahlgrenska Academy at the University of Gothenburg, Sweden.

Several of the tests previously used to predict which elderly individuals risk developing dementia do not seem to work any longer. The thesis shows that memory loss is the only factor that can still be used to indicate who is at risk, although not among the very old.

The study compared nondemented 70-year-olds examined in the early 1970s with nondemented 70-year-olds examined in the year 2000. The results show that those who were examined in 2000 scored much higher on psychological tests than those examined 30 years earlier. This finding clearly indicates that such tests can no longer be used to predict future dementia.

- In the early 1970s, several different tests could be used to predict people's risks of developing dementia, but today it seems like psychiatric evaluation of the memory is the only useful test. In addition, it is more difficult to predict dementia the higher the person's level of education, says physician PhD Simona Sacuiu, the author of the thesis.

The follow-up of the 70-year-olds five years later showed that 5% had developed dementia. Those with memory problems showed an increased risk of developing dementia, although not everybody with poor memory developed dementia. Consequently, the link between forgetfulness and future dementia is more complex than commonly thought. Memory loss among elderly individuals may, but doesn't have to be, an early sign.

- In order to effectively detect dementia at an early stage, we need a useful tool that includes several types of tests, but the tests need continuous adjustments since the elderly of today perform much better at standardised psychological tests than previous generations, says PhD Sacuiu.

Examinations of a group of nondemented 85-year-olds show that the link between memory problems and dementia is not as clear in this age group. The 85-year-olds' ability to find words, to copy a geometric figure and to take quick decisions were some qualities that were evaluated in a psychiatric assessment. More than 300 individuals participated in the study, of which 17% had developed dementia three years later.

- We can't say that memory loss is the only meaningful sign of future dementia among 85-year-olds, since other symptoms, such as difficulties finding words or drawing a geometric figure, were needed for their risk of developing dementia to increase, says Sacuiu.

The H70 study

H70, short for Health 70, is a unique population study at the Sahlgrenska Academy. The study was started in 1971 with an assessment of 70-year-olds. The individuals were followed up regularly for 30 years. A new H70 study was started in the year 2000. Its participants will be followed up again during 2009 at age 79. The study includes data on over 2000 residents of Gothenburg, Sweden. The participants have been examined both physically and mentally, and have made it possible for several research teams to pinpoint various trends in physical and mental health in the ageing population.

New 'broadband' cloaking technology simple to manufacture

WEST LAFAYETTE, Ind. - Researchers have created a new type of invisibility cloak that is simpler than previous designs and works for all colors of the visible spectrum, making it possible to cloak larger objects than before and possibly leading to practical applications in "transformation optics."

Whereas previous cloaking designs have used exotic "metamaterials," which require complex nanofabrication, the new design is a far simpler device based on a "tapered optical waveguide," said Vladimir Shalaev, Purdue University's Robert and Anne Burnett Professor of Electrical and Computer Engineering.

Waveguides represent established technology - including fiber optics - used in communications and other commercial applications.

The research team used their specially tapered waveguide to cloak an area 100 times larger than the wavelengths of light shined by a laser into the device, an unprecedented achievement. Previous experiments with metamaterials have been limited to cloaking regions only a few times larger than the wavelengths of visible light.

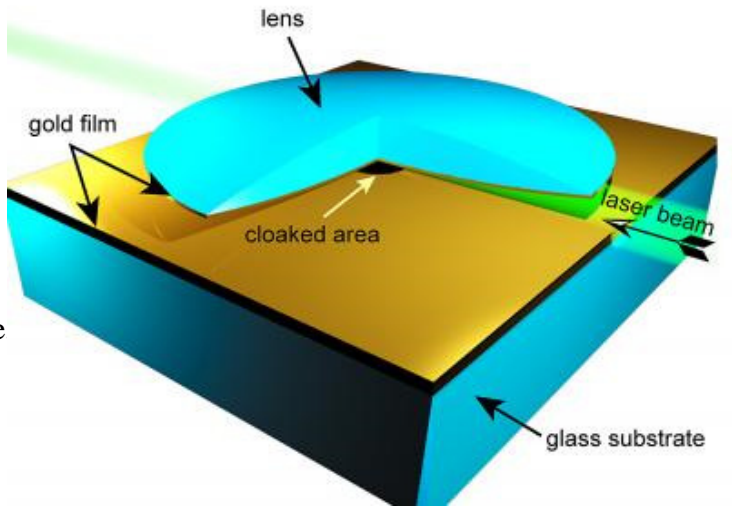
Because the new method enabled the researchers to dramatically increase the cloaked area, the technology offers hope of cloaking larger objects, Shalaev said.

Findings are detailed in a research paper appearing May 29 in the journal Physical Review Letters. The paper was written by Igor I. Smolyaninov, a principal electronic engineer at BAE Systems in Washington, D.C.; Vera N. Smolyaninova, an assistant professor of physics at Towson University in Maryland; Alexander Kildishev, a principal research scientist at Purdue's Birck Nanotechnology Center; and Shalaev.

"All previous attempts at optical cloaking have involved very complicated nanofabrication of metamaterials containing many elements, which makes it very difficult to cloak large objects," Shalaev said. "Here, we showed that if a waveguide is tapered properly it acts like a sophisticated nanostructured material."

The waveguide is inherently broadband, meaning it could be used to cloak the full range of the visible light spectrum. Unlike metamaterials, which contain many light-absorbing metal components, only a small portion of the new design contains metal.

Theoretical work for the design was led by Purdue, with BAE Systems leading work to fabricate the device which is formed by two gold-coated surfaces, one a curved lens and the other a flat sheet. The researchers cloaked an object about 50 microns in diameter, or roughly the width of a human hair, in the center of the waveguide.



This image shows the design of a new type of invisibility cloak that is simpler than previous designs and works for all colors of the visible spectrum, making it possible to cloak larger objects than before and possibly leading to practical applications in "transformation optics." **Purdue University**

"Instead of being reflected as normally would happen, the light flows around the object and shows up on the other side, like water flowing around a stone," Shalaev said.

The research falls within a new field called transformation optics, which may usher in a host of radical advances, including cloaking; powerful "hyperlenses" resulting in microscopes 10 times more powerful than today's and able to see objects as small as DNA; computers and consumer electronics that use light instead of electronic signals to process information; advanced sensors; and more efficient solar collectors.

Unlike natural materials, metamaterials are able to reduce the "index of refraction" to less than one or less than zero. Refraction occurs as electromagnetic waves, including light, bend when passing from one material into another. It causes the bent-stick-in-water effect, which occurs when a stick placed in a glass of water appears bent when viewed from the outside. Each material has its own refraction index, which describes how much light will bend in that particular material and defines how much the speed of light slows down while passing through a material.

Natural materials typically have refractive indices greater than one. Metamaterials, however, can be designed to make the index of refraction vary from zero to one, which is needed for cloaking.

The precisely tapered shape of the new waveguide alters the refractive index in the same way as metamaterials, gradually increasing the index from zero to 1 along the curved surface of the lens, Shalaev said.

Previous cloaking devices have been able to cloak only a single frequency of light, meaning many nested devices would be needed to render an object invisible.

Kildishev reasoned that the same nesting effect might be mimicked with the waveguide design. Subsequent experiments and theoretical modeling proved the concept correct.

Researchers do not know of any fundamental limit to the size of objects that could be cloaked, but additional work will be needed to further develop the technique.

Recent cloaking findings reported by researchers at other institutions have concentrated on a technique that camouflages features against a background. This work, which uses metamaterials, is akin to rendering bumps on a carpet invisible by allowing them to blend in with the carpet, whereas the Purdue-based work concentrates on enabling light to flow around an object.

***Related Web site**: Vladimir Shalaev https://engineering.purdue.edu/ECE/People/profile?resource_id=3322*

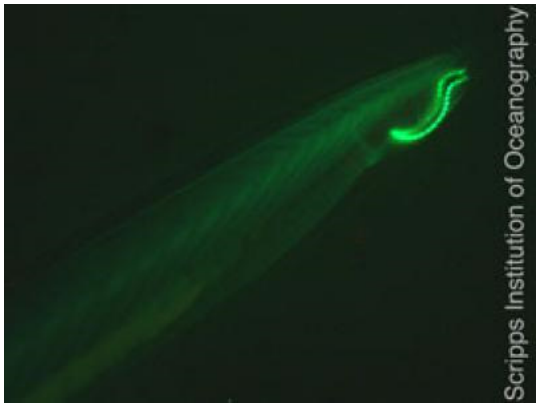
Unusually large family of green fluorescent proteins discovered in marine creature

Scripps scientists find unexpected role for proteins: antioxidants

Researchers at Scripps Institution of Oceanography at UC San Diego and the Salk Institute for Biological Studies have discovered a family of green fluorescent proteins (GFPs) in a primitive sea animal, along with new clues about the role of the proteins that has nothing to do with their famous glow.

GFPs recently gained international attention with the awarding of the 2008 Nobel Prize in Chemistry, shared by UC San Diego's Roger Tsien, as word spread of their extensive presence in nature as well as benefit to researchers. GFPs, originally isolated from a luminous jellyfish, have gained scientific ubiquity in uses ranging from biomedical tracers to probes for testing environmental quality. But while the value of GFPs in

biomedicine and bioengineering has become evident, their diversity across the tree of life and their role in nature haven't been as easily deciphered.



New hints have emerged as Erin Bomati, a former postdoctoral researcher at Scripps Oceanography, Gerard Manning of the Salk Institute for Biological Studies and Scripps lead-scientist Dimitri Deheyn discovered the largest known family of GFPs. They found 16 related types of GFPs in amphioxus, a thin, non-luminous fish-like animal that lives in coastal areas and spends most of its time burrowed in ocean sand. The discovery, described in the journal BioMed Central (BMC) Evolutionary Biology, was made in Branchiostoma floridae, an amphioxus species collected off Tampa, Fla.

Amphioxus fluorescence is only very intense in specific areas of the mouth. The remainder of the body shows less or no fluorescence. This discrepancy in fluorescence distribution is possible because the 16 GFPs of amphioxus have different fluorescent capacities. **Scripps Institution of Oceanography, UC San Diego**

Amphioxus, also known as lancelets, is the closest living invertebrate relative of vertebrates and much more evolved than the jellyfish in which the original GFP discovery was made. In the paper, the researchers demonstrate that the 16 newly discovered GFPs have different characteristics of light production, some brightly fluorescent and others less or not at all.

"Despite a huge knowledge base about the biochemistry of GFPs, little is know about their biological functions and our results clearly indicate that it is not always related to fluorescence," said Deheyn.

Using a range of genetic analyses and techniques, including sequencing and cloning, the researchers discovered that some GFPs, especially those with low fluorescence capacity, could have a defense function in the wild acting as an antioxidant, working to protect the animal in times of illness or stress. It's the first evidence of the proteins being used in a role beyond glowing fluorescence within the same organism.

Under white light (top), amphioxus appears whitish/translucent. Under epifluorescence (bottom), amphioxus exhibits strong green fluorescence in the head part (arrow), while the rest of the body is either slightly fluorescent or not at all. Different parts of amphioxus seem to express different GFPs, with distinct fluorescence capacity and/or antioxidant capacity. **Scripps Institution of Oceanography, UC San Diego**

"Originally GFPs might have been selected for their function of being able to absorb or re-emit light, but here we show that some GFPs can also act as antioxidants," said Deheyn. "This is the first time that we have identified distinct functions in coexisting GFPs."

Deheyn said GFPs appear to suppress so-called "oxygen radicals" from harmful effects to the amphioxus' body, similar to the role antioxidants serve in human bodies.

Deheyn said the new findings will help scientists understand the evolution of this protein across the animal kingdom, while providing bioengineers and biotechnologists a new window of comparison through the novel family of GFPs and an unveiled aspect of their application. The range of colors and functions encoded by these GFPs may also help to decode which aspects of their sequences are responsible for which functions and the engineering of new forms of GFP probes.

Face protection effective in preventing the spread of influenza

Surgical mask and respirator use should be encouraged during current swine flu outbreak

Stanford, CA - A new article in the journal Risk Analysis assessed various ways in which aerosol transmission of the flu, a central mode of diffusion which involves breathing droplets in the air, can be reduced. Results show that face protection is a key infection control measure for influenza and can thus affect how people should try to protect themselves from the swine flu.

Lawrence M. Wein, Ph.D., and Michael P. Atkinson of Stanford University constructed a mathematical model of aerosol transmission of the flu to explore infection control measures in the home.

Their model predicted that the use of face protection including N95 respirators (these fit tight around the face and are often worn by construction workers) and surgical masks (these fit looser around the face and are often worn by dental hygienists) are effective in preventing the flu. The filters in surgical masks keep out 98 percent of the virus. Also, only 30 percent of the benefits of the respirators and masks are achieved if they are used only after an infected person develops symptoms.

"Our research aids in the understanding of the efficacy of infection control measures for influenza, and provides a framework about the routes of transmission," the authors conclude.

This timely article has the potential to impact current efforts and recommendations to control the so-called swine flu by international, national and local governments in perspective.

This study is published in the journal Risk Analysis. Media wishing to receive a PDF of this article may contact journalnews@bos.blackwellpublishing.net.

Magma pulses may reveal Earth's 'heartbeat'

* 20 May 2009 **by Catherine Brahic**

EARTH may have a heartbeat. Evidence from Hawaii and Iceland hints that the planet's core may be dispatching simultaneous plumes of magma towards the surface every 15 million years or so.

If the hypothesis is true, it would revolutionise our ideas of what's happening far below our feet. Independent scientists contacted by New Scientist were split, with some scornful and others intrigued.

Rolf Mjelde of the University of Bergen and Jan Inge Faleide of the University of Oslo, both in Norway, used seismological data to measure the thickness of Earth's crust between Iceland and Greenland (see map). Iceland is on the Mid-Atlantic Ridge, where magma wells up to form fresh crust.

The measurements allowed Mjelde and Faleide to infer the past flow of magma in the plume generally thought to rise beneath Iceland. When this plume is strong, it thickens the crust that it forms at the surface. They found that the crust has thickened roughly every 15 million years, suggesting the plume pulses at around that frequency.

Regular pulsing of plumes is not a new idea, but when the pair compared their results with similar pulsing in Hawaii, which also sits on a plume, they found a surprising correlation. Data collected by Emily Van Ark and Jian Lin of the Woods Hole Oceanographic Institution, Massachusetts, suggests that Hawaii's plume pulses have coincided with Iceland's (Marine Geophysical Research, DOI: 10.1007/s11001-009-9066-0).

"These two are on very different parts of the Earth, so I don't think the synchrony could be related to something in the mantle," says Mjelde. "It must relate to the core somehow. I can't see any other possibility." This would mean that the Earth's core periodically heats up the overlying mantle, generating synchronised plumes that rise to the surface at widely separated spots.

The synchrony must relate to the core somehow. I can't see any other possibility

"If correct, it would be a significant alteration from our current thoughts," says Rhodri Davies of Imperial College London. Most geologists who believe that mantle plumes exist think that pulsing can be explained by processes in the mantle alone, such as magma build-up in regions of different viscosity. "A new way of thinking would be needed," agrees Mjelde. However, several geologists contacted by New Scientist said they could not explain how the enormous pulses of heat required could be generated in the core.

There could be other explanations for the synchronicity. More detailed measurements may reveal the timings of the two plumes' pulses are close but not synchronous. Furthermore, Mike Coffin of the National Oceanography Centre in Southampton, UK, points out that the mantle is not homogeneous, so plumes leaving the core at the same time might not reach the crust at the same time.

"I am sceptical that they are co-pulsing from the evidence presented," says Huw Davies of Cardiff University, UK. Still, the idea is "potentially very exciting", he adds.

Ötzi the iceman: Up close and personal

Ötzi is a mummified human discovered in 1991 in the Schnalstal glacier in the Alps, on the border between Austria and Italy. He died around 3300 BC.

The mummy offers a wealth of information about the humans living in Europe at the time. Ötzi was named after the Ötztal region where he was found.

The new Iceman photoscan website now gives all web users access to images of the body gathered by researchers. The site has a dynamic online-map-style interface to let people zoom into photographs that capture Ötzi from all angles and show details as small as 1 millimetre.

Ötzi the iceman (Image: © South Tyrol Museum of Archaeology / Eurac / Marco Samadelli / Gregor Staschitz)

Using "dominance" to explain dog behaviour is old hat

Paper in the Journal of Veterinary Behaviour: Clinical Applications and Research

A new study shows how the behaviour of dogs has been misunderstood for generations: in fact using misplaced ideas about dog behaviour and training is likely to cause rather than cure unwanted behaviour. The findings challenge many of the dominance related interpretations of behaviour and training techniques suggested by some TV dog trainers.

Contrary to popular belief, aggressive dogs are NOT trying to assert their dominance over their canine or human "pack", according to research published by academics at the University of Bristol's Department of Clinical Veterinary Sciences in the Journal of Veterinary Behavior: Clinical Applications and Research.

The researchers spent six months studying dogs freely interacting at a Dogs Trust rehoming centre, and reanalysing data from studies of feral dogs, before concluding that individual relationships between dogs are learnt through experience rather than motivated by a desire to assert "dominance".

The paper "Dominance in domestic dogs – useful construct or bad habit?" reveals that dogs are not motivated by maintaining their place in the pecking order of their pack, as many well-known dog trainers preach.

Far from being helpful, the academics say, training approaches aimed at "dominance reduction" vary from being worthless in treatment to being actually dangerous and likely to make behaviours worse.

Instructing owners to eat before their dog or go through doors first will not influence the dog's overall perception of the relationship – merely teach them what to expect in these specific situations. Much worse, techniques such as pinning the dog to the floor, grabbing jowls, or blasting hooters at dogs will make dogs anxious, often about their owner, and potentially lead to an escalation of aggression.

Dr Rachel Casey, Senior Lecturer in Companion Animal Behaviour and Welfare at Bristol University, said: "The blanket assumption that every dog is motivated by some innate desire to control people and other dogs is frankly ridiculous. It hugely underestimates the complex communicative and learning abilities of dogs. It also leads to the use of coercive training techniques, which compromise welfare, and actually cause problem behaviours.

"In our referral clinic we very often see dogs which have learnt to show aggression to avoid anticipated punishment. Owners are often horrified when we explain that their dog is terrified of them, and is showing aggression because of the techniques they have used – but its not their fault when they have been advised to do so, for example by unqualified 'behaviourists' recommending such techniques."

At Dogs Trust, the UK's largest dog welfare charity, rehoming centre staff see the results of misguided dog training all the time. Veterinary Director Chris Laurence MBE, added: "We can tell when a dog comes in to us which has been subjected to the 'dominance reduction technique' so beloved of TV dog trainers. They can be very fearful, which can lead to aggression towards people.

"Sadly, many techniques used to teach a dog that his owner is leader of the pack is counter-productive; you won't get a better behaved dog, but you will either end up with a dog so fearful it has suppressed all its natural behaviours and will just do nothing, or one so aggressive it's dangerous to be around."

The paper: 'Dominance in domestic dogs – useful construct or bad habit? by John W. S. Bradshaw, Emily J. Blackwell, Rachel A. Casey. Journal of Veterinary Behavior: Clinical Applications and Research, Volume 4, Issue 3, Pages 109-144 (May-June 2009). The academics would like to thank Claire Cooke and Nicola Robertson for permission to describe their study of freely interacting dogs, Dogs Trust for providing access to a group of dogs. Support for academic posts from the Waltham Centre for Pet Nutrition, RSPCA and Cats Protection is also acknowledged.

Elderly women with 'dowager's hump' may be at higher risk of earlier death

Hyperkyphosis, or "dowager's hump" - the exaggerated forward curvature of the upper spine seen commonly in elderly women - may predict earlier death in women whether or not they have vertebral osteoporosis, UCLA researchers have found.

In a study published in the May 19 issue of Annals of Internal Medicine, researchers found that older white women with both vertebral fractures and the increased spinal curvature that results in the bent-over posture characteristic of hyperkyphosis had an elevated risk for earlier death. The finding was independent of other factors that included age and underlying spinal osteoporosis. Women who had only hyperkyphosis, without vertebral fractures, did not show an increased risk for premature death.

Hyperkyphosis can be caused by a number of factors besides osteoporosis, including habitual poor posture and degenerative diseases of the muscles and intervertebral discs.

"Just being bent forward may be an important clinical finding that should serve as a trigger to seek medical evaluation for possible spinal osteoporosis, as vertebral fractures more often than not are a silent disease," said Dr. Deborah Kado, an associate professor of orthopedic surgery and medicine at the David Geffen School of

Medicine at UCLA and the study's primary investigator. "We demonstrated that having this age-related postural change is not a good thing. It could mean you're likely to die sooner."

For the study, the researchers reviewed data on 610 women, age 67 to 93, from a cohort of 9,704 participants in the Study of Osteoporotic Fractures. The participants were recruited between 1986 and 1988 in Baltimore, Md.; Minneapolis, Minn.; Portland, Ore.; and Pennsylvania's Monongahela Valley. Researchers measured spinal curvature with a flexicurve and assessed vertebral fractures from spinal radiographs; they assessed mortality based on follow-ups averaging 13.5 years.

Adjusting for age, as well as osteoporosis-related factors such as low bone density, moderate and severe vertebral fractures, and the number of prevalent vertebral fractures, the researchers found that women with previous vertebral fractures and increasing degrees of spinal curvature were at increased mortality risk from the spinal condition, regardless of age, smoking, spinal bone-mineral density, or the number and severity of their spinal fractures.

These study findings provide evidence that it is not just vertebral fracture alone but the associated increased spinal curvature that may be most predictive of adverse health outcomes. Other studies linking hyperkyphosis to poor health, such as impaired physical function, increased fall risk, fractures and mortality, have been unable to exclude the possibility that vertebral fractures alone were the underlying explanation for the findings.

The researchers note several caveats. This study focused on women, though hyperkyphosis also affects men; measurements for vertebral fractures were based only on height ratios, which could lead to misclassification of other causes of height ratio decreases, such as Scheuermann disease; and the timing of the assessments could have affected the results, though it's unlikely to have made much difference.

However, this study demonstrates a possible association between hyperkyphosis and increased risk for earlier death independent of the number and severity of vertebral fractures or osteoporosis in older women, the researchers write.

"These results add to the growing literature that suggests that hyperkyphosis is a clinically important finding. Because it is readily observed and is associated with ill health in older persons, hyperkyphosis should be recognized as a geriatric syndrome — a 'multifactorial health condition that occurs when the accumulated effect of impairments in multiple systems renders a person vulnerable to situational challenges.'"

Study co-authors include Arun S. Karlamangla of UCLA; Li-Yung Lui and Steven R. Cummings of the California Pacific Medical Center Research Institute; and Kristine E. Ensrud and Howard A. Fink of the University of Minnesota.
The National Institute of Arthritis and Musculoskeletal and Skin Diseases and the National Institute on Aging funded this study.

'Wolf man' condition down to huge DNA malfunction

* 18:11 21 May 2009 **by Ewen Callaway**

A 31-year-old Chinese man whose body is 96 per cent coated in hair has an extra chunk of DNA that could explain his condition – called congenital generalized hypertrichosis terminalis (CGHT).

A new study of the patient known as "KK" – one of the world's hairiest men – and three families with a history of CGHT suggests that the disease is caused by vast genomic changes on chromosome 17.

CGHT is exceedingly rare, with fewer than 100 cases documented in news reports and the scientific literature, says Xue Zhang, a geneticist at Peking Union Medical College in Beijing, who led the new study.

The disease is one of at least several forms of hypertrichosis – all characterised by overgrowth of hair. One of the earliest recorded cases involved a Mexican Indian woman, Julia Pastrana, who toured Europe in the 1850s and 60s, before dying due to complications from childbirth.

Disturbed DNA

To find the genetic changes responsible for CGHT, Zhang's team first scanned the genomes of 16 people with the disease and their unaffected relatives, looking for obvious differences.

***Yu Zhenhuan, who calls himself King Kong, is a modern equivalent of the bearded ladies, with his own media presence* (Image: Sinopix/Rex Features)**

A region on chromosome 17 jumped out, and after further study, Zhang's team showed that family members with CGHT were missing between 500,000 and 900,000 DNA letters on that chromosome. Patient KK, on the other hand, had 1.4 million extra nucleotides at the same place on the genome.

Exactly how these changes cause the disease is unclear, says Zhang. One of the several genes in this region, MAP2K6, could be involved in hair growth. But mice missing lacking this gene have normal hair, and a 12-

year-old girl missing this gene shows no signs of CGHT. More likely, the changes on chromosome 17 affect the expression of distant genes, Zhang's team suggests.

Far-reaching effects?

Large deletions or insertions of DNA can interfere with the relationship between genes and the non-coding sequences that control their activity. So the gene or genes truly responsible for CGHT could be millions of letters away from the changes that Zhang's team found.

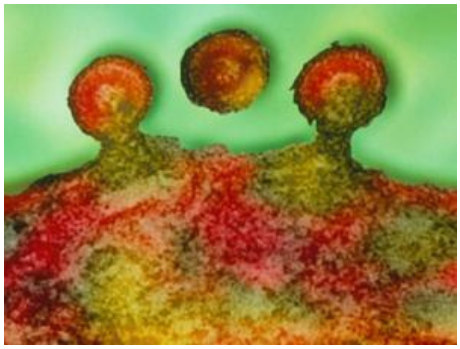
"It's not going to be trivial for them to sort this out," says Pragna Patel, a medical geneticist at the University of Southern California, who was not involved in the study.

Yet finding the true cause of CGHT will help scientists understand and potentially treat, not just a rare disease, but other conditions characterised by excessive hair growth or loss, Patel says. "I think beyond helping these individual patients, clearly there's a large segment of the population that would be interested in that."

Journal reference: American Journal of Human Genetics (DOI: 10.1016/j.cell.2009.03.020)

HIV vaccine turns muscle into antibody factories

* 22 May 2009 **by Andy Coghlan**



HOW do you deal with a virus which attacks the immune system that is trying to fight it off? It's a question HIV researchers have been trying to solve for years, and now they may have come up with a solution: bypass the immune system altogether.

Nine macaques have been protected against the monkey version of HIV with a novel vaccine that sidesteps the monkey immune system. Instead, the vaccine turns monkey muscles into factories for churning out antibodies which kill simian immunodeficiency virus (SIV) - the monkey equivalent of HIV.

This coloured transmission electron micrograph (TEM) shows a section through the cell membrane of a T-lymphocyte white blood cell (T-cell). The "bubbles" are budding Human Immunodeficiency Viruses (HIV) **(Image: BSIP VEM / Science Photo Library)**

The vaccine is a departure from the usual approach, which is to prime the body's immune system for attack by exposing it to a harmless version of the real pathogen. Thus primed, the immune system prepares for a real invasion by building its own stockpile of antibodies that target the pathogen.

Instead, Philip Johnson of the Children's Hospital of Philadelphia in Pennsylvania and his colleagues injected the monkeys' muscles with a harmless virus carrying genes for making immunoadhesins, antibody-like molecules pre-selected to attack SIV.

The viruses load the genes into the nuclei of muscle cells, which produce and churn out the immunoadhesins, potentially indefinitely. "Instead of expecting the person's own immune system to do the job, we're giving them their own supply of 'off-the-peg' antibodies," Johnson says.

Instead of using their own immune system, we're giving them a supply of 'off-the-peg' antibodies

"It is now 85 weeks since all nine macaques received their jabs, followed by injections of SIV, and they still haven't suffered any infections," he says. "By contrast, four of six unvaccinated animals died of monkey AIDS" (Nature Medicine, DOI: 10.1038/nm.1967).

Johnson says the approach is especially suitable for combating HIV, which overwhelms the immune system that is supposed to fight it. With all conventional vaccines so far "the virus always wins in the end", he says.

Given such a strong proof of principle, the team is already gearing up for clinical trials, with four potential "superantibodies" from people who are HIV-resistant.

"Within two to three years, we would hope to have this in the clinic," says Wayne Koff, senior vice-president of research and development at the International AIDS Vaccine Initiative, which is collaborating with Johnson on this next phase. "It will be a tremendous test of the concept to see if what has protected the monkeys pans out into people," he says.

Corals upgrade algae to beat the heat

* 14:55 22 May 2009 **by Catherine Brahic**

In oceans around the world, heat-resistant algae are offering the prospect of a colourful future for corals. The reef-forming animals are upgrading their symbiotic algae so that they can survive the bleaching that occurs in waters warming under climate change.

"The most exciting thing was discovering live, healthy corals on reefs already as hot as the ocean is likely to get 100 years from now," says Stephen Palumbi of Stanford University.

Corals have a symbiotic relationship with tiny algae called zooxanthellae. The corals give the algae a home and, in exchange, the algae provide the corals with food. When water temperatures get too hot, the corals expel

the algae. This is what is known as coral bleaching and it is expected to kill coral reefs around the world as global temperatures rise.

In the past few years, biologists have discovered that some zooxanthellae can live at warmer temperatures than others, making the corals that host them naturally heat-resistant. What's more, during a heatwave on the Great Barrier Reef in 2006, an Australian team found that many corals that survived the hot period had swapped their algae for more heat-resistant ones.

Hot pools

To see how widespread this algae upgrading is, Palumbi and Stanford colleague Tom Oliver sampled coral colonies from tidal pools that are naturally at different temperatures on the island of Ofu in American Samoa. They found that the proportion of corals that hosted heat-tolerant algae was directly related to how hot the pools were, suggesting that they are able to adapt to their local conditions.

"From reef to reef, the number of corals that have tolerant algae varies with the local temperature regime," says Palumbi.

The heat-tolerant algae allow corals to survive 1.5 °C rises in temperature above their usual range. In some regions, this may be enough to survive through to the end of the century despite global warming.

Palumbi says that other experiments in American Samoa suggest corals may have more tricks to survive in warmer seas. His team is currently teasing these results apart.

Ultimately, the aim is to determine which reefs will be able to survive warmer seas and which will not, so that conservation efforts can be targeted. *Journal reference: Marine Ecology Progress Series (vol. 378, p 93)*

The Next Steps for Swine Flu: Predictions, Protection and Prevention

By DONALD G. McNEIL Jr.

Federal health officials will probably recommend that most Americans get three flu shots this fall: one regular flu shot and two doses of any vaccine made against the new swine flu strain.

Having had annual flu shots for the last several years gives “little or no immune benefit” against the new virus, the officials said on Thursday as they released more details of blood tests briefly described on Wednesday.

The “working hypothesis” of the Centers for Disease Control and Prevention is that most Americans will need two swine flu shots to get full protection, although the elderly may be able to get away with just one, said Dr. Anne Schuchat, the agency’s director of immunization and respiratory disease.

Many people born before the 1957 Asian flu, and particularly those 65 or older, seem to have antibodies in their blood protecting them against the new virus, Dr. Schuchat said. But she described existing antibody protection as looking “pretty wimpy” compared with a properly matched flu shot.

Nonetheless, the outbreak is bearing out what the blood samples predicted: only 1 percent of the 5,764 confirmed and probable swine flu cases thus far have been in people over 65, Dr. Schuchat said.

Across the country, what the C.D.C. calls “flu activity” seems to be going down, Dr. Schuchat said, adding that there had been no unusual increase in deaths from influenza, in general, or pneumonia.

Flu activity measures the percentage of visitors to 4,500 doctors, clinics and hospitals complaining of flulike symptoms, like fever, cough and aches. Most are treated, based on how bad the symptoms are, without being tested.

The measure implies that “on average, the worst may be over” for this flu season, Dr. Schuchat said. But it could also mean that people are becoming less scared and not seeking treatment. The decrease in flu activity is also not surprising, since seasonal flu disappears as the weather warms while swine flu has still barely begun to spread. Historically, pandemics infect a third of any population over about two years, so unless a vaccine intervenes, 100 million cases of swine flu could be expected.

Also, flu activity is still surging in New York, New Jersey and the rest of the Northeast. Flu, “like weather, is a local occurrence,” she said. Also like the weather, it is unpredictable and has to be watched.

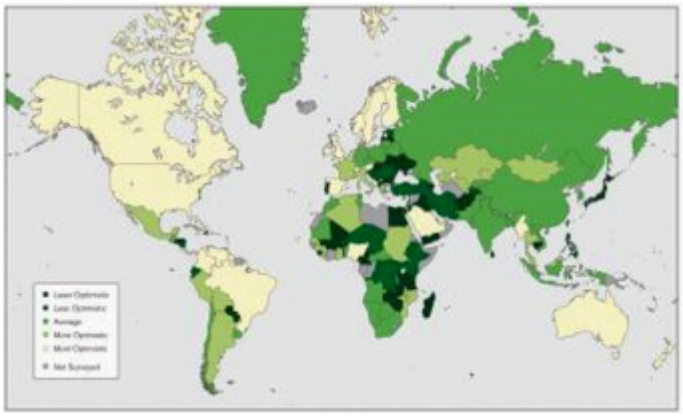
“In New York City, things looked like they were getting a little better, and then it looked like they were getting worse,” Dr. Schuchat said.

In New York City on Thursday, eight more schools were closed, bringing the total to 38 citywide: in Queens, Public School and Intermediate School 499 in Flushing, P.S. 143 in Corona, P.S. 203 in Oakland Gardens and I.S. 73 in Maspeth; also P.S. 111 in Eastchester, the Bronx, and Middle School 113 in Fort Greene, Brooklyn, which also houses a special education school. But four schools were scheduled to reopen on Friday, and many of the rest on Tuesday, after the three-day weekend.

The World Health Organization in Geneva said that confirmed cases of swine flu have been found in 41 countries. Eighty-five people have died of it, 75 of them in Mexico.

Mexico City removed its swine flu alert on Thursday afternoon, wire services reported. Officials there said no swine flu cases had been confirmed since May 14.

Study indicates people by nature are universally optimistic



LAWRENCE, Kan. – Despite calamities from economic recessions, wars and famine to a flu epidemic afflicting the Earth, a new study from the University of Kansas and Gallup indicates that humans are by nature optimistic.

The study, to be presented Sunday, May 24, 2009, at the annual meeting of the Association for Psychological Science in San Francisco, found optimism to be universal and borderless.

Data from the Gallup World Poll drove the findings, with adults in more than 140 countries providing a representative sample of 95 percent of the world's population. The sample included more than 150,000 adults.

At the country level, optimism is highest in Ireland, Brazil, Denmark, and New Zealand and lowest in Zimbabwe, Egypt, Haiti and Bulgaria. The United States ranks number 10 on the list of optimistic countries. **University of Kansas/Gallup**

Eighty-nine percent of individuals worldwide expect the next five years to be as good or better than their current life, and 95 percent of individuals expected their life in five years to be as good or better than their life was five years ago.

"These results provide compelling evidence that optimism is a universal phenomenon," said Matthew Gallagher, a psychology doctoral candidate at the University of Kansas and lead researcher of the study.

At the country level, optimism is highest in Ireland, Brazil, Denmark, and New Zealand and lowest in Zimbabwe, Egypt, Haiti and Bulgaria. The United States ranks number 10 on the list of optimistic countries.

Demographic factors (age and household income) appear to have only modest effects on individual levels of optimism.

Ancient teeth hint that right-handedness is nothing new

* 12:27 23 May 2009 **by Ewen Callaway**

Ancient bones suggest "lefties" have been coping with a right-handed world for more than half a million years. A study of Homo heidelbergensis, an ancestor of Neanderthals, seems to show that the ancient humans were predominately right-handed.

"Finding that a hominin species as old as Homo heidelbergensis is already right-handed helps to trace back the chain of modernity concerning hand laterality," says Marina Mosquera, a paleoanthropologist at Universitat Rovira i Virgili in Tarragona, Spain, who was involved in the study.

Humans are the only animal believed to show a strong preference for performing tasks with one hand or the other. Determining when right-handedness first evolved could shed light on traits linked to lateralised brains, such as language and technology, Mosquera says. Efforts to solve this mystery have looked to ancient human skulls and marks left on tools.

But these methods may not be reliable. Two-million-year-old tools carved out of animal bones contain marks that might be indicative of use by right-handers; however left-handers could have created the same patterns, she says.

Similarly ancient skulls may have been split into two hemispheres, but these changes could also reflect language processing, which occurs predominately in the left brain of both right-handed and left-handed people, Mosquera says.

'Third hand'

In search of a less ambiguous indicator of handedness, Mosquera's team looked to teeth, of all things. Ancient humans probably used their teeth like a third hand, she says, clenching onto meat and other objects to cut them with stone tools. And in the process, ancient humans might have grazed their incisors, creating diagonal marks.

To avoid cutting their noses off, ancient humans probably moved their blade in a downward motion, causing right-handers to make tooth marks in one direction, left-handers in another. Mosquera's team confirmed this bias by asking left and right-handed assistants to simulate the process while wearing mouth guards.

Next, her team analyzed 592 cut marks on 163 teeth found at Sima de los Huesos cave in northern Spain, which has produced a trove of Homo heidelbergensis remains. The vast majority of the marks looked to be made by right-handers, Mosquera's team found.

Indeed, out of the 19 individuals to whom the teeth belonged, 15 appeared to be right-handed and none left-handed. Teeth from four individuals contained mostly vertical marks and, therefore, could not be interpreted.

'Same old problems'

Travis Pickering, a biological anthropologist at the University of Wisconsin in Madison, agrees that dental marks are a good way of determining handedness in ancient humans. "Most hominins, even early hominins, are going to be bright enough not to bring a blade up to their noses," he says.

But the new study runs into the same problems as other attempts to understand ancient human behaviour by analysing marks left on teeth or tools, Pickering says.

A right-handed lab assistant may create diagonal marks across a tooth guard while using a stone tool, but cut marks on a 500,000 year-old tooth could have come from entirely different activities or even natural wear and tear. *Journal reference: Evolution and Human Behavior (DOI: 10.1016/j.evolhumbehav.2009.03.001)*

The Coming Superbrain

By JOHN MARKOFF

Mountain View, Calif. — It's summertime and the Terminator is back. A sci-fi movie thrill ride, "Terminator Salvation" comes complete with a malevolent artificial intelligence dubbed Skynet, a military R.&D. project that gained self-awareness and concluded that humans were an irritant — perhaps a bit like athlete's foot — to be dispatched forthwith.

The notion that a self-aware computing system would emerge spontaneously from the interconnections of billions of computers and computer networks goes back in science fiction at least as far as Arthur C. Clarke's "Dial F for Frankenstein." A prescient short story that appeared in 1961, it foretold an ever-more-interconnected telephone network that spontaneously acts like a newborn baby and leads to global chaos as it takes over financial, transportation and military systems.

Today, artificial intelligence, once the preserve of science fiction writers and eccentric computer prodigies, is back in fashion and getting serious attention from NASA and from Silicon Valley companies like Google as well as a new round of start-ups that are designing everything from next-generation search engines to machines that listen or that are capable of walking around in the world. A.I.'s new respectability is turning the spotlight back on the question of where the technology might be heading and, more ominously, perhaps, whether computer intelligence will surpass our own, and how quickly.

The concept of ultrasmart computers — machines with "greater than human intelligence" — was dubbed "The Singularity" in a 1993 paper by the computer scientist and science fiction writer Vernor Vinge. He argued that the acceleration of technological progress had led to "the edge of change comparable to the rise of human life on Earth." This thesis has long struck a chord here in Silicon Valley.

Artificial intelligence is already used to automate and replace some human functions with computer-driven machines. These machines can see and hear, respond to questions, learn, draw inferences and solve problems. But for the Singulatarians, A.I. refers to machines that will be both self-aware and superhuman in their intelligence, and capable of designing better computers and robots faster than humans can today. Such a shift, they say, would lead to a vast acceleration in technological improvements of all kinds.

The idea is not just the province of science fiction authors; a generation of computer hackers, engineers and programmers have come to believe deeply in the idea of exponential technological change as explained by Gordon Moore, a co-founder of the chip maker Intel.

In 1965, Dr. Moore first described the repeated doubling of the number transistors on silicon chips with each new technology generation, which led to an acceleration in the power of computing. Since then "Moore's Law" — which is not a law of physics, but rather a description of the rate of industrial change — has come to personify an industry that lives on Internet time, where the Next Big Thing is always just around the corner.

Several years ago the artificial-intelligence pioneer Raymond Kurzweil took the idea one step further in his 2005 book, "The Singularity Is Near: When Humans Transcend Biology." He sought to expand Moore's Law to encompass more than just processing power and to simultaneously predict with great precision the arrival of post-human evolution, which he said would occur in 2045.

In Dr. Kurzweil's telling, rapidly increasing computing power in concert with cyborg humans would then reach a point when machine intelligence not only surpassed human intelligence but took over the process of technological invention, with unpredictable consequences.

Profiled in the documentary "Transcendent Man," which had its premier last month at the TriBeCa Film Festival, and with his own Singularity movie due later this year, Dr. Kurzweil has become a one-man marketing machine for the concept of post-humanism. He is the co-founder of Singularity University, a school supported by Google that will open in June with a grand goal — to "assemble, educate and inspire a cadre of leaders who strive to understand and facilitate the development of exponentially advancing technologies and apply, focus and guide these tools to address humanity's grand challenges."

Not content with the development of superhuman machines, Dr. Kurzweil envisions “uploading,” or the idea that the contents of our brain and thought processes can somehow be translated into a computing environment, making a form of immortality possible — within his lifetime.

That has led to no shortage of raised eyebrows among hard-nosed technologists in the engineering culture here, some of whom describe the Kurzweilian romance with supermachines as a new form of religion.

The science fiction author Ken MacLeod described the idea of the singularity as “the Rapture of the nerds.” Kevin Kelly, an editor at Wired magazine, notes, “People who predict a very utopian future always predict that it is going to happen before they die.”

However, Mr. Kelly himself has not refrained from speculating on where communications and computing technology is heading. He is at work on his own book, “The Technium,” forecasting the emergence of a global brain — the idea that the planet’s interconnected computers might someday act in a coordinated fashion and perhaps exhibit intelligence. He just isn’t certain about how soon an intelligent global brain will arrive.

Others who have observed the increasing power of computing technology are even less sanguine about the future outcome. The computer designer and venture capitalist William Joy, for example, wrote a pessimistic essay in Wired in 2000 that argued that humans are more likely to destroy themselves with their technology than create a utopia assisted by superintelligent machines.

Mr. Joy, a co-founder of Sun Microsystems, still believes that. “I wasn’t saying we would be supplanted by something,” he said. “I think a catastrophe is more likely.”

Moreover, there is a hot debate here over whether such machines might be the “machines of loving grace,” of the Richard Brautigan poem, or something far darker, of the “Terminator” ilk.

“I see the debate over whether we should build these artificial intellects as becoming the dominant political question of the century,” said Hugo de Garis, an Australian artificial-intelligence researcher, who has written a book, “The Artilect War,” that argues that the debate is likely to end in global war.

Concerned about the same potential outcome, the A.I. researcher Eliezer S. Yudkowsky, an employee of the Singularity Institute, has proposed the idea of “friendly artificial intelligence,” an engineering discipline that would seek to ensure that future machines would remain our servants or equals rather than our masters.

Nevertheless, this generation of humans, at least, is perhaps unlikely to need to rush to the barricades. The artificial-intelligence industry has advanced in fits and starts over the past half-century, since the term “artificial intelligence” was coined by the Stanford University computer scientist John McCarthy in 1956. In 1964, when Mr. McCarthy established the Stanford Artificial Intelligence Laboratory, the researchers informed their Pentagon backers that the construction of an artificially intelligent machine would take about a decade. Two decades later, in 1984, that original optimism hit a rough patch, leading to the collapse of a crop of A.I. start-up companies in Silicon Valley, a time known as “the A.I. winter.”

Such reversals have led the veteran Silicon Valley technology forecaster Paul Saffo to proclaim: “never mistake a clear view for a short distance.”

Indeed, despite this high-technology heartland’s deeply held consensus about exponential progress, the worst fate of all for the Valley’s digerati would be to be the generation before the generation that lives to see the singularity.

“Kurzweil will probably die, along with the rest of us not too long before the ‘great dawn,’ ” said Gary Bradski, a Silicon Valley roboticist. “Life’s not fair.”

Eczema's link to asthma uncovered

Scientists believe they have found what triggers many children with eczema to go on to develop asthma.

The Public Library of Science Biology study points to a way to stop what is known as the "atopic march".

The US team at the Washington University School of Medicine showed that a substance made by the damaged skin triggered asthma symptoms in mice. The same substance, thymic stromal lymphopoietin (TSLP), is also produced in the lungs of asthma patients.

Early treatment of the skin rash and blocking TSLP production might stop asthma developing in young patients with eczema, they hope. Drugs that act on TSLP might also protect against asthma development even in cases that are not linked to eczema.

Atopic march

Allergies and asthma often occur together. Studies show that 50-70% of children with severe allergic skin problems - atopic dermatitis - go on to develop asthma.

The researchers studied mice bred with a genetic defect that made them develop a condition similar to eczema in humans.

The defective skin secreted TSLP, which the researchers believe alerts the body that its protective barrier has failed. When they tested the lungs of the mice, they found this tissue also responded strongly to the TSLP signal and had the hallmark traits of asthma - mucous secretion, airway muscle contraction and invasion of white blood cells. They did more experiments and found that even mice with normal skin but bred to overproduce TSLP also developed asthma-like symptoms, suggesting TSLP is indeed the culprit.

Lead researcher Dr Raphael Kopan said: "We are excited because we've narrowed down the problem of atopic march to one molecule. "We've shown that the skin can act as a signalling organ and drive allergic inflammation in the lung by releasing TSLP. "Now it will be important to address how to prevent defective skin from producing TSLP. If that can be done, the link between eczema and asthma could be broken."

Dr Elaine Vickers of Asthma UK said: "This is the first piece of research to suggest that the natural protein TSLP could play a direct role in causing people with eczema to develop asthma.

"These results were obtained from studies with mice, so it is important to establish whether the same causal link exists in humans. "Scientists are already exploring the potential of targeting TSLP to create new treatments for eczema, asthma and other allergic conditions.

"Although it is still a long way off, this research raises the exciting possibility that as well as improving symptoms, these treatments might be able to limit, or even prevent, the development of asthma."