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Swine flu hoax? Get real

- 26 May 2010 by **Debora MacKenzie**

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Expensive overreaction or the right thing to do? (Image: Sipa Press/Rex Features)

ONCE upon a time, a village asked its nerds to warn it when wolves threatened the chickens. One day the nerds saw wolf tracks - but how many wolves were there, and how hungry? The forest was big and there was not enough time to find out before sunset, so the nerds advised the panicked villagers to buy rifles.

But before the rifles were even loaded, one small and skinny wolf slunk out of the woods, killed two chickens and ran away. The nerds tried to explain that there were probably more wolves out there, but the angry villagers took the rifles back to the store and lynched the nerds.

This is the parable of swine flu. Governments had asked the World Health Organization to coordinate their response to flu pandemics, and when one broke in April 2009 the WHO did exactly that, triggering expensive government health measures and vaccine purchases. Critics now allege the flu was less deadly than normal flu, meaning vast sums of public money were wasted on nothing more than a scare. Some even claim that it was a conspiracy to boost vaccine company profits.

So were the WHO and governments right to respond as they did? Or was it all an expensive overreaction, or a hoax? This week an independent inquiry by a WHO committee delivers its preliminary answers to these questions. Similar inquiries are under way in the UK, the US and elsewhere.

Here's the answer I hear from scientists: declaring a pandemic and making vaccine were overwhelmingly the right things to do given the science and technology at our disposal.

First and foremost, the notion that swine flu is not so deadly is an illusion caused by incomplete statistics: it certainly rivals normal flu, and its impact so far exceeds some previous flu pandemics.

Even if that were not true, the reaction was still correct. To understand why decisions were made, you have to look at how events unfolded.

Governments have pandemic vaccine orders in place largely because they are worried about bird flu. Nobody disputes that this is the correct strategy. If this highly lethal virus starts spreading readily in

people, it could be worse than the 1918 flu pandemic, which killed millions. But other flu viruses are potential pandemic threats too.

Most new strains of flu do not cause pandemics because they are related to strains already in circulation, so most people are partially protected by antibodies. Occasionally, though, a flu virus appears that is so different no one has antibodies to it, whereupon it spreads like wildfire. That is a pandemic virus.

By March 2009, it was clear that H1N1 swine flu was in this category: it didn't react with antibodies to any recent flu. So we knew then it would go pandemic.

What about lethality? Even though early reports from Mexico suggested a high mortality rate, when the virus hit the US in April it did seem fairly benign. Should the vaccine plans have been shelved at that point?

No. The virus's lethality in April is not what mattered. The crucial point is that it takes six months to make useful quantities of vaccine. That means you have to predict the virus's next move, which is currently impossible. Flu evolves, especially when it is blasting through millions of new hosts.

The virus did seem fairly benign in April 2009, but its lethality in April is not what mattered

We know the 1918 virus got worse as it spread. Nobody knew in April last year what swine flu would be like six months down the line, at the start of the winter flu season in the northern hemisphere. It could have turned very nasty - and to have vaccine ready for that eventuality meant making it immediately.

Given these constraints, what health agencies did was no overreaction. What if the virus had become highly lethal and they had decided not to make vaccine? British officials are being castigated for citing epidemic models that predicted up to 65,000 deaths - which did not materialise. Imagine if 65,000 people had died because they decided not to prepare.

The real scandal is the antiquated and slow vaccine-making technology used by all the major vaccine companies. In the US, that delayed deliveries until cases were already subsiding and some 12,000 Americans had died. Meanwhile, poor countries got no vaccine at all. Just as well the virus was a wimp.

We could do better next time round - but that requires more investment in research and development. Will we get it after all these ugly accusations? That may be what is now at stake. For example, we knew this kind of swine flu posed a pandemic threat many years ago, yet H1N1 spread undetected in Mexico for months. We need better surveillance.

There are also ways to estimate the lethality of a flu virus, by looking at immune reactions other than antibodies. They weren't used last April because there are no standard tests yet. It would be good to develop some.Most importantly, we need the capacity to make much more vaccine much faster, so we don't have to make near-impossible decisions months in advance and end up squabbling over limited supplies. Prototype technologies exist, but investment has been limited because making flu vaccine will never bring in massive profits. How ironic, when companies are now being accused of fabricating a pandemic for money.

Industry enthusiasm for novel flu vaccines is unlikely to grow as the belief spreads that the pandemic was a rip-off. Indeed, we may lose what we have. With several countries asking for their money back on unused vaccine, my industry sources say future pandemic contracts are unlikely to allow returns, meaning fewer countries will place orders.If that happens, we will be even less prepared for the next pandemic. Those making ill-informed accusations ought to keep that in mind.

Debora MacKenzie is New Scientist's European correspondent, based in Brussels, Belgium

http://www.newscientist.com/article/mg20627616.700-swine-flu-hoax-get-real.html

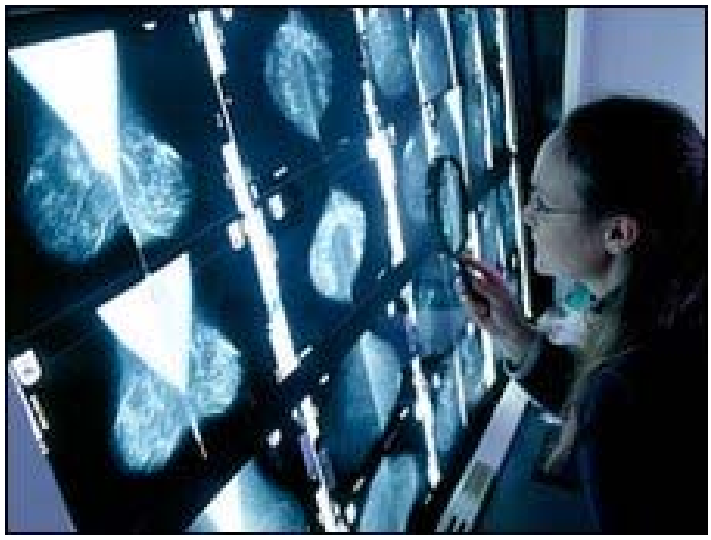
Breast cancer gene clue discovery
By Helen Briggs
Health reporter, BBC News

Five genetic clues to why some women have a family history of breast cancer have been identified by UK researchers.

It brings to 18 the number of common genetic variations linked to a small increased risk of breast cancer.

The Cambridge University-led research, published in Nature Genetics, could see targeted screening and treatment of women more likely to get breast cancer.

It is thought about one in 20 of all breast cancers are down to inherited faults in known genes.


A radiologist studies mammograms

Breast cancer is the most common cancer in the UK with more than 45,500 new cases diagnosed each year.

The precise reasons why a woman develops the disease are still unknown.

However, inherited, environmental and lifestyle factors are all thought to play a role.

In the largest project of its kind and funded by Cancer Research UK, the researchers scanned the entire genetic code of around 4,000 British patients with a family history of breast cancer.

They then studied the DNA of another 24,000 women, with and without breast cancer.

The researchers found five "spots" on the human genome linked to a family history of breast cancer. Another 13 have already been located.

“There isn't anything we can do about the genes we inherit, we do know that you can reduce your risk of breast cancer by maintaining a healthy weight, limiting alcohol consumption and exercising regularly”

Dr Caroline Hacker, Breakthrough Breast Cancer

Scientists also know about two high risk genes which are more likely to be defective in someone with breast cancer, known as BRCA1 and BRCA2.

Genetic profiling

Dr Douglas Easton of the University of Cambridge, is lead author of the study.

He told the BBC: "We know for sure that these gene variations are associated with risk.

"It is not the whole picture but it will contribute ultimately to genetic profiling of risk.

"It also contributes to our understanding of why the disease develops and will lead to a better understanding of the biology of the disease."

Women with a strong family history of breast cancer are already given early screening for signs of tumours.

They are also entitled to genetic tests if they have a close relative with breast cancer.

The 18 genetic changes linked to breast cancer are not currently tested for. They are thought to account for around 8% of inherited cases of breast cancer.

Dr Caroline Hacker, policy manager at Breakthrough Breast Cancer, said: "This could lead to new genetic tests which may help identify women who have an increased risk of breast cancer due to inherited faults in genes.

"Hereditary breast cancer is rare and only around one in 20 of all breast cancers are due to inherited faults in breast cancer genes.

"Although there isn't anything we can do about the genes we inherit, we do know that you can reduce your risk of breast cancer by maintaining a healthy weight, limiting alcohol consumption and exercising regularly."

Dr Helen George, head of science information at Cancer Research UK, said: "This research takes us a step closer to developing a powerful genetic test for the disease.

"Such a test could help doctors identify women who have an increased breast cancer risk so that they can make informed decisions about how to take steps to reduce their chance of developing the disease."

http://news.bbc.co.uk/2/hi/health/8667944.stm

'Historic' day as first non-Latin web addresses go live

Page last updated at 15:41 GMT, Thursday, 6 May 2010 16:41 UK

Egypt's Ministry of Communications is amongst the first live web addresses

Arab nations are leading a "historic" charge to make the world wide web live up to its name.

Net regulator Icann has switched on a system that allows full web addresses that contain no Latin characters.

Egypt, Saudi Arabia and the United Arab Emirates are the first countries to have so-called "country codes" written in Arabic scripts.

The move is the first step to allow web addresses in many scripts including Chinese, Thai and Tamil.

More than 20 countries have requested approval for international domains from the Internet Corporation for Assigned Names and Numbers (Icann).

It said the new domains were "available for use now" although it admitted there was still some work to do before they worked correctly for everyone. However, it said these were "mostly formalities".

Icann's senior director for internationalised domain names, Tina Dam, told BBC News that this has been "the most significant day" since the launch of the internet, adding that "it's been a very big day for Icann, more so for the three Arabic countries that were the first to be introduced".

Icann president Rod Beckstrom described the change as "historic".

Read right

The introduction of the first web names using so-called country code top-level domains (CCTLDs) is the culmination of several years of work by the organisation.

Previously, websites could use some non-Latin letters, but the country codes such as .eg for Egypt had to be written in Latin script.

The three new suffixes will allow web addresses to be completely written in native characters.

The first country codes:

- Egypt: رصم
- Saudi Arabia: السعودية
- United Arab Emirates: تارام ا

Source: Icann

"All three are Arabic script domains, and will enable domain names written fully right-to-left," said Kim Davies of Icann in a blog post.

One of the first websites with a full Arabic address is the Egyptian Ministry of Communications.

Egypt's communication and information technology minister Tarek Kamal told the Associated Press that three Egyptian companies were the first to receive registrar licences for the '.masr' domain, written in Arabic.

Mr Kamal described the development as a "milestone in internet history".

Masr means Egypt in Arabic.

Some countries, such as China and Thailand, had already introduced workarounds that allow computer users to enter web addresses in their own language.

However, these were not internationally approved and do not necessarily work on all computers.

Ms Dam explained that the change was "not about shutting non-Arabic or non-Chinese speakers out of the internet.

"It's about including that large part of our world into the internet today."

She said there had previously been a risk the internet might have started to split.

"The chances are people would start creating their own internets, where it was only in Chinese, Arabic, Thai or whatever," she said.

Icann warned that the internationalised domain names (IDNs), as they are known, would also not work on all PCs immediately.

"You may see a mangled string of letters and numbers, and perhaps some percent signs or a couple of "xn--"s mixed into the address bar," said Mr Davies. "Or it may not work at all."

Previously, Icann has said that people would have to update the software on their computers to view the domains.

"Computers never come with the complete set of fonts that will allow it to show every possible IDN in the world.

"Often this is fixed by downloading additional language packs for the missing languages, or specifically finding and installing fonts that support the wanted languages."

Global access

When Icann first announced its plans for non-Latin web names it said it was the "biggest change" to the net "since it was invented 40 years ago".

"Over half the internet users around the world don't use a Latin-based script as their native language," said Mr Beckstrom at the time.

"IDNs are about making the internet more global and accessible for everyone."

Icann said it had received 21 requests for IDNs in 11 different languages, including Chinese, Russian, Tamil and Thai.

Website owners in Egypt, Saudi Arabia and the United Arab Emirates will now be able to apply for web addresses using the new country codes.

http://news.bbc.co.uk/2/hi/technology/10100108.stm

Meningitis C vaccine 'wears off in early teens'
Three-quarters of children vaccinated against meningitis C lose their protection against the disease by their early teens, research suggests.

The Oxford team which did the work says its findings fuel calls for a booster jab to be offered to adolescents.

The study of 250 children aged six to 12, presented to a European conference, looked at immunity seven years after the jab was given.

UK experts agreed a booster may be needed in the future.

The research was carried out by the Oxford Vaccine Group at Oxford University.

The group tested the children, who had all been vaccinated against meningitis C, for levels of antibodies against the bacteria in their bloodstream.

There has been a campaign to immunise children against meningitis C

It was found that just 25% of the children had sufficiently high levels of the antibodies to give them protection against the disease.

The researchers say that British children are still protected against the potentially fatal bacteria at the moment, through the existence of herd immunity.

That means that vaccination has significantly reduced the level of meningitis in the population, and so even people who are not vaccinated are also protected.

But the researchers, led by Professor Andrew Pollard, told the European Society for Paediatric Infectious Diseases (ESPID) meeting in Nice, France, that if herd immunity starts to decline many children will be vulnerable.

'All time low'

Professor Pollard said: "This study is just the latest to show that the personal protection given by meningitis C vaccines in early childhood doesn't last forever and several countries have now responded to these findings by introducing teenage boosters, before protection fails in the population."

Falling immunity levels against meningitis C vaccination have been reported in Greece, the Netherlands and Spain.

Austria, Canada and Switzerland have already introduced booster jabs.

Dr Jamie Findlow, deputy head of the Health Protection Agency's Vaccine Evaluation Unit in Manchester, said: "By giving each teenager a booster dose of meningococcal vaccine as they are entering adolescence, we can ensure that they are protected when they most need it."

Professor Ray Borrow, head of the unit, said: "Parents should not be worried - at the moment cases of meningitis C are at an all time low.

"In 2008-2009 in England and Wales there were just 13 cases - and nine of these were in adults over 25 who may not have been vaccinated.

"We and other researchers are looking at how and when a booster could be introduced, but it doesn't have to come tomorrow."

He said herd immunity should last until around 2015.

Sue Davie, chief executive of the Meningitis Trust said the Oxford team's research raised "significant concerns".

"Vaccination is the only way to prevent meningitis and save lives. We support the use of safe and effective vaccines and encourage people to receive the vaccines that are currently available.

"If, as a result of this research, a booster programme is introduced, we would actively encourage the introduction of this."

A Department of Health spokeswoman said: "The number of cases of meningococcal C disease is currently very low.

"All new research on vaccines will be reviewed by the Joint Committee on Vaccination and Immunisation."

http://news.bbc.co.uk/2/hi/health/8668182.stm

Doctors 'cause blood pressure to rise'

The 'white-coat' effect - where blood pressure rises during a check by a doctor - is even worse in someone whose level is already high, researchers say.

Doctors can cause blood pressure to rise

The effect is due to patients becoming stressed by being in a doctor's surgery or a hospital.

Writing in the British Medical Journal, an Australian team say giving people a cuff to wear for 24 hours is a better way of checking blood pressure.

A UK expert said it showed clearly that external factors affected readings.

High blood pressure affects about 40% of adults in the UK and is a major risk factor for heart attack, heart failure, kidney disease and stroke.

In 2001, 90 million prescriptions for blood pressure lowering drugs were issued by the NHS at a cost of £840 million.

“Many people feel slightly anxious when going to see a doctor”

Professor Graham MacGregor, Blood Pressure Association

It can either be measured in a clinical setting, or by the patient wearing a cuff as they go about their daily lives - known as ambulatory blood pressure checks.

The researchers monitored over 8,500 patients who were being assessed at 11 blood pressure clinics around Australia.

They compared ambulatory blood pressure measurements with those taken by doctors and nurses and found that there can be a difference of as much as 29 units if a doctor checked it, compared with a rise of 17 units if a nurse took the measurement.

The differences also varied depending on the sex and age of the patient.

However, the study also found that the closer the patient's blood pressure to normal levels, the less of a difference between measurements taken by ambulatory monitoring and those taken by a nurse or doctor.

No 'one size fits all'

Professor Arduino Mangoni, who recently joined the University of Aberdeen from Flinders University in Adelaide, said: "Ambulatory blood pressure monitoring is the tool of choice to correctly diagnose high blood pressure.

"Clearly, if you're going to be treating a person for the rest of their life, you want to get the readings right, and often the reading in the doctor's office is much higher."

Professor Mangoni said the fact there was a difference between doctors' readings and ambulatory measurements was already known - but the surprise finding was how big the gap was for those with high blood pressure.

He said the team's findings should be used to help shape new blood pressure monitoring guidelines.

"Current guidelines for the diagnosis and treatment of hypertension don't pay enough attention to the role of ambulatory monitoring, often adopting a one- size-fits-all approach which doesn't properly address different patient groups."

Writing in the BMJ, Professor Richard McManus, a cardiovascular expert from the University of Birmingham, said a patient's care should be managed using clinic-based and ambulatory measurements, taking into account where the test was done and by whom.

Professor Graham MacGregor, chairman of the Blood Pressure Association, said: "This is interesting research which clearly illustrates how external factors such as environment and who is checking blood pressure can have a significant impact on blood pressure readings.

"Many people feel slightly anxious when going to see a doctor, which is why we have always encouraged blood pressure measuring at home as well as in the clinic, and promotes the use of home blood pressure monitors and ambulatory testing where indicated.

"This research may well be considered as part of the review of the NICE [National Institute of health and Clinical Excellence] guidelines for the treatment of hypertension which is currently being conducted, and will be released next year."

http://news.bbc.co.uk/2/hi/health/8667638.stm

Did Phosphorus Trigger Complex Evolution -- And Blue Skies?

Algal bloom in a pond during summer months. (Credit: iStockphoto/Alexey Stiop)

ScienceDaily (May 11, 2010) — The evolution of complex life forms may have gotten a jump start billions of years ago, when geologic events operating over millions of years caused large quantities of phosphorus to wash into the oceans. According to this model, proposed in a new paper by Dominic Papineau of the Carnegie Institution for Science, the higher levels of phosphorus would have caused vast algal blooms, pumping extra oxygen into the environment which allowed larger, more complex types of organisms to thrive.

"Phosphate rocks formed only sporadically during geologic history," says Papineau, a researcher at Carnegie's Geophysical Laboratory, "and it is striking that their occurrences coincided with major global biogeochemical changes as well as significant leaps in biological evolution."

In his study, published in the journal *Astrobiology*, Papineau focused on the phosphate deposits that formed during an interval of geologic time known as the Proterozoic, from 2.5 billion years ago to about 540 million years ago. "This time period is very critical in the history of the Earth, because there are several independent lines of evidence that show that oxygen really increased during its beginning and end," says Papineau. The previous atmosphere was possibly methane-rich, which would have given the sky an orangish color. "So this is the time that the sky literally began to become blue."

During the Proterozoic, oxygen levels in the atmosphere rose in two phases: first ranging from 2.5 to 2 billion years ago, called the Great Oxidation Event, when atmospheric oxygen rose from trace amounts to about 10% of the present-day value. Single-celled organisms grew larger during this time and acquired cell structures called mitochondria, the so-called "powerhouses" of cells, which burn oxygen to yield energy. The second phase of oxygen rise occurred between about 1 billion and 540 million years ago and brought oxygen levels to near present levels. This time intervals is marked by the earliest fossils of multi-celled organisms and climaxed with the spectacular increase of fossil diversity known as the "Cambrian Explosion."

Papineau found that these phases of atmospheric change corresponded with abundant phosphate deposits, as well as evidence for continental rifting and extensive glacial deposits. He notes that both rifting and climate changes would have changed patterns of erosion and chemical weathering of the land surface,

which would have caused more phosphorous to wash into the oceans. Over geologic timescales the effect on marine life, he says, would have been analogous to that of high-phosphorus fertilizers washed into bodies of water today, such as the Chesapeake Bay, where massive algal blooms have had a widespread impact.

"Today, this is happening very fast and is caused by us," he says, "and the glut of organic matter actually consumes oxygen. But during the Proterozoic this occurred over timescales of hundreds of millions of years and progressively led to an oxygenated atmosphere."

"This increased oxygen no doubt had major consequences for the evolution of complex life. It can be expected that modern changes will also strongly perturb evolution," he adds. "However, new lineages of complex life-forms take millions to tens of millions of years to adapt. In the meantime, we may be facing significant extinctions from the quick changes we are causing."

The research was supported by the Geophysical Laboratory of the Carnegie Institution for Science, Carnegie of Canada, and from the Fonds québécois pour la recherche sur la nature et les technologies (FQRNT), NASA Exobiology and Evolutionary Biology Program, and the NASA Astrobiology Institute through Cooperative Agreement NNA04CC09A.

Story Source:

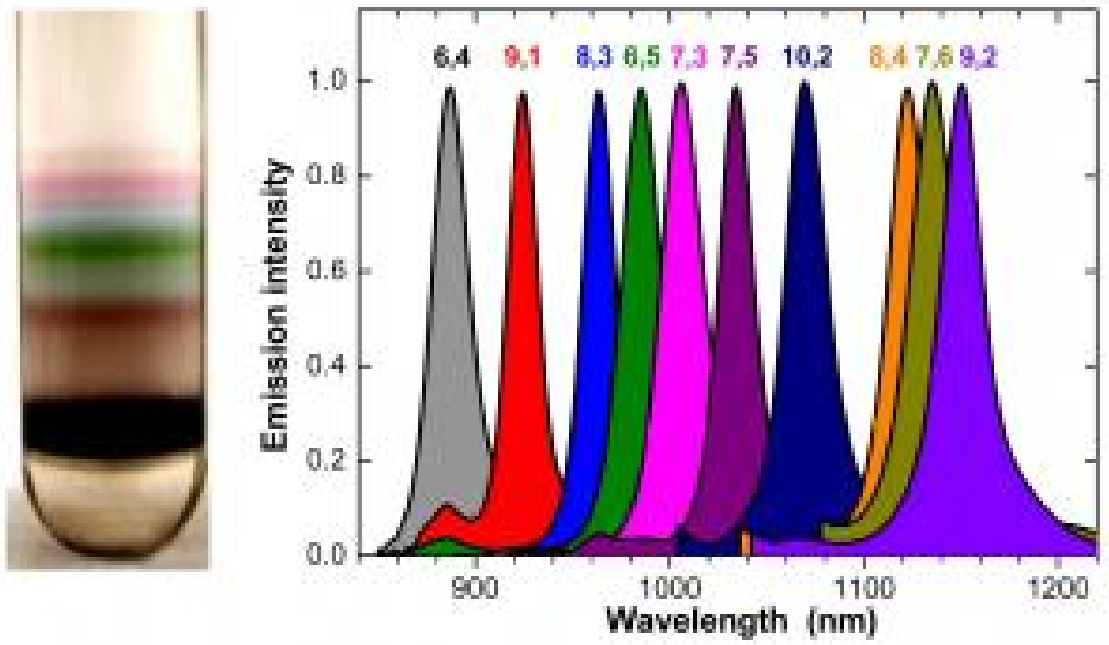
Adapted from materials provided by Carnegie Institution, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Dominic Papineau. **Global Biogeochemical Changes at Both Ends of the Proterozoic: Insights from Phosphorites**. *Astrobiology*, 2010; 10 (2): 165 DOI: 10.1089/ast.2009.0360

http://www.sciencedaily.com/releases/2010/05/100510132159.htm

Researchers Spin Pure Batches of Nanotubes Species



Researchers report using ultracentrifugation to create highly purified samples of carbon nanotube species. (Credit: Image courtesy of Rice University)

ScienceDaily (May 11, 2010) — In two new papers, Rice University researchers report using ultracentrifugation (UCF) to create highly purified samples of carbon nanotube species.

One team, led by Rice Professor Junichiro Kono and graduate students Erik Haroz and William Rice, has made a small but significant step toward the dream of an efficient nationwide electrical grid that depends on highly conductive quantum nanowire.

The other, led by Rice Professor Bruce Weisman and graduate student Saunab Ghosh, employed UCF to prepare structurally sorted batches of semiconducting nanotubes that could find critical uses in medicine and electronics.

UCF is what it sounds like: a super-fast version of the centrifuge process medical lab technicians use to separate blood cells from plasma.

The process involves suspending mixtures of single-walled carbon nanotubes in combinations of liquids of different densities. When spun by a centrifuge at up to 250,000 g -- that's 250,000 times the force of gravity -- the nanotubes migrate to the liquids that match their own particular densities. After several hours in the centrifuge, the test tube becomes a colorful parfait with layers of purified nanotubes. Each species has its own electronic and optical characteristics, all of which are useful in various ways.

Weisman's lab reported its results in the online edition of *Nature Nanotechnology*. Weisman is a professor of chemistry at Rice.Kono's lab reported its results recently in the online edition of *ACS Nano*. Kono is a professor in electrical and computer engineering and professor of physics and astronomy.The lack of pure batches of nanotubes species "has been a real hindrance in the field for nearly 20 years," Weisman said. While the UCF technique is not new, Ghosh found careful fine-tuning of the gradient structure let him

sort at least 10 of the numerous species of nanotubes contained in a single sample produced by the Rice-created HiPco process.

Basic research is a big early winner, "because when you can get pure samples of nanotubes, you can learn so much more about them," Weisman said. "Secondly, some electronic applications become much simpler because the tube type determines the nanotube's band gap, a crucial electronic property." Biomedical applications may benefit by exploiting the optical properties of specific types of nanotubes.In the Kono lab, metallic nanotubes rose to the top of the spinning vial while nearly all of the semiconducting nanotubes sank to the bottom. What surprised lead researchers Haroz and Rice was that nearly all of the metallic tubes were armchair SWNTs, the most desirable species for the manufacture of quantum nanowire. Zigzag and near-zigzag species, also considered metallic, would also sink out.

Armchair nanotubes are so-called because of their "U"-shaped end segments. Theoretically, armchairs are the most conductive nanotubes, letting electrons charge down the middle with nothing to slow them.The composition of the gradient solution made a difference in the quality of the samples, Haroz said. "One of the surfactants we're using, sodium cholate, has a molecular structure that's similar to a nanotube -- basically hexagons put together," he said. "We think there's a match between the sodium cholate and the structure of nanotubes, and it binds just a little bit better to an armchair than it does to zigzags."

Hurdles remain in the path to quantum armchair nanowires that nanotechnology pioneer and Nobel laureate Richard Smalley, Haroz' first mentor at Rice who died in 2005, felt would be a panacea for many of the world's problems. Fix the distribution of energy and solutions to other challenges -- clean water, food, environmental woes -- will fall into place, he believed.

"Step 1 of the armchair quantum nanowire project is, 'Can we get armchairs?' We've done that," said Haroz. "Now let's make macroscopic structures -- not necessarily long cables, but small structures -- to test their conductivity."Rice research scientist Sergei Bachilo is co-author of the *Nature Nanotechnology* paper with Weisman and Ghosh. Grants from the National Science Foundation and the Welch Foundation supported the research.

Co-authors of the *ACS Nano* paper with Kono, Haroz, Rice, Weisman and Ghosh are Robert Hauge, Distinguished Faculty Fellow in Chemistry at Rice, Rice junior Ben Lu and Los Alamos National Laboratory researcher Stephen Doorn. The Department of Energy office of Basic Energy Sciences, the Welch Foundation, the Air Force Research Laboratories, the National Science Foundation and the Laboratory Directed Research and Development program at Los Alamos National Laboratory supported the research.

Story Source:

Adapted from materials provided by Rice University.

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http://www.sciencedaily.com/releases/2010/05/100510105134.htm

Folic Acid Found to Improve Vascular Function in Amenorrheic Runners

ScienceDaily (May 10, 2010) — A study led by sports medicine researcher Anne Hoch, D.O. at The Medical College of Wisconsin in Milwaukee has found that oral folic acid may provide a safe and inexpensive treatment to improve vascular function in young female runners who are amenorrheic (not menstruating).

The study is published in the May 2010 issue of *Clinical Journal of Sport Medicine.*

While the benefits for women leading an active lifestyle, including running, are profound and well-known, there are serious exercise-associated health risks. Young female athletes who do not eat enough to offset the energy they expend exercising can stop menstruating or develop irregular menses as a consequence. Their resulting estrogen profile is similar to that of postmenopausal women who have low estrogen levels placing the young women at higher risk for early onset heart disease.There are nearly three million girls in high school sports and approximately 23 million women who run at least six times a week. The prevalence of athletic-associated amenorrhea among these runners is now estimated at 44 percent. A previous study by Dr. Hoch conducted at Divine Savior Holy Angels High School, Milwaukee, revealed that 54 percent of the varsity athletes were currently or had a history of amenorrhea."The earliest sign of heart disease can be measured by reduced dilation in the brachial artery of the arm in response to blood flow. Reduced vascular dilation can limit oxygen uptake and affect performance," says Anne Hoch, D. O., the study's lead author. Dr. Hoch is a professor of orthopaedic surgery and director of the Froedtert & the Medical College Women's Sports Medicine Center.

The current study by Dr. Hoch's research team found that folic acid supplement improved blood flow-mediated dilation in the brachial artery which correlates with increased blood flow to the heart.oth children and adults require folic acid to produce healthy red blood cells and prevent anemia. Folic acid, also known as vitamin B9, folacin and collate, is the form of the vitamin needed during periods of cell growth.The researchers recruited 20 female college or recreational runners, ages 18 to 35, who were not on birth control pills and had been running at least 20 miles a week for the past 12 months. At the start of the study, women who were amenorrheic had reduced blood vessel dilation similar to postmenopausal women. Women who were menstruating were included in the control group. Both groups were given 10 mg. of folic acid per day for four weeks. Vascular function returned to normal in the amenorrheic women after folic acid supplementation. Despite supplementation, vascular function remained at normal levels in the control group.

More research is needed to determine the lowest optimal dose of folic acid for athletic amenorrhea which offers the maximum benefit. Folic acid supplementation is important because folic acid may not only decrease cardiovascular risks but also improve athletic performance for these women.The study was partially funded by a grant from the Cardiovascular Center and the Department of Orthopaedic Surgery at the Medical College.

Story Source:

Adapted from materials provided by Medical College of Wisconsin, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Anne Z Hoch, Stacy L Lynch, Jason W Jurva, Jane E Schimke, David D Gutterman. **Folic Acid Supplementation Improves Vascular Function in Amenorrheic Runners**. *Clinical Journal of Sport Medicine*, 2010; 20 (3): 205 DOI: 10.1097/JSM.0b013e3181df59f4

http://www.sciencedaily.com/releases/2010/05/100510174624.htm

Quantum Mechanics Reveals New Details of Deep Earth

Silica -- the most common mineral on Earth -- is relatively uncommon deep within the planet, new research shows. (Credit: iStockphoto)

ScienceDaily (May 10, 2010) — Scientists have used quantum mechanics to reveal that the most common mineral on Earth is relatively uncommon deep within the planet.

Using several of the largest supercomputers in the nation, a team of physicists led by Ohio State University has been able to simulate the behavior of silica in a high-temperature, high-pressure form that is particularly difficult to study firsthand in the lab.

The resulting discovery -- reported in the early online edition of the *Proceedings of the National Academy of Sciences (PNAS)* -- could eventually benefit science and industry alike.

Silica makes up two-thirds of the Earth's crust, and we use it to form products ranging from glass and ceramics to computer chips and fiber optic cables.

"Silica is all around us," said Ohio State doctoral student Kevin Driver, who led this project for his doctoral thesis. "But we still don't understand everything about it. A better understanding of silica on a quantum-mechanical level would be useful to earth science, and potentially to industry as well."

Silica takes many different forms at different temperatures and pressures -- not all of which are easy to study, Driver said.

"As you might imagine, experiments performed at pressures near those of Earth's core can be very challenging. By using highly accurate quantum mechanical simulations, we can offer reliable insight that goes beyond the scope of the laboratory."

Over the past century, seismology and high-pressure laboratory experiments have revealed a great deal about the general structure and composition of the earth. For example, such work has shown that the planet's interior structure exists in three layers called the crust, mantle, and core. The outer two layers -- the mantle and the crust -- are largely made up of silicates, minerals containing silicon and oxygen.

Still, the detailed structure and composition of the deepest parts of the mantle remain unclear. These details are important for geodynamical modeling, which may one day predict complex geological processes such as earthquakes and volcanic eruptions.

Even the role that the simplest silicate -- silica -- plays in Earth's mantle is not well understood.

"Say you're standing on a beach, looking out over the ocean. The sand under your feet is made of quartz, a form of silica containing one silicon atom surrounded by four oxygen atoms. But in millions of years, as the oceanic plate below becomes subducted and sinks beneath the Earth's crust, the structure of the silica changes dramatically," Driver said.

As pressure increases with depth, the silica molecules crowd closer together, and the silicon atoms start coming into contact with oxygen atoms from neighboring molecules. Several structural transitions occur, with low-pressure forms surrounded by four oxygen atoms and higher-pressure forms surrounded by six. With even more pressure, the structure collapses into a very dense form of the mineral, which scientists call alpha-lead oxide.

It's this form of silica that likely resides deep within the earth, in the lower part of the mantle, just above the planet's core, Driver said.

When scientists try to interpret seismic signals from that depth, they have no direct way of knowing what form of silica they are dealing with. So they must simulate the behavior of different forms on computer, and then compare the results to the seismic data. The simulations rely on quantum mechanics.

In *PNAS*, Driver, his advisor John Wilkins, and their coauthors describe how they used a quantum mechanical method to design computer algorithms that would simulate the silica structures. When they did, they found that the behavior of the dense, alpha-lead oxide form of silica did not match up with any global seismic signal detected in the lower mantle.

This result indicates that the lower mantle is relatively devoid of silica, except perhaps in localized areas where oceanic plates have subducted, Driver explained.

Wilkins, Ohio Eminent Scholar and professor of physics at Ohio State, cited Driver's determination and resourcefulness in making this study happen. The physicists used a method called quantum Monte Carlo (QMC), which was developed during atomic bomb research in World War II. To earn his doctorate, Driver worked to show that the method could be applied to studying minerals in the planet's deep interior.

"This work demonstrates both the superb contributions a single graduate student can make, and that the quantum Monte Carlo method can compute nearly every property of a mineral over a wide range of pressure and temperatures," Wilkins said. He added that the study will "stimulate a broader use of quantum Monte Carlo worldwide to address vital problems."

While these algorithms have been around for over half a century, applying them to silica was impossible until recently, Driver said. The calculations were simply too labor-intensive.

Even today, with the advent of more powerful supercomputers and fast algorithms that require less computer memory, the calculations still required using a number of the largest supercomputers in the United States, including the Ohio Supercomputer Center in Columbus.

"We used the equivalent of six million CPU hours or more, to model four different states of silica" Driver said.

He and his colleagues expect that quantum Monte Carlo will be used more often in materials science in the future, as the next generation of computers goes online.

Coauthors on the paper included Ronald Cohen of the Carnegie Institution of Washington; Zhigang Wu of the Colorado School of Mines; Burkhard Militzer of the University of California, Berkeley; and Pablo López Ríos, Michael Towler, and Richard Needs of the University of Cambridge.

This research was funded by the National Science Foundation and the Department of Energy. Computing resources were provided by the National Center for Atmospheric Research, the National Energy Research Scientific Computing Center, the National Center for Supercomputing Applications, the Computational Center for Nanotechnology Innovations, the TeraGrid, and the Ohio Supercomputer Center.

Story Source:

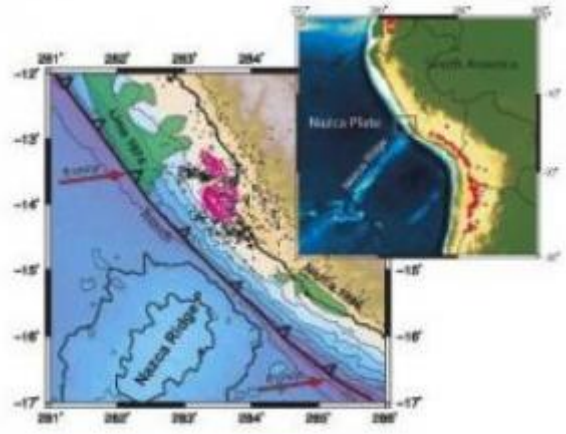
Adapted from materials provided by Ohio State University. Original article written by Pam Frost Gorder.

Journal Reference:

1. K. P. Driver, R. E. Cohen, Zhigang Wu, B. Militzer, P. López Ríos, M. D. Towler, R. J. Needs, J. W. Wilkins. **Quantum Monte Carlo computations of phase stability, equations of state, and elasticity of high-pressure silica**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.0912130107

http://www.sciencedaily.com/releases/2010/05/100510161332.htm

Aseismic Slip as a Barrier to Earthquake Propagation



The 2007 Pisco earthquake ruptured two patches (indicated by the contour lines of seismic slip in red) of the plate interface along which the Nazca plate slides under South America at about 6 cm/yr (red arrows). The black dots show the aftershocks triggered by this quake. Two other large earthquakes had ruptured the plate interface in 1974 and 1996 (green areas). (Credit: Caltech Tectonics Observatory)

ScienceDaily (May 5, 2010) — On August 15, 2007, a magnitude 8.0 earthquake struck in Central Peru, killing more than 500 people -- primarily in the town of Pisco, which was heavily damaged by the temblor -- and triggering a tsunami that flooded Pisco's shore and parts of Lima's Costa Verde highway. The rupture occurred as the Nazca tectonic plate slipped underneath the South American plate in what is known as a subduction zone.

Soon thereafter, Hugo Perfettini -- a former postdoctoral scholar with the Tectonics Observatory at the California Institute of Technology (Caltech), now at the Institut de Recherche pour le Développement in France -- deployed an array of GPS stations in southern Peru. They were used to measure the postseismic deformation -- the deformation that occurred in the first year after the earthquake.

When the research team -- made up of a collaboration of scientists at the Caltech Tectonics Observatory and their partners in Peru and France -- looked at the data from these GPS stations and compared them to the distribution of aftershocks in the area, they noticed something "amazing," says Jean-Philippe Avouac, director of the Tectonics Observatory and professor of geology at Caltech

The team's analysis of this data -- and the conclusions they were able to draw as a result -- are described in a paper in the May 6 issue of the journal *Nature*.

"After the earthquake, the plate interface slipped quite a bit," Avouac says. "But the aftershocks were tiny compared to the displacement. In other words, there was a lot of deformation, but most of it was aseismic." (Aseismic slippage, or aseismic creep, is movement along a fault that occurs without any accompanying seismic waves.)

This was contrary to what had long been assumed about plate movement in the area. "We used to think the plate interface at a subduction zone -- which extends in this case from the surface to a depth of about 40 kilometers -- was only slipping during large earthquakes," Avouac explains. "In Peru, 50 percent of the slippage within this range of depth is actually aseismic."

When the team mapped this aseismicity, they found that it occurred in a sort of "patchwork" pattern, says Avouac, with areas that "mostly slip aseismically and areas that mostly slip during earthquakes." As it turns out, some of these areas are always aseismic, "creeping continuously," he notes -- and therefore act as a sort of permanent barrier to the propagation of an earthquake. Since seismic stress cannot build up in

these particular aseismic areas, there is no stress to be released in an earthquake; any seismic rupture traveling through such an area would stop dead in its tracks.

What was perhaps most surprising, Avouac adds, is that one of the largest aseismic areas the researchers found "corresponds with where the Nazca ridge comes into the trench."

"This large area of aseismic slip is good news," he says. "It lowers the seismic hazard in that region, and allows us to be a little bit predictive. We cannot tell you when there will be an earthquake, but we can tell you where there is stress buildup, and where there is no stress buildup. Where there is no stress buildup, there will be no seismic rupture. That is where the earthquakes are going to stop."

The lessons learned in Peru, Avouac says, should be generalizable to just about any subduction zone -- Sumatra, for instance, or Chile -- and probably to any other kind of fault as well. And so Avouac -- along with Nadia Lapusta, associate professor of mechanical engineering and geophysics at Caltech, and postdoctoral scholar Yoshihiro Kaneko from the Scripps Institution of Oceanography, who worked on this project while doing his PhD at Caltech -- decided to look at "the long-term evolution of slip on a model fault where two seismogenic, locked segments are separated by an aseismically slipping patch where rupture is impeded," they explain in a paper recently published online in the journal *Nature Geoscience*.

When the locked segments (i.e., the areas in which stress builds up, and which produce earthquakes when they rupture) are far apart -- or if the intervening aseismic area has frictional characteristics that make aseismic slip easy -- they "tend to rupture independently," says Avouac. If they are very close together, they tend to interact and eventually break together.

The interesting question, Avouac says, is what we can expect to happen when the two segments are close, but not too close -- and are separated by an aseismic area, as was seen in the Peru patchwork. By looking at what geologists call interseismic coupling -- "the fraction of sliding that is aseismic and occurs between earthquakes," explains Avouac -- and by factoring in distance, time, and the sliding speed, the team was able to determine whether an earthquake that begins in one locked area is likely to stop when it hits an aseismic barrier, or whether it will be able to cross that barrier and rupture the segment on the other side.

"This model demonstrates that, based on geodetic monitoring of a subduction zone, we can not only locate the places that are accommodating plate motion through slow, aseismic slip, but also determine the probability that they will be able to arrest seismic ruptures," says Lapusta.

The hope, Avouac adds, is that this sort of modeling can be applied to data derived from actual subduction zones. "We want to create models that will take into account the physical properties of a fault to produce a scenario of how the system might evolve," he says, in much the same way that meteorologists forecast the weather.

"Our study opens the possibility of predicting patterns of large earthquakes that a fault system could produce on the basis of observations of its coupling," adds Kaneko, "and suggests that regions of low coupling may reveal permanent barriers to large earthquakes."

In addition to Avouac and Perfettini, the other authors on the *Nature* paper, "Seismic and aseismic slip on the Central Peru megathrust," were Pierre Soler, Francis Bondoux, Mohamed Chlieh, and Laurence Audin of the Institut de Recherche pour le Développement; Hernando Tavera of the Instituto Geofisico del Perú; Andrew Kositsky, a former Caltech undergraduate student, now at Ashima Research in Pasadena; Jean-Mathieu Nocquet of Géoazur in Valbonne, France; Anthony Sladen, a staff seismologist at Caltech; and Daniel Farber of the University of California, Santa Cruz. The work was supported by grants from the Institut de Recherche pour le Développement, the Gordon and Betty Moore Foundation (through the Caltech Tectonics Observatory), and the National Science Foundation (NSF).The work was

funded by grants from the NSF and the Gordon and Betty Moore Foundation (through the Caltech Tectonics Observatory).

Story Source:

Adapted from materials provided by California Institute of Technology.

Journal Reference:

1. Yoshihiro Kaneko, Jean-Philippe Avouac, Nadia Lapusta. **Towards inferring earthquake patterns from geodetic observations of interseismic coupling**. *Nature Geoscience*, 2010; 3 (5): 363 DOI: 10.1038/ngeo843

http://www.sciencedaily.com/releases/2010/05/100505133306.htm

Smarter Use of Existing Treatment Helps Dramatically Boost Survival of Young Acute Myeloid Leukemia Patients

ScienceDaily (May 11, 2010) — More individualized therapy and better supportive care helped push the survival for children with acute myeloid leukemia (AML) to 71 percent three years after diagnosis, according to new research led by St. Jude Children's Research Hospital investigators and reported in the medical journal The *Lancet Oncology*.

The survival rate of 71 percent is 20 percent better than previously reported U.S. rates and is similar to the success achieved in a 2009 Japanese study, said Jeffrey Rubnitz, M.D., Ph.D., a member of the St. Jude Oncology department.

Results of the study, which involved 230 young AML patients treated at St. Jude and six other U.S. hospitals, are among the best reported nationally or internationally. Rubnitz said saving even more lives will likely require new medications and novel treatments. He is the lead author of this study, which appears in the current advance online issue of the journal The *Lancet Oncology* and is scheduled for publication in the June print edition.

AML, a cancer of certain white blood cells, is diagnosed in about 500 U.S. children and adolescents each year. While cure rates for acute lymphoblastic leukemia (ALL), the most common childhood cancer, have soared to better than 90 percent, long-term survival among AML patients has lagged.

"In this study, we focused on getting the maximum benefit from existing therapies and applying lessons learned from earlier studies to identify and treat patients who faced the highest risk of relapse," Rubnitz said.

More than three years after diagnosis, about 89 percent of study patients classified at low-risk of relapse were still alive, compared with about 63 percent of standard-risk patients and about 47 percent of high-risk patients. AML patients are most likely to relapse within a year of diagnosis, and Rubnitz said cancer rarely returns after two years.

This study featured several firsts, including the first use of minimal residual disease (MRD) to guide the timing and makeup of later chemotherapy. MRD measures cancer cells that survive treatment. Rubnitz said patients assigned to more intensive therapy had MRD levels of greater than 1 cancer cell in 1,000 normal bone marrow cells after the first or second course of chemotherapy. In the study, MRD measures were also used to determine which patients received the drug gemtuzumab ozogamicin. The drug has been approved for use in AML patients age 60 and older and is now being studied in young patients.

MRD screening is commonly used to help guide ALL treatment, but Rubnitz said technical issues delayed widespread application in AML care.

The study also marked the first time all patients received antibiotics after each course of chemotherapy in hopes of preventing bacterial and fungal infections. The strategy dramatically decreased all measures of infection, including hospitalizations and deaths. Initially, all patients were treated with the anti-fungal medication voriconazole, but later the antibiotics vancomycin and ciprofloxacin were added.

The study included patients ranging in age from 2 days to 21 years. The work helped answer several other questions, including whether patients benefited from using a high dose of the anti-cancer drug cytarabine early in treatment. Researchers found no additional benefit.

In addition to MRD, the study used genetic factors, including chromosomal rearrangements and gene mutations, and tailored treatment to reflect if patients had high, standard or low risk AML.

Patients initially received three-drug combination therapy, including either high- or low-dose cytarabine. After the first and second courses of chemotherapy, investigators used genetics factors and MRD measures to determine additional care a patient received, including whether patients were referred for a transplant to replace diseased blood-producing stem cells with cells from a healthy donor.

The study's authors were Hiroto Inaba, Raul Ribeiro, Stanley Pounds, Xueyuan Cao, Susana Raimondi, Mihaela Onciu, Elaine Coustan-Smith, James Downing, Wing Leung, Ching-Hon Pui and senior author Dario Campana, all of St. Jude; Bassem Razzouk, formerly of St. Jude and now of St. Vincent Children's Hospital, Indianapolis; Gary Dahl and Norman Lacayo, of Packard Children's Hospital and Stanford Cancer Center; W. Paul Bowman of Cook Children's Medical Center, Ft. Worth, TX.; Jeffrey Taub of Children's Hospital of Michigan, Detroit; Soheil Meshinchi of Hutchinson Cancer Research Center, Seattle; Barbara Degar, Dana-Farber Cancer Center Institute, Boston; and Gladsone Airewele, Texas Children's Cancer Center, Houston.

This work was supported in part by the National Institutes of Health and ALSAC.

Story Source:

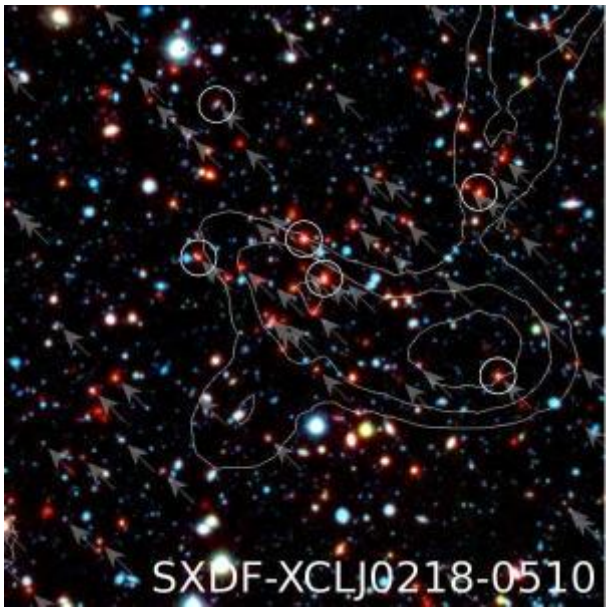
Adapted from materials provided by St. Jude Children's Research Hospital, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Jeffrey E Rubnitz, Hiroto Inaba, Gary Dahl, Raul C Ribeiro, W Paul Bowman, Jeffrey Taub, Stanley Pounds, Bassem I Razzouk, Norman J Lacayo, Xueyuan Cao. **Minimal residual disease-directed therapy for childhood acute myeloid leukaemia: results of the AML02 multicentre trial**. *The Lancet Oncology*, 2010; DOI: 10.1016/S1470-2045(10)70090-5

http://www.sciencedaily.com/releases/2010/05/100510105023.htmhttp://www.sciencedaily.com/releases/2010/05/100510105023.htm

Ancient City of 'Modern' Galaxies: May Be Most Distant Galaxy Cluster Ever Detected



This false color image is 3.4 arcmin on a side (about 1/10 the size of the moon). The arrows indicate galaxies that are likely located at the same distance, clustered around the center of the image. The contours indicate the X-ray emission of the cluster. Galaxies with confirmed distance measurements of 9.6 billion light years are circled. The combination of the X-ray detection and the collection of massive galaxies unequivocally proves a real, gravitationally bound cluster. (Credit: Image courtesy of Max Planck Institute for Extraterrestrial Physics)

ScienceDaily (May 10, 2010) — Using NASA's Spitzer Space Telescope, a Texas A&M University-led team of astronomers has uncovered what may be the earliest, most distant cluster of galaxies ever detected.

The group of roughly 60 galaxies, called CLG J02182-05102, is nearly 10 billion years old -- born just 4 billion years after the Big Bang. However, it's not the size nor the age of the cluster that amazes the team of researchers led by Dr. Casey Papovich, an assistant professor in the Texas A&M Department of Physics and Astronomy and member of the George P. and Cynthia Woods Mitchell Institute for Fundamental Physics and Astronomy. Rather, it's the surprisingly modern appearance of CLG J02182-05102 that has them baffled -- a huge, red collection of galaxies typical of only present-day galaxies.

"It's like we dug an archaeological site in Rome and found pieces of modern Rome amongst the ruins," explains Papovich, lead author of the team's study to be published in Astrophysical Journal.

While its neighboring galaxies appear vastly smaller and far fainter, Papovich says CLG J02182-05102 stands out as a densely-populated bundle of ancient galaxies. Enormous red galaxies at the center contain almost 10 times as many stars as our Milky Way, he notes, combining for a total size that rivals that of the most monstrous galaxies of our nearby universe.

Before now, Papovich says, such a finding would be considered by many astronomers to be highly unlikely, considering the time frame in which they were found.

"The predictions are that these things should be very rare when the universe was 4 billion years old, and yet, we found them," Papovich explains. "Not only did we find them, it looks for all intents and purposes like they had already formed completely and evolved into the large concentrations of galaxies that we see in clusters today."

Exactly why these particular galaxies are fully formed that early is what Papovich and his collaborators -- which include astronomers from NASA's Jet Propulsion Laboratory at the California Institute of Technology (Caltech) as well as Carnegie Observatories -- hope to one day uncover, but for now, studying CLG J02182-05102 could help them and other researchers better understand how galaxies form and cluster in general.

The find resulted from a project initiated two years ago when Papovich and his team observed an area of the sky that could encompass 250 full moons, the largest extragalactic survey of space ever made -- the Spitzer Wide-area InfraRed Extragalctic (SWIRE) survey. The team focused on a cosmic region of the survey that previously had been observed by other instruments including Japan's Subaru telescope in Mauna Kea, Hawaii, and the European Space Agency's orbiting XMN-Newton telescope. This, combined with infrared data from the United Kingdom Infrared Telescope -- also in Hawaii -- and Spitzer's Public Ultra Deep Sky survey instantly revealed a number of distant galaxies.

It wasn't until Papovich's group studied faint light from CLG J02182-05102's least-dim galaxies that they were able to determine they had found a cluster that contained about 60 galaxies full of old, red stars, at a time when the universe was only 4 billion years old -- about 30 percent of the universe's current age of 13.7 billion years. At this point in time, most other galaxies would still be forming their very first stars and certainly would not have congregated with other galaxies yet.

In essence, Papovich said the galaxies in CLG J02182-05102 must have subscribed to a "rock 'n' roll" lifestyle -- they lived fast and died young. It's another mystery Papovich hopes to solve through deeper observations, including spectroscopy, with the Hubble Telescope later this year.

"That's one of the reasons this is so interesting," he adds. "It seems that they somehow had a premonition they would end up in these big clusters, so that's another thing we want to find out."

Story Source:

Adapted from materials provided by Texas A&M University, via EurekAlert!, a service of AAAS.

Journal Reference:

1. M. Tanaka, A. Finoguenov, Y. Ueda. **A spectroscopically confirmed X-ray cluster at z=1.62 with a possible companion in the Subaru/XMM-Newton deep field**. *Astrophysical Journal Letters*, 2010; (accepted for publication) DOI: http://arxiv.org/abs/1004.3606

http://www.sciencedaily.com/releases/2010/05/100510131505.htm

Waterpipes: New Pastime for North American Youth? Hookah or Shisha Use on Rise, Yet Contains Nicotine, Carbon Monoxide and Carcinogens

Man smoking a traditional waterpipe (or "hookah"). (Credit: iStockphoto/Beth Ambrose)

ScienceDaily (May 10, 2010) — As fewer people puff on cigarettes, a new smoking trend may be gaining popularity among North American youth. A study published in the journal *Pediatrics* has found that almost one-quarter of young adults in Montreal had used waterpipes (also known as shishas or hookahs) in the past year.

"The popularity of waterpipes may be due in part to perceptions that they are safer than cigarettes. However, waterpipe smoke contains nicotine, carbon monoxide, carcinogens and may contain greater amounts of tar and heavy metals than cigarette smoke," warns senior investigator Jennifer O'Loughlin, a professor at the University of Montreal Department Of Social and Preventive Medicine and a scientist at the University of Montreal Hospital Research Center.

As part of a longitudinal cohort investigation (NDIT Study), 871 youth aged 18 to 24 completed questionnaires on their smoking habits. The research team, which included scientists from the University of Montreal, the National Institute of Public Health of Quebec and McGill University, found that 23 percent of respondents had used a waterpipe within the last 12 months and that 5 percent had used waterpipes one or more times in the past month.

The study found waterpipes to be particularly popular among young, English-speaking males who lived on their own and had a higher household income. In addition, the research team found that waterpipe users were more likely to use other psychoactive substances such as cigarettes, marijuana, illicit drugs and alcohol.

The paper, "Waterpipe Smoking Among North American Youths," published in the journal *Pediatrics*, was authored by Erika Dugas, Daniel Cournoyer and Jennifer O'Loughlin of the University of Montreal and University of Montreal Hospital Research Center; Michèle Tremblay of the National Institute of Public Health of Quebec and Nancy C. P. Low of McGill University.

Story Source:

Adapted from materials provided by University of Montreal.

Journal Reference:

1. Erika Dugas, Michèle Tremblay, Nancy C.P. Low, Daniel Cournoyer, and Jennifer O'Loughlin. **Water-Pipe Smoking Among North American Youths**. *Pediatrics*, 2010; DOI: 10.1542/peds.2009-2335

http://www.sciencedaily.com/releases/2010/05/100510121219.htm

Cellulosic Ethanol: Expanding Options, Identifying Obstacles

ARS microbiologist Ken Bischoff has developed a shake-flask model to simulate the bacterial outbreaks that can contaminate ethanol plants and cut yields as much as 27 percent. (Credit: Image courtesy of USDA/Agricultural Research Service)

ScienceDaily (May 10, 2010) — Agricultural Research Service (ARS) scientists are figuring out how to turn wheat straw into ethanol "gold," and learning more about the bacteria that can "infect" ethanol plants and interfere with fuel production.

At the ARS National Center for Agricultural Utilization Research (NCAUR) in Peoria, Ill., ARS chemist Badal Saha conducted a 5-year study that examined whether wheat straw -- a crop residue left over after the grain has been harvested -- could have commercial potential for cellulosic ethanol production.

Saha found he could access and ferment almost all the plant sugars in the biofeedstock when it was pretreated with alkaline peroxide and then broken down by enzymes. This process released even hard-to-reach sugars in plant cell walls, which significantly boosted the overall ethanol output to around 93 gallons per ton of wheat straw.

But the same environments that facilitate fermentation can also nurture microorganisms that "infect" ethanol production facilities and disrupt output. ARS geneticist Tim Leathers collected bacteria from samples at commercial ethanol facilities, including a wet-mill facility that had never been dosed with antibiotics and a dry-grind facility that periodically dosed with antibiotics after bacterial outbreaks. He found that most of the bacterial isolates he collected from both facilities were different types of lactic acid bacteria.

Meanwhile, ARS microbiologist Ken Bischoff developed a model for simulating bacterial contamination and infection. He found that when test cultures were inoculated with *Lactobacillus fermentum* -- one of the most common sources of bacterial infections in ethanol plants -- ethanol yields decreased by 27 percent. Sometimes the "infection" could be cured with antibiotics, but he also found one bacterial strain that was already resistant to treatment.

Results from this research have been published in several journals, including *Biotechnology and Bioengineering*, the *Journal of Biobased Materials and Bioenergy*, and the *Journal of Industrial Microbiology and Biotechnology*.

Story Source:

Adapted from materials provided by USDA/Agricultural Research Service.

http://www.sciencedaily.com/releases/2010/04/100409105352.htm

Mozart's Music Does Not Make You Smarter, Study Finds

Wolfgang A. Mozart. (Credit: Image courtesy of University of Vienna)

ScienceDaily (May 10, 2010) — For over 15 years, scientists have been discussing alleged performance-enhancing effects of hearing classical music. Now, University of Vienna researchers Jakob Pietschnig, Martin Voracek and Anton K. Formann present quite definite results on this so-called "Mozart effect" in the US journal Intelligence. These new findings suggest no evidence for specific cognitive enhancements by mere listening to Mozart's music.

In 1993, in the journal *Nature*, University of California at Irvine psychologist Frances H. Rauscher and her associates reported findings of enhanced spatial task performance among college students after exposure to Mozart's music. Mozart's 1781 sonata for two pianos in D major (KV 448) supposedly enhanced students' cognitive abilities through mere listening. Scientific articles only rarely attract such public attention and excitement as was the case for Rauscher's publication: the New York Times wrote that listening to Mozart would give college-bound students an edge in the SAT. What is more, other commentators hailed Mozart music as a magic bullet to boost children's intelligence.

In the course of this hype, then Georgia governor Zell Miller even issued a bill in 1998, ensuring that every mother of a newborn would receive a complimentary classical music CD. In the same year, Florida's state government passed a law, requiring state-funded day-care centers to play at least one hour of classical music a day.

Debunking the myth

In the scientific community, however, Rauscher's finding was met with scepticism, as researchers around the world found it surprisingly hard to replicate. University of Vienna psychologists Jakob Pietschnig, Martin Voracek, and Anton K. Formann now report the findings of their meta-analysis of the "Mozart effect" in the US journal Intelligence.

Their comprehensive study of studies synthesizes the entirety of the scientific record on the topic. Retrieved for this systematic investigation were about 40 independent studies, published ones as well as a number of unpublished academic theses from the US and elsewhere, totalling more than 3000 participants.

The University of Vienna researchers' key finding is clear-cut: based on the cumulated evidence, there remains no support for gains in spatial ability specifically due to listening to Mozart music.

"I recommend listening to Mozart to everyone, but it will not meet expectations of boosting cognitive abilities," says Jakob Pietschnig, lead author of the study. A specific "Mozart effect," as suggested by Rauscher's 1993 publication in Nature, could not be confirmed. The meta-analysis from the University of Vienna exposes the "Mozart effect" as a legend, thus concurring with Emory University psychologist Scott E. Lilienfeld, who in his recent book "50 Great Myths of Popular Psychology" already ranked the "Mozart effect" number six.

Story Source:

Adapted from materials provided by University of Vienna, via AlphaGalileo.

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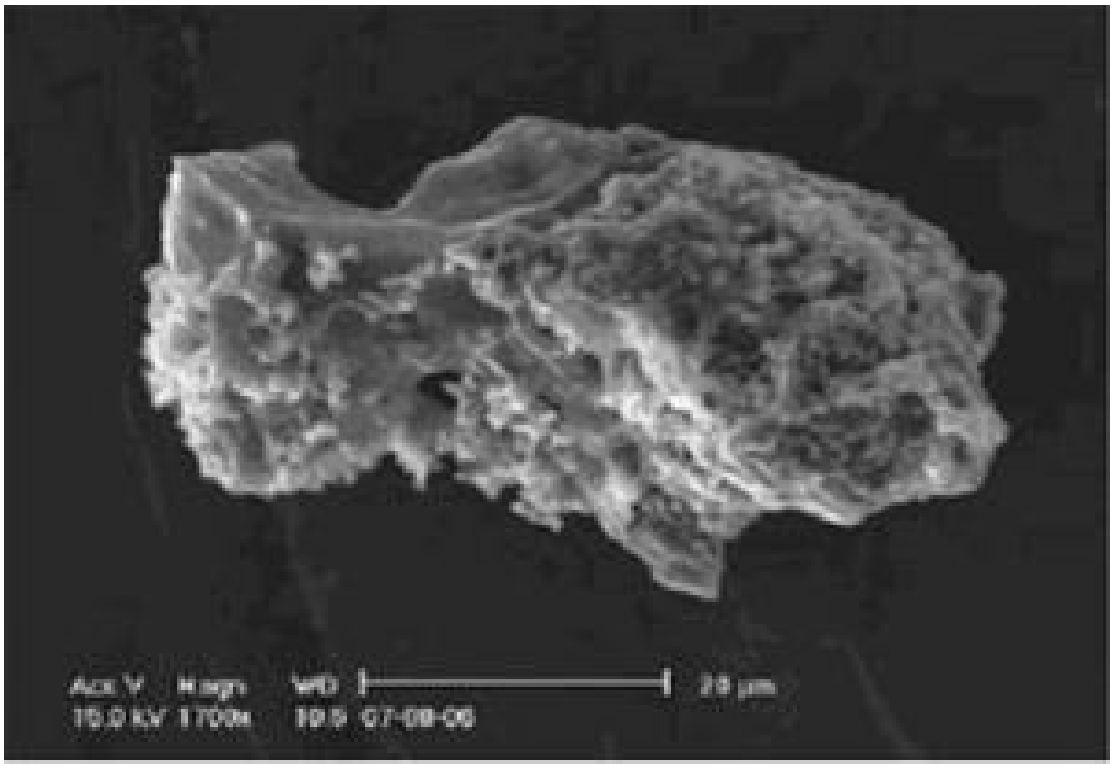
http://www.sciencedaily.com/releases/2010/05/100510075415.htm

Cometary Dust in Antarctica?



Ultracarbonaceous micrometeorite found near the Concordia base, seen through a scanning electron microscope. (Credit: CSNSM-CNRS)

ScienceDaily (May 10, 2010) — A new family of extraterrestrial particles, probably of cometary origin, has been identified for the first time in snow in Central Antarctica.

Discovered by researchers from the Center for Nuclear Spectrometry and Mass Spectrometry (CSNSM) (CNRS/Université Paris-Sud 11), attached to IN2P3 (Institut national de physique nucléaire et de physique des particules), the micrometeorites, which are remarkably well preserved, are made up of organic matter containing small assemblages of minerals from the coldest and most remote regions of the Solar System. This work is published in the journal Science.

The French-Italian scientific base Concordia is located at Dome C in the central region of the Antarctic continent. This is one of the most remote places in the world, where the amount of dust of terrestrial origin is extremely small.

Thanks to logistic support from the French Paul-Émile Victor Polar Institute (IPEV) and its Italian counterpart PNRA (Programma Nazionale Ricerche in Antartidea), CSNSM (Centre de spectrométrie nucléaire et spectrométrie de masse) researchers have discovered a new family of extraterrestrial particles in layers of ultra-clean snow located at a depth of four meters in the vicinity of the base. The CSNSM team identified ultracarbonaceous micrometeorites (particles less than 1 mm in size containing 50-80% carbonaceous material). The approximately 0.1 mm-sized particles have no equivalent in collections of extraterrestrial material available in laboratories until now, and have given rise to a series of additional analyses as part of a collaboration between CSNSM, the French Natural History Museum, the University of Lille 1, and the Ecole Normale Supérieure in Paris.

Analyses using transmission electron microscopy have shown that the micrometeorites are made up of only very slightly altered organic matter containing small assemblages of minerals. Analysis with an ion

microprobe has revealed that its hydrogen isotopic composition shows exceptionally high deuterium/hydrogen (D/H) ratios (around 10 times the value found in terrestrial oceans). Taken all together, the results indicate that the particles very likely come from the most distant bodies in the Solar System, comets.

Comets are made up of a mixture of icy materials and dust. Occasionally, some of them enter the inner Solar System. When they pass near the Sun, the rise in temperature causes massive sublimation of the icy materials, leading to an ejection of a mixture of gases and cometary grains into interplanetary space. Some dust grains may cross Earth's orbit as they drift towards the Sun, where most of them finish their journey. It is probably some of these cometary grains that the CSNS scientists discovered in Antarctica.

Until now, only the US Stardust space mission had enabled international teams to carry out mineralogical and geochemical analyses of cometary grains (emitted by comet 81P/Wild2 as it passed near the Sun). The micrometeorites discovered at Concordia show numerous similarities to the samples from the Stardust mission. For the first time, they allow scientists to study extremely well preserved assemblages of minerals and organic material that were present beyond Jupiter's current orbit at the time when the Sun and the planets were being formed. Their chemical and isotopic composition should make it possible to comprehend the physical and chemical processes at work inside the disk of gas and dust that surrounded the early Sun 4.5 billion years ago.

Story Source:

Adapted from materials provided by CNRS (Délégation Paris Michel-Ange).

Journal Reference:

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http://www.sciencedaily.com/releases/2010/05/100510075417.htm

Dietary Protein May Reduce Hip Fractures in the Elderly

ScienceDaily (May 10, 2010) — Seniors who consume a higher level of dietary protein are less likely to suffer hip fractures than seniors whose daily dietary protein intake is less, according to a new study by the Institute for Aging Research of Hebrew SeniorLife in Boston, an affiliate of Harvard Medical School.

The study, which examined the daily protein intake of 946 seniors from the Framingham Osteoporosis Study, found that individuals who were in the lowest 25 percent of dietary protein intake had approximately 50 percent more hip fractures than those who consumed greater amounts of dietary protein (all within normal intakes). Those who suffered hip fractures consumed less than the 46 grams of dietary protein per day recommended for adults.

"Study participants who consumed higher amounts of protein in their diet were significantly less likely to suffer a hip fracture," says senior study author Marian T. Hannan, D.Sc., M.P.H., co-director of the Musculoskeletal Research Program at the Institute for Aging Research.

The study, which was funded in part by the National Institute of Arthritis and Musculoskeletal and Skin Diseases, will be published this week in the online-first edition of *Osteoporosis International*. It builds on previous studies that included mostly women and reported a relationship between greater dietary protein intake and decreased risk of hip fracture.

While other studies have shown that dietary protein intake is also linked with higher bone mineral density, Dr. Hannan says dietary protein may further protect elderly people against hip fracture by building stronger muscles in the legs. Most fractures occur after a fall, which may be caused by less muscle mass and decreased strength in the lower extremities.

Dr. Hannan, an associate professor of medicine at Harvard Medical School, recommends that older women consume at least 46 grams of protein per day, and that older men consume at least 56 grams of protein daily. This can come from both animal sources (meal, poultry, fish, eggs, milk, cheese and yogurt) and plants (legumes, grains, nuts, seeds and vegetables). The study did not examine the type of protein consumed.

In addition to increased dietary protein, Dr. Hannan says regular exercise to build stronger muscles and better balance, as well as other falls prevention strategies, such as reducing hazards in the home, can help protect seniors against falls and hip fractures.

More than 25 million Americans over the age of 50 have either osteoporosis, a disease in which bones become fragile and more likely to break, or osteopenia, a condition in which bone mineral density is lower than normal, but not low enough to be considered osteoporosis. More than 95 percent of hip fractures in people over the age of 65 are caused by falls and can lead to severe health problems, including decreased quality of life and premature death.

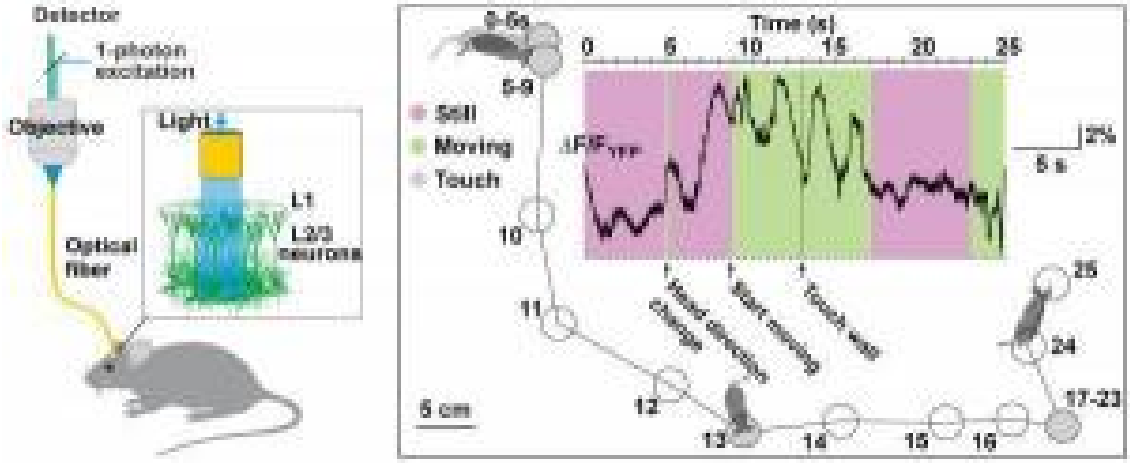
Scientists at the Institute for Aging Research conduct rigorous medical and social studies, leading the way in developing strategies for maximizing individuals' strength, vigor and physical well-being, as well as their cognitive and functional abilities in late life.

Story Source:

Adapted from materials provided by Hebrew SeniorLife Institute for Aging Research, via EurekAlert!, a service of AAAS.

http://www.sciencedaily.com/releases/2010/05/100505092000.htm

Blinking Neurons Give Thoughts Away



Fibre-optic recording of YC3.60 signals in barrel cortex. Schematics of a setup (left) and functional signals in a freely-moving mouse (right). (Credit: Mazahir T. Hasan)

ScienceDaily (May 10, 2010) — Electrical currents are invisible to the naked eye -- at least they are when they flow through metal cables. In nerve cells, however, scientists are able to make electrical signals visible. Working with fellow experts from Switzerland and Japan, scientists from the Max Planck Institute for Medical Research in Heidelberg successfully used a specialized fluorescent protein to visualize electrical activity in neurons of living mice. In a milestone study, scientists are able to apply the method to watch activity in nerve cells during animal behaviour.

Neurons communicate with one another via so-called action potentials. During an action potential, voltage-gated calcium channels are opened resulting in rapid calcium ion influx. Because of this tight coupling, fluorescent calcium indicator proteins can visualize action potentials. These proteins have two fluorescent subunits, one of which radiates yellow light and the other blue. When the proteins bind calcium, the proportion of yellow to blue light changes. Colour variation from blue light towards yellow thus reports different calcium levels -- which is why the protein has been dubbed a "cameleon."

Measuring action potentials optically

With the cameleon protein YC3.60, a fairly new variant, the scientists succeeded in recording the reaction of nerve cells to sensory stimuli in the intact brain of mice: every time the whiskers were deflected by a puff of air, there was a change of colour in the cameleon proteins in the nerve cells of the sensory areas of the cortex. It could therefore be deduced that the affected cells had reacted to the stimulus with action potentials. "The cameleon protein YC3.60 gives us the ability to measure action potentials not only in brain slices, but also in the intact brain. The molecule reacts quickly and sensitively and also captures changes in calcium concentrations occurring in rapid sequence," explains Mazahir Hasan from the Max Planck Institute for Medical Research.

The scientists were able to investigate activity in single cells as well as in whole groups of nerve cells. "YC3.60 has therefore proven to be a suitable tool for studying nerve tissue at different levels: on the one hand, we can monitor the fluctuation of calcium to infer action potentials within nerve cells. And what is even more advantageous, we can simultaneously measure the activity of neural networks or entire brain regions," says Mazahir Hasan. Consequently, the next step the scientists want to do is to selectively introduce cameleon proteins into a specific cortical layer or into different types of nerve cells. "Then we may be in a position to understand how different nerve cells in brain circuits generate complex behaviours," states Mazahir Hasan hopefully.

Measuring without electrodes

Cameleon proteins could therefore revolutionize the study of electrical activity in the brain. To date, the only way scientists could do this is by inserting electrodes into the nerve tissue or the cells. This electrode technique is blind to cell identity and it damages the tissue. By contrast, the cameleon protein's colour changes can be observed in a much less invasive procedure using glass fibres as light conductors or with the help of modern fluorescence microscopes -- known as two-photon laser-scanning microscopes. Moreover, cameleon proteins can be formed by cells themselves provided a corresponding section of DNA has been inserted into the genome in advance. In the experiments conducted by the scientists, viruses served as the vehicle for smuggling the genetic information for the cameleon proteins into the nerve cells.

In two earlier studies, an international team of scientists headed by Mazahir Hasan were the first to demonstrate that similar genetic probes can successfully detect natural sensation (such as smell and touch) in the mammalian brain in the form of unique activity patterns (Hasan et al., 2004) and, more importantly, with single-cell, single-action-potential resolution (Wallace et al., 2008). In the current study, they have reached yet another major milestone as they demonstrate that the cameleon YC3.60 can be used to record activity from a large number of nerve cells during behaviour in freely moving mice. Additionally, it is well suited for recording activity from the same nerve cells in the same animals over a long time period and should help scientists to understand how network activity patterns form to code for different experiences and animal behaviour.

These new advances, using light to study the brain, provide us with a unique opportunity to investigate how memories are formed and lost and, furthermore, when and where nerve cell activity patterns become altered as in the case of aging and also in neurological diseases such as Alzheimer's disease, Parkinson's disease and schizophrenia.

Story Source:

Adapted from materials provided by Max-Planck-Gesellschaft.

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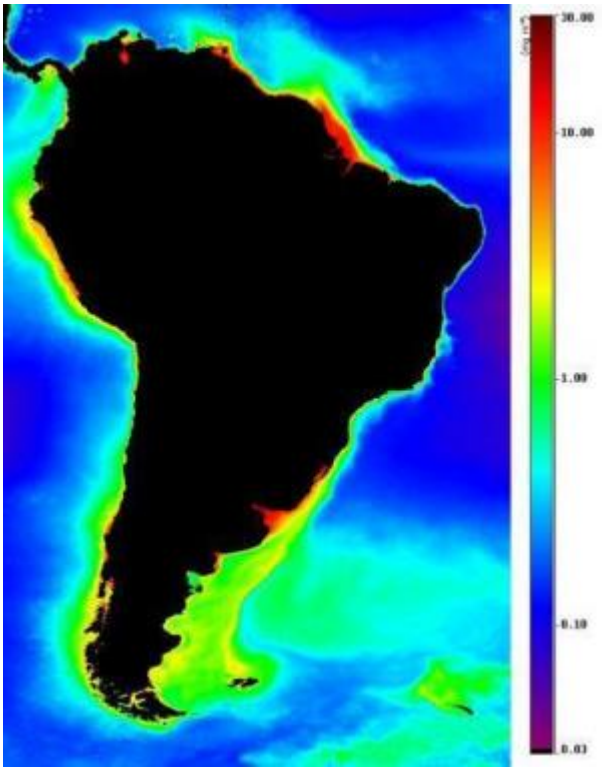
http://www.sciencedaily.com/releases/2010/05/100505102555.htm

Molecular Data and Images from Space Used to Study Imperiled Coastal Dolphins



This satellite image of chlorophyll concentration, obtained from the SeaWiFS satellite, was used by researchers to understand how franciscana dolphin populations are formed by environmental barriers. (Credit: Goddard Space Flight Center, NASA)

ScienceDaily (May 10, 2010) — Using DNA samples and images from Earth-orbiting satellites, conservationists from Columbia University, the Wildlife Conservation Society, the American Museum of Natural History, and Fundación AquaMarina, are gathering new insights about the franciscana -- a poorly known coastal dolphin species of eastern South America -- in an effort to understand populations and conserve them.

The study, one of the first to combine molecular data along with range-wide environmental information for a marine species, is helping researchers to understand how seemingly monotonous marine environments actually contain significant habitat differences that are shaping populations of this threatened species, which averages between 5-6 feet in length and around 80-90 pounds in weight. According to findings published in the most recent edition of *Molecular Ecology*, genetic differences between dolphins from different sites correlate to measurable differences in water temperature, turbidity and chlorophyll levels, a tantalizing indication of how largely hidden oceanographic variables could drive population structure of marine animals.

The authors of the study are: Martin Mendez of Columbia University, the American Museum of Natural History (AMNH), and the Wildlife Conservation Society; Howard Rosenbaum of the Wildlife Conservation Society; Ajit Subramaniam of Lamont Doherty Earth Observatory at Columbia University; Charles Yackulic of Columbia University; and Pablo Bordino of Fundación AquaMarina and the Wildlife Trust Alliance.

"The availability of both genetic and environmental data provided us with a rare opportunity to examine how ecological factors affect population structure in a marine species," said Martin Mendez, the study's lead author. "In this instance, the study subject is possibly the most endangered cetacean in South America, so delineating populations and the factors that create them certainly plays an important role in conservation measures."

As a result of the study, the researchers recommend that the genetically distinct population of franciscanas to the north of Buenos Aires -- probably created in part by oceanographic conditions -- should be protected as part of a larger effort to save the species.

The research team started its investigation on the molecular level, one of the most efficient ways of determining the structure of marine animal populations. Working at the American Museum of Natural History's Sackler Institute for Comparative Genomics, researchers compared 275 genetic samples from dolphins that had been stranded, entangled in fishing gear, or captured and released in six locations along coastal Argentina (the southern portion of the animal's full range). Using genetic markers to statistically

gauge the geneflow between dolphin groups at different sites, the scientists discovered that there are two -- and possibly three -- distinct populations of franciscanas in Argentina's coastal waters.

What really sets the study apart is the use of region-wide satellite data that shows how environmental differences -- temperature, turbidity, and chlorophyll levels -- are probably involved in creating those genetically distinct populations. The oceanographic data was provided by NASA's SeaWiFS and MODIS, two satellites designed to gather information on oceanic conditions.

The combination of genetic and environmental information allowed the scientists to examine the effects of detectable habitat differences on population structure in franciscanas. Specifically, researchers were able to test the role of two biological hypotheses on population formation, one based on the assumption that geneflow between two groups decreases with distance, and one based on decreased geneflow as a result of environmental barriers (the latter of which is easy to detect with terrestrial species separated by mountains, and usually undetectable in marine environments over wide areas).

In comparing both data sets, researchers were surprised to discover that dolphins in closely located sites in the northern portion of the study area were most genetically different; in particular, two closely located groups of dolphins near the mouth of the La Plata Estuary (some 35 kilometers--about 22 miles--apart) were the most genetically dissimilar in the study, a finding that coincided with detectable environmental discontinuities. By contrast, two sites separated by hundreds of kilometers to the south were found to be the most similar.

Other correlations hint at the possible role of behavioral patterns in population structure. An examination of both mitochondrial DNA (inherited through maternal lines) and nuclear DNA seems to reinforce current knowledge of cetacean behavior, with females remaining faithful to their natal location and males ranging more widely (except when oceanographic barriers impede their movement). More research on franciscana behavior could further illuminate the role of behavior in population structure.

"We're only beginning to understand the interactions between environmental factors and population patterns in marine environments," said Dr. Howard Rosenbaum, director of the Wildlife Conservation Society's Ocean Giants Program. "What this study shows is that marine systems are not homogeneous environments, but full of variations that could play important roles in shaping and reinforcing how animal populations use their habitat; these types of information are essential for developing strategies on how best to protect these coastal dolphins and broader marine spatial planning."

The franciscana, or La Plata dolphin, is found along the Atlantic coastal waters of South America, from southern Brazil to Península Valdes in Argentina. Although a member of the river dolphin family, the franciscana -- one of the world's smallest cetaceans -- actually lives in coastal waters and estuaries. The species is listed as "Vulnerable" by the World Conservation Union (IUCN), and is threatened by accidental capture in gill nets and other fishing gear.

Story Source:

Adapted from materials provided by Wildlife Conservation Society, via EurekAlert!, a service of AAAS.

http://www.sciencedaily.com/releases/2010/04/100430131153.htm

How Darwin's Little-Known Work Impacts Current Schizophrenia and Autism Treatment

Peter Snyder, Ph.D., vice president of research for Lifespan, shows Charles Darwin's work involving the recognition of emotional expression may be the first example of a prospective single-blind study in this area, and has direct implications to current work today in the areas of schizophrenia, autism spectrum disorder and other neuropsychiatric conditions. "No one in the past 500 years has done more to shape modern biological science," Snyder says. (Credit: Lifespan)

ScienceDaily (May 10, 2010) — Historical research by Peter J. Snyder, PhD, reveals more of Charles Darwin's thinking when he completed what may be the first example of a prospective "single-blind" study of human perception of emotional expression. Through scrutiny of Darwin's work, including previously unpublished handwritten notes on his experiments, Snyder explains how this early experiment has direct implications to current work today in the areas of schizophrenia, autism spectrum disorders and other neuropsychiatric conditions.

The paper is published in the Volume 19, Issue 2, 2010 of the *Journal of the History of the Neurosciences*.

Charles Darwin is well-known for his pioneering theory of evolution, but far less is known about some of his later work, such as delving into experimental psychology. While researching his book, The Expression of the Emotions in Man and Animals (1872), Darwin corresponded with a French neurologist, G.B.A. Duchenne. Duchenne conducted experiments on human facial expression of emotion by applying electrical stimulation directly to facial muscles. He produced a set of 65 photographic plates to show his belief that there are different muscles in the face that are responsible for every single, discrete emotion.

Darwin studied Duchenne's work closely and doubted this view. He believed there was a smaller set core of emotions commonly expressed cross-culturally. As a result, Darwin designed and conducted a truly novel scientific test of Duchenne's claim in what may be the first ever single-blind study of the recognition of human facial expression of emotion. Snyder, who is vice president of research for Lifespan, began an in-depth study of this experiment and relied on what is believed to be previously unpublished notes recorded by Darwin with the help of his wife, Emma.

Snyder says, "No one in history has done more to shape modern biological science. After finding these handwritten tables in the Cambridge University Library (with the assistance of staff from the Darwin Correspondence Project), I found it to be a phenomenal experience to find something new and remarkable in Darwin's work." Snyder continues, "Darwin is certainly not one of the first who come to mind when we think of human experimental psychology, but here is proof of the tremendous impact he has had upon our current work and thinking." Snyder, who is also professor of neurology at The Warren Alpert Medical School of Brown University, explains that Darwin designed an "experiment" that he conducted at his home, during which he showed a selection of Duchenne's photographic plates to 24 guests. To determine which of the plates to include in his book, Darwin initially chose 11 of the plates and listed them in a data table, which Snyder uncovered in the Cambridge Library. Darwin then showed those images without

identifying titles to his guests and asked them to describe the emotion represented in each photographic image.

Snyder says, "As far as we are aware, the images of these three data tables from Darwin's experiment are being reprinted in this paper for the first time. The markings in the tables tell us that he started to tabulate the results of his 'subjects' to determine the fewest number of the 11 plates that were associated with the most agreement with respect to the identification of the emotion being displayed." Snyder's research sought to determine, specifically, which of the original 65 plates in the larger Duchenne folio he specifically chose as the 11 stimuli in his experiment. "We can only surmise which plates he chose based on his own labels for these images, reflected on the y-axis of the data tables, and by relating this information to specific mention of this experiment in Expression and his actual selection of the woodcut reproductions of the original photographic plates found in the first edition."

Recognition of emotion, and tests for it, serve as a proxy for "social cognition" -- the accurate and rapid recognition of emotion in human faces -- have been shown repeatedly to be compromised in a variety of psychiatric diseases. "This single and very novel psychological experiment is a little-known forerunner for an entire modern field of study with contemporary clinical relevance," says Snyder. Darwin's specific questions regarding the cardinal human emotions remain an actively studied topic today, with the intent of identifying novel biomarkers to promote and assist in the development of new therapies for the treatment of schizophrenia, autism and other neuropsychiatric diseases. Snyder notes, "Just over the past three years, we have designed and validated a facial recognition of emotion test that has been used in multiple drug trials, and is essentially the same paradigm pioneered by Darwin in the late 1860's and early 1870's." As Snyder says, "The core skills or abilities required for successful completion of our tests today differ very little from that small experiment conducted by Darwin at his home in England approximately 140 years ago.

"Charles Darwin provided the evidence and model that forms the cornerstone of modern biology, as well as the framework by which we place advances in genetics and molecular biomedicine into context. Far less known is his unique contribution to experimental psychology and the beginnings of a line of enquiry that is being used today in the discovery of novel therapeutics for the treatment of several devastating human disorders, including autism spectrum and schizophrenia. I, for one, continue to remain in awe of Darwin's contributions," Snyder comments.

Other researchers who worked with Snyder include Rebecca Kaufman of the department of neuroscience at Brown University; John Harrison, PhD, division of neurosciences and mental health at the Imperial College of London, UK, and CogState, Ltd., in Melbourne, Victoria, Australia; and Paul Maruff, PhD, centre for neuroscience, University of Melbourne and CogState, Ltd., Melbourne, Victoria, Australia.

Story Source:

Adapted from materials provided by Lifespan, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Peter J. Snyder; Rebecca Kaufman; John Harrison;Paul Maruff. **Charles Darwin's Emotional Expression 'Experiment' and His Contribution to Modern Neuropharmacology**. *Journal of the History of the Neurosciences*, 2010; DOI: 10.1080/09647040903506679

http://www.sciencedaily.com/releases/2010/05/100504124346.htm

Grapes Reduce Risk Factors for Heart Disease and Diabetes, Animal Study Shows

Could eating grapes slow what's for many Americans a downhill sequence of high blood pressure and insulin resistance leading to heart disease and type 2 diabetes? (Credit: iStockphoto/Bota Horatiu)

ScienceDaily (May 10, 2010) — Could eating grapes slow what's for many Americans a downhill sequence of high blood pressure and insulin resistance leading to heart disease and type 2 diabetes?

Scientists at the University of Michigan Health System are teasing out clues to the effect of grapes in reducing risk factors related to cardiovascular disease and metabolic syndrome. The effect is thought to be due to phytochemicals -- naturally occurring antioxidants -- that grapes contain.

Findings from a new animal study will be presented April 26 at the Experimental Biology convention in Anaheim, Calif., and show encouraging results of a grape-enriched diet preventing risk factors for metabolic syndrome, a condition affecting an estimated 50 million Americans and is often a precursor to type 2 diabetes.

Researchers studied the effect of regular table grapes (a blend of green, red and black grapes) that were mixed into a powdered form and integrated into the diets of laboratory rats as part of a high-fat, American style diet. All of the rats used were from a research breed that is prone to being overweight.

They performed many comparisons between the rats consuming a grape-enriched diet and the control rats receiving no grape powder. Researchers added calories and sugars to the control group to balance the extra calories and sugars gained from getting the grape powder.

After three months, the rats that received the grape-enriched diet had lower blood pressure, better heart function, and reduced indicators of inflammation in the heart and the blood than rats who received no grape powder. Rats also had lower triglycerides and improved glucose tolerance.

The effects were seen even though the grape-fed animals had no change in body weight.

In all, researchers say the study demonstrates that a grape-enriched diet can have broad effects on the development of heart disease and metabolic syndrome and the risk factors that go along with it.

"The possible reasoning behind the lessening of metabolic syndrome is that the phytochemicals were active in protecting the heart cells from the damaging effects of metabolic syndrome. In the rats, inflammation of the heart and heart function was maintained far better," says Steven Bolling, M.D., heart surgeon at the U-M Cardiovascular Center and head of the U-M Cardioprotection Research Laboratory.

The researchers also looked for signs of inflammation, oxidative damage and other molecular indicators of cardiac stress. Again, the rats who consumed the grape powder had lower levels of these markers than rats who did not receive grapes.

There is no well-accepted way to diagnose metabolic syndrome which is really a cluster of characteristics: excess belly fat (for men, a waist measuring 40 inches or more and for women, a waist measuring 35 inches or more); high triglycerides which can lead to plague build-up in the artery walls; high blood pressure; reduced glucose tolerance; and elevated c-reactive protein, a marker for inflammation in the body.

Those with metabolic syndrome are at higher risk for cardiovascular disease and type 2 diabetes.

But the U-M study suggests that it may be possible that grape consumption can change the downhill sequence that leads to heart disease by prolonging the time between when symptoms begin to occur and a time of diagnosis.

"Reducing these risk factors may delay the onset of diabetes or heart disease, or lessen the severity of the diseases," says E. Mitchell Seymour, Ph.D., lead researcher and manager of the U-M Cardioprotection Research Laboratory. "Ultimately it may lessen the health burden of these increasingly common conditions."

Rats were fed the same weight of food each day, with powered grapes making up 3 percent of the diet. Although the current study was supported in part by the California Table Grape Commission, which also supplied the grape powder, the researchers note that the commission played no role in the study's design, conduct, analysis or preparation of the presentation.

Research on grapes and other fruits containing high levels of antioxidant phytochemicals continues to show promise. U-M will further its research this summer when it begins a clinical trial to test the impact of grape product consumption on heart risk factors.

"Although there's not a particular direct correlation between this study and what humans should do, it's very interesting to postulate that a diet higher in phytochemical-rich fruits, such as grapes, may benefit humans," Bolling says.

Bolling says that people who want to lower their blood pressure, reduce their risk of diabetes or help with weakened hearts retain as much pumping power as possible should follow some tried-and-true advice to eat a healthy diet low in saturated fat, trans fat and cholesterol, achieve a desirable weight and increase physical activity.

Story Source:

Adapted from materials provided by University of Michigan Health System, via EurekAlert!, a service of AAAS.

http://www.sciencedaily.com/releases/2010/04/100426081024.htm

Novel Artificial Pancreas Successfully Controls Blood Sugar More Than 24 Hours

Depiction of the bihormonal closed-loop control system used in the clinical trial. The controller responded to venous blood glucose measured every five minutes using an FDA-approved GlucoScout (International Biomedical), and commanded insulin-glucagon control doses. The doses were administered using FDA approved Deltec CoZmo infusion pumps (Smiths Medical). (Credit: Image courtesy of Massachusetts General Hospital)

ScienceDaily (May 10, 2010) — An artificial pancreas system that closely mimics the body's blood sugar control mechanism was able to maintain near-normal glucose levels without causing hypoglycemia in a small group of patients.

The system, combining a blood glucose monitor and insulin pump technology with software that directs administration of insulin and the blood-sugar-raising hormone glucagon, was developed at Boston University (BU). The first clinical trial of the system was conducted at Massachusetts General Hospital (MGH) and confirmed the feasibility of an approach utilizing doses of both hormones. In their report, appearing in *Science Translational Medicine*, the researchers also found unexpectedly large differences in insulin absorption rates between study participants, differences they were able to account for by adjustments to the system.

"This is the first study to test an artificial pancreas using both insulin and glucagon in people with type 1 diabetes. It showed that, by delivering both hormones in response to frequent blood sugar tests, it is possible to control blood sugar levels without hypoglycemia, even after high-carbohydrate meals," says Steven Russell, MD, PhD, of the MGH Diabetes Unit, who co-led the research team with Edward Damiano, PhD, of the BU Department of Biomedical Engineering.

In type 1 diabetes, the insulin-producing beta cells of the pancreas are destroyed by the immune system, requiring insulin treatment to regulate blood sugar levels. Intensive glucose control involving frequent blood sugar testing and insulin administration can delay or prevent long-term complications -- such as retinal damage, kidney failure, or cardiovascular disease -- but is extremely demanding and difficult to maintain. Continuous glucose monitors and insulin pumps can help, but patients remain at risk for hypoglycemia, a potentially life-threatening drop in blood sugar caused by too much insulin.

Because any administration of insulin, even by an artificial pancreas system, has been associated with the risk of hypoglycemia, BU investigators Damiano and lead author Firas El-Khatib, PhD, developed a system that both accounts for the rate of insulin absorption and also incorporates glucagon, a hormone naturally released by the pancreas to raise blood sugar levels. While the alpha cells of the pancreas that produce glucagon are not destroyed in people with type 1 diabetes, the cells no longer release glucagon in response to low blood sugar.

"Large doses of glucagon are used as a rescue drug for people with severely low blood sugar," explains Damiano. "Our system is designed to counteract moderate drops in blood sugar with minute doses of glucagon spread out throughout the day, just as the body does in people without diabetes." In 2007 Damiano's team tested the system in diabetic pigs, which led to FDA approval of the human trial.

The current study enrolled 11 adults with type 1 diabetes and was primarily designed to test the software that controls the system. To get the most accurate glucose levels, the system used a monitor that directly reads blood sugar through a sensor placed into a vein instead of a continuous glucose monitor that takes readings under the skin. Participants' blood sugar was controlled by the system for 27 hours, during which time they ate three standardized, high-carbohydrate meals and slept through the night at the hospital. While the system kept glucose levels close to the target range for six participants, five others experienced hypoglycemia significant enough that they needed a dose of orange juice to raise their blood sugar.

Close analysis of participants' blood-insulin levels revealed a nearly fourfold difference in the rate at which individuals absorbed and cleared the fast-acting insulin used in the study, with some rates of absorption being much slower than anticipated. Since the controlling software determined dosage based on the expected rate of insulin absorption, participants who absorbed at a slower rate received excessive doses, leading to hypoglycemia. A test of participants' response to a single insulin injection verified that some had consistently slow and some consistently fast rates of insulin absorption. Rates of absorption also varied too much from experiment to experiment, even on an individual basis, to allow participant-specific dosage calculations.

After globally adjusting the software parameters to a slower insulin absorption rate, the researchers conducted repeat experiments in the same participants. This time none of the slow-absorption participants experienced hypoglycemia significant enough to require intervention. Blood-sugar levels were only slightly higher in repeat experiments involving participants with fast insulin absorption, showing that the adjusted software parameters were effective for all study participants and may be adequate for everyone with type 1 diabetes. The elimination of episodes of hypoglycemia in repeat experiments involving the same participants affirmed that the initial mismatch between parameter settings and insulin absorption rate had been the cause of the hypoglycemia. All previous reported studies of artificial pancreas systems have included episodes of hypoglycemia, but this is the first study to confirm and address the cause of that hypoglycemia.

Later this spring the researchers will begin a follow-up study with a system using the revised settings and driven by an FDA-approved continuous glucose monitor. Those experiments will last more than 48 hours and include children as well as adults. The investigators also plan to compare the insulin/glucagon system with a version that uses only insulin. "The device we ultimately envision will be wearable and incorporate a glucose sensor inserted under the skin that communicates wirelessly with a pump about the size of a cell phone," says Russell, who is an instructor in Medicine at Harvard Medical School. "The pump would administer insulin and probably glucagon, and would contain a microchip that runs the control software."

Damiano, whose 11-year-old son was diagnosed with type 1 diabetes at the age of 1, adds, "A system like this would replace the need for people to constantly check their blood sugar and to make treatment decisions every few hours. It would need to be maintained but could take over the decision-making process, closely emulating a functioning pancreas. It wouldn't be a cure, but it has the potential to be the ultimate evolution of insulin therapy for type 1 diabetes." Damiano is an associate professor of Biomedical Engineering at Boston University.

The study was supported by grants from the Juvenile Diabetes Research Foundation, the Wallace H. Coulter Foundation, the Charlton Fund for Innovative Research in Diabetes and the National Center for Research Resources. Co-authors of the *Science Translational Medicine* paper are David M. Nathan, MD, director of the MGH Diabetes Center, and Robert Sutherlin, RN, also of the MGH Diabetes Center.

Story Source:

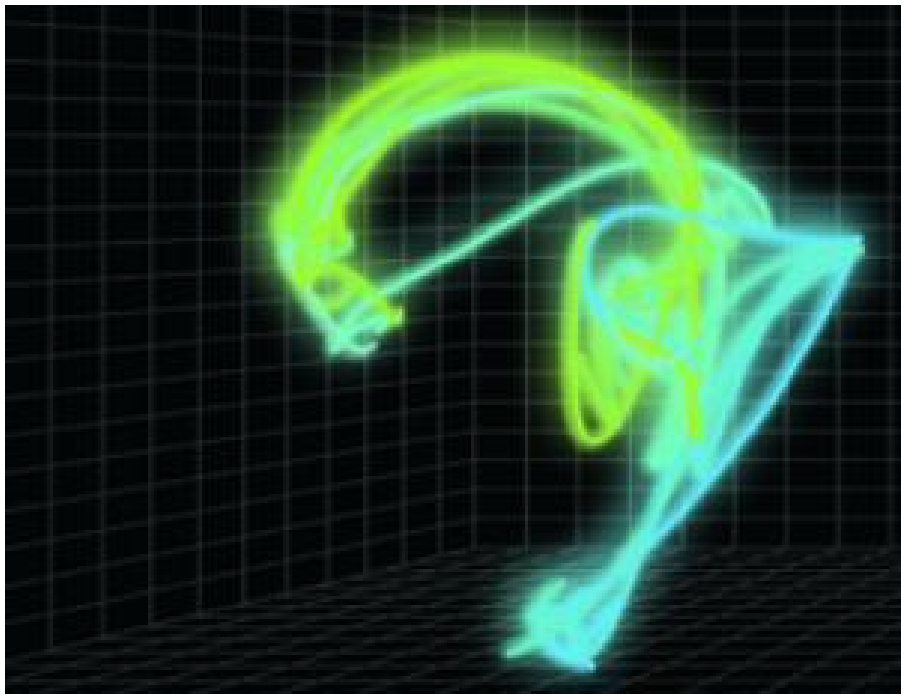
Adapted from materials provided by Massachusetts General Hospital.

Journal Reference:

1. F. H. El-Khatib, S. J. Russell, D. M. Nathan, R. G. Sutherlin, E. R. Damiano. **A Bihormonal Closed-Loop Artificial Pancreas for Type 1 Diabetes**. *Science Translational Medicine*, 2010; 2 (27): 27ra27 DOI: 10.1126/scitranslmed.3000619

http://www.sciencedaily.com/releases/2010/04/100414152127.htm

Odors Classified by Networks of Neurons



Trajectories show the dynamics of neuronal activity patterns evoked by morphing two similar odors (blue to green) in the zebrafish olfactory bulb. (Credit: Image courtesy of Friedrich Miescher Institute for Biomedical Research)

ScienceDaily (May 10, 2010) — Scientists at the Friedrich Miescher Institute for Biomedical Research (FMI, part of the Novartis Research Foundation), are unraveling how odors are processed by the brain. As they report in Nature, odors in the olfactory brain are classified into groups represented by discrete activity states of neuronal circuits. Using advanced optical methods, they discovered that gradual variations in odors result in abrupt transitions between patterns of neuronal activity. These findings provide fundamental insights into the brain's information-processing mechanisms.

A sommelier has no difficulty in discriminating between lime, peach and apricot aromas, hints of cinnamon and cedar, or blackberry and cherry notes in the bouquet of a fine wine. For those with a less discerning nose, such subtle differences are difficult to detect. At the same time, however, the sommelier will not perceive a relatively weak background odor, such as perfume. This is because, from the flood of sensory inputs, the human brain extracts certain information and screens out inessential stimuli so as to produce a well-defined perception.

This was the starting point for the study by a team of FMI researchers led by Rainer Friedrich, published in the latest issue of *Nature*.

Discrete representation of similar odors

Rainer Friedrich's group investigated how the brain responds when an odor is gradually varied. This involved either altering the concentration of a given odor or "morphing" one odor into another similar one. They observed the activity of cells in neuronal circuits of the olfactory bulb, the first center for the processing of olfactory information in the brain.

In zebrafish experiments, the FMI neurobiologists showed that patterns of neuronal activity were largely insensitive to changes in odor concentration. But the situation was quite different when the odor itself was

changed: initially, a change in the molecular identity of an odor had little effect, but at a certain point the activity pattern switched, producing a new odor representation. In this abrupt transition, certain neurons were inactivated while others were activated. The pattern of neuronal activity thus represented the odor in a discrete fashion. The researchers concluded that, in the olfactory bulb, different odors are specifically classified and represented by clearly defined neuronal network activity states. These experimental results support theoretical models which neurobiologists have been seeking to confirm for some time.

Decision making also shaped by discrete perceptual categories

The neurons and circuits of the brain have to perform a tricky balancing act: as well as being able to detect minimal changes in sensory input, they are required to disregard what is not important. We should recognize the lime note in the wine but ignore the perfume worn by the person sitting next to us at the wine-tasting event. Neurobiologists have therefore assumed that sensory inputs within a certain range are classified and processed in the same manner. However, this also means that a minimal change in sensory cell activity can abruptly lead to a different classification if it exceeds the defined range. This has now been demonstrated by Friedrich's group for odor representation. But the same principle may also be operative in other brain processes -- for example, when we make decisions. Here, too, a small item of additional information or one further impression may often be all that is needed for us to change our mind. Rainer Friedrich, Senior Group Leader at the FMI, comments: "We believe that discrete classification of odors by neuronal circuits reflects a fundamental information-processing strategy which is also likely to be relevant for other brain functions."

Story Source:

Adapted from materials provided by Friedrich Miescher Institute for Biomedical Research.

Journal Reference:

1. Jörn Niessing, Rainer W. Friedrich. **Olfactory pattern classification by discrete neuronal network states**. *Nature*, 2010; DOI: 10.1038/nature08961

http://www.sciencedaily.com/releases/2010/04/100426081237.htm

Researchers Quantify Benefits of Minimally Invasive Removal of Hard-to-Reach Tumors

Philip Theodosopoulos, MD. (Credit: Image courtesy of University of Cincinnati Academic Health Center)

ScienceDaily (May 10, 2010) — A minimally invasive endoscopic procedure holds promise for safely removing large brain tumors from an area at the bottom of the skull, near the sinus cavities, clinical researchers at the Brain Tumor Center at the University of Cincinnati Neuroscience Institute (UCNI) at University Hospital have found.

The findings, to be published in the April 2010 issue of the Journal of Neurosurgery and previously published online in October 2009, have important implications for patients with large pituitary tumors (pituitary macroadenomas).

"This is the first time that a quantitative advantage has been shown for the use of endoscopy in cranial surgery," says Philip Theodosopoulos, MD, principal investigator of the study, director of skull base surgery at UC and a neurosurgeon with the Mayfield Clinic.

"This signals the dawn of a new era in minimally invasive cranial surgery. We have moved from the realm of assessing whether it is feasible to studying its clinical effectiveness. In this way, it is slowly starting to change from a novelty to standard treatment, setting the bar for the quality of surgical outcomes higher than ever before."

Although tumors of the pituitary gland, located near the base of the skull, are benign, pituitary macroadenomas can wreak havoc, causing acromegaly (an overproduction of growth hormone), Cushing disease (an overproduction of the hormone cortisol) and hyperthyroidism, as well as visual problems, headaches and dizziness.

When removing pituitary macroadenomas (tumors that are larger than 10 millimeters), surgeons have employed three distinct routes to the tumor:

• Through the skull, in a procedure called a craniotomy. • Through an incision under the upper lip and then through the septum, which must be split apart. • Through the nostrils -- a transnasal approach -- without an incision.

The endoscopic transsphenoidal approach, Theodosopoulos says, follows natural anatomical corridors and causes less disruption of nasal tissues. This approach, as the new study reveals, also holds benefits related to complete tumor removal, which is important for the patient's quality of life.

Removing an entire pituitary macroadenoma can be difficult because the tumor's growth pattern can cause it to extend through the sinus corridor, which is out of the surgeon's view.

Surgeons can ensure that the entire tumor has been removed if their hospital operating room is equipped with a technology known as intraoperative MRI, or ioMRI. The surgery-prolonging technology enables surgeons to take MRI scans while the patient is still under anesthesia and on the operating table. The UC Neuroscience Institute at University Hospital has had ioMRI since 1999, but the expensive technology is not available at most hospitals.

An endoscopic approach, by contrast, allows the surgeon to check for remaining tumor with "intrasellar endoscopy." Using a tiny, sophisticated camera on an angled endoscope, the surgeon can peer around bends and into crevasses to identify any remaining tumor. "The endoscopic approach holds the potential for less invasive treatment for all patients and more complete tumor resections for individuals treated in hospitals without access to intraoperative MRI," Theodosopoulos says.

During the retrospective study at University Hospital, the team analyzed surgical outcomes of 27 consecutive patients between 2005 and 2007 who had undergone endoscopic removal of pituitary macroadenomas. The search for unexpected residual tumor was conducted two ways in all patients: first with the tiny endoscopic camera (intrasellar endoscopy) and then with intraoperative MRI.

Following the initial endoscopic tumor removal, intrasellar endoscopy revealed that 23 of the 27 patients (85 percent) had no unexpected residual tumor. Surgeons were able to safely perform additional surgery on three of the four patients who had unacceptable residual tumor.

Following the endoscopic procedures, all patients were checked with intraoperative MRI, which revealed that tumor removal was successful in 26 patients (96 percent).

The study results show that maximum tumor removal can be successfully achieved with endoscopy and without intraoperative MRI, Theodosopoulos says. He adds, however, that the findings could be strengthened by a larger study.

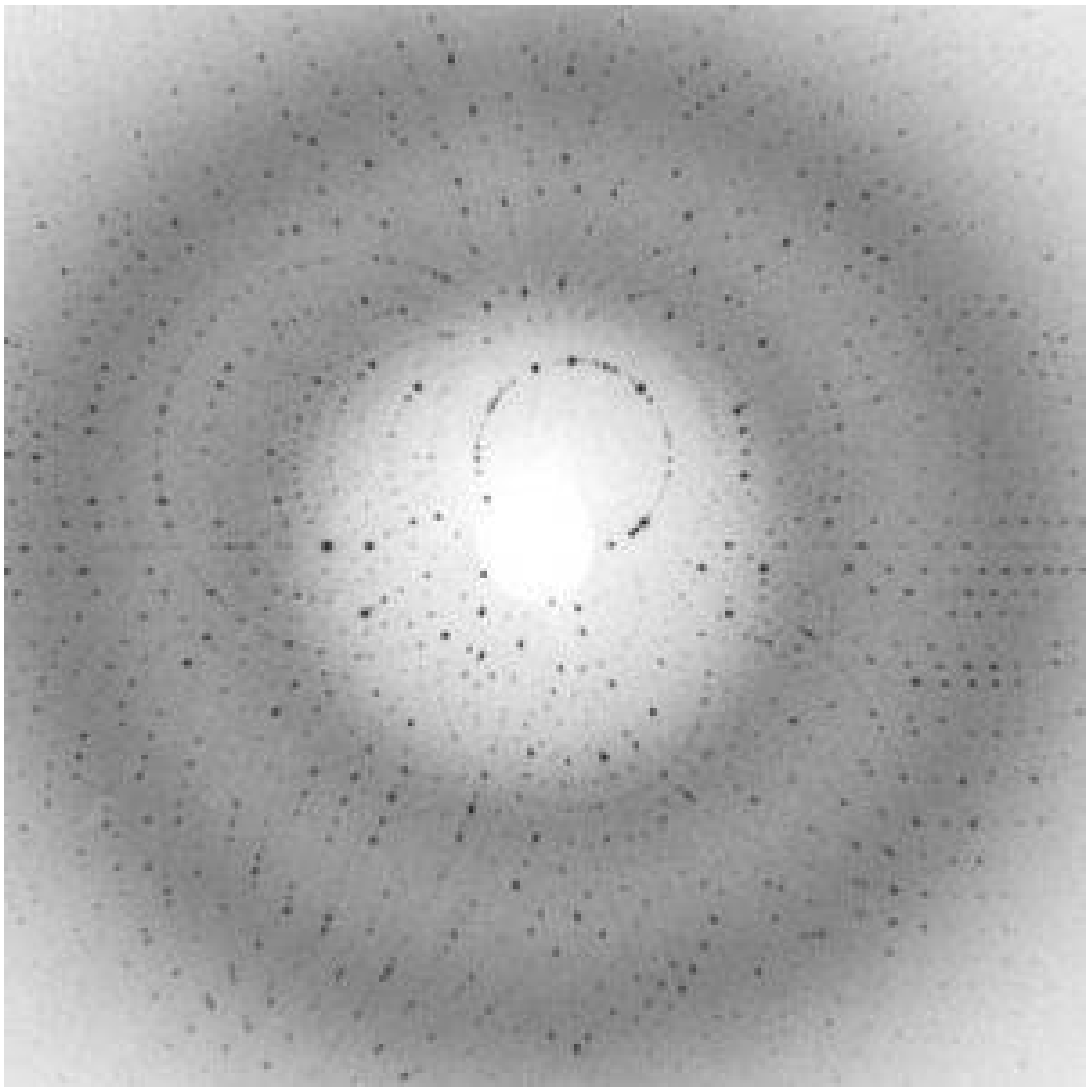
Additional study participants included John Tew, MD (Mayfield Clinic, UC Department of Neurosurgery and UCNI), Lee Zimmer, MD (UC Department of Otolaryngology and UCNI), James Leach, MD (Cincinnati Children's Hospital Medical Center and UCNI), Bharat Guthikonda, MD (UC Department of Neurosurgery) and Amanda Denny, MD (UC Department of Endocrinology). Also participating was Sebastien Froelich, MD (Department of Neurosurgery, University of Strasbourg, France).

Story Source:

Adapted from materials provided by University of Cincinnati Academic Health Center.

http://www.sciencedaily.com/releases/2010/04/100401130236.htm

Atomic Movement During Photosynthesis Photographed With X-Ray Flash



Photograph of the photosynthetic reaction taken with an 80-microsecond X-ray pulse. (Credit: Image courtesy of University of Gothenburg)

ScienceDaily (May 10, 2010) — Researchers at the University of Gothenburg, Sweden, have managed, with the help of an advanced X-ray flash, to photograph the movement of atoms during photosynthesis -- an achievement reported in the journal *Science*.

The European Synchrotron Radiation Facility in Grenoble is home to one of the world's most advanced particle accelerators, whose pulsing X-ray beams are used by researchers to photograph and study life's tiniest components: atoms, molecules and proteins.

Using the special X-ray camera, researchers can depict the position of atoms in a molecule and obtain a three-dimensional image of something that is smaller than a billionth of a metre. Researchers at the Department of Chemistry at the University of Gothenburg and at Chalmers University of Technology have now used this advanced technology to photograph the dynamics of life's most fundamental system: photosynthesis.

The focus of the study was a protein which is central to the conversion of light to chemical energy during photosynthesis, and which process the Gothenburg researchers have been the first to successfully photograph. The X-ray image shows how the protein temporarily stores the light energy immediately before a chemical bond forms -- a movement that takes place on a scale of less than a nanometre.

The photograph is not only a fascinating snapshot of the very core of life, but could also be used in the solar panels of the future, where researchers hope to be able to imitate the sophisticated energy conversion of photosynthesis.

Story Source:

Adapted from materials provided by University of Gothenburg, via AlphaGalileo.

Journal Reference:

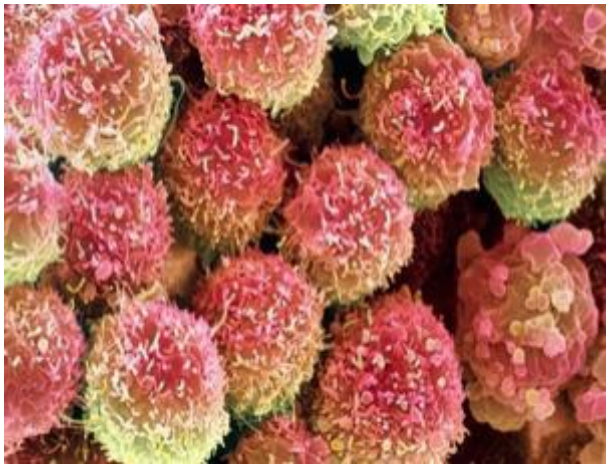
1. A. B. Wohri, G. Katona, L. C. Johansson, E. Fritz, E. Malmerberg, M. Andersson, J. Vincent, M. Eklund, M. Cammarata, M. Wulff, J. Davidsson, G. Groenhof, R. Neutze. **Light-Induced Structural Changes in a Photosynthetic Reaction Center Caught by Laue Diffraction**. *Science*, 2010; 328 (5978): 630 DOI: 10.1126/science.1186159

http://www.sciencedaily.com/releases/2010/05/100509202634.htm

Cancer's sweet tooth becomes a target

- 12 May 2010 by **Andy Coghlan**

Magazine issue 2760.



.Stop cancer cells dividing, and rule (Image: Steve Gschmeissner/SPL)

A DRUG that blocks the way cancer cells generate energy could lead to a new class of cancer treatments.

The first human trial of the drug, published this week, is reported to have extended the lives of four people with an aggressive form of brain cancer.

The result is preliminary, but it suggests that, as an approach, tackling "cancer metabolism" is sound. "We are still a long way from a treatment, but this opens the window on drugs that target cancer metabolism," says Evangelos Michelakis of the University of Alberta in Edmonton, Canada, who led the trial.

Elsewhere, researchers have started experimenting with a host of other molecules that might target cancer metabolism. "It's about identifying which target is best," says Lewis Cantley of Harvard Medical School in Boston, Massachusetts, whose company Agios Pharmaceuticals is screening for such targets.

Most of these efforts stem from an observation dating back to the 1930s - that cancer cells generate energy via glycolysis. This is different to the way cells normally make energy, through aerobic respiration in specialised chambers called mitochondria. Ordinary cells do use glycolysis but only if they are short of oxygen, as it is hugely inefficient, gobbling up large amounts of glucose for very little energy (see diagram).

At the time, it was assumed that the switch to glycolysis was a product of the cell becoming cancerous, rather than the other way around. "It was seen as a follower, not a leader or driver," says Ronald Evans of the Salk Institute in La Jolla, California.

However, in 2008, Cantley showed that glycolysis may actually benefit cancer cells. Though it is inefficient in terms of energy, the process also generates the chemical building blocks for making cells, including amino acids for making proteins, fats for cell membranes and nucleotides to build a genome. As cancer cells replicate very rapidly, the finding suggests that glycolysis might actually help drive cancer.

A year earlier, Michelakis had shown that mitochondria could be "reawakened" in human cancer cells cultured in the lab, and in rats, by a drug called dichloroacetate (DCA). This suggested that mitochondria

are not impaired in cancer, just underactive, and that switching cells back to using them might fight cancer.

The mitochondria are not impaired, just underactive. Reawakening them might fight cancer

Now Michelakis has given DCA to five people with an aggressive form of brain cancer called glioblastoma multiforme. One person died of the cancer, but tumours stopped growing in the other four and, in one case, disappeared completely. All four were still alive 18 months later, three times the average survival time following the standard treatment of radiation therapy plus temozolomide, which the patients also received (*Science Translational Medicine*, DOI: 10.1126/scitranslmed.3000677).

Side effects were minimal, but Michelakis cautions against being overly optimistic and points out that larger trials are now necessary. "Could the patients have done as well without DCA? Unless we have a placebo-controlled trial, we can't tell."

The trial was useful, nevertheless, not least for the fact that biopsies of the patients' tumours helped confirm DCA's mechanism of action. They show that cancer cells produce an enzyme that stops mitochondria from working, and that DCA disables this enzyme.

Once it was blocked, the mitochondria swung into action, opening pores to admit glucose and producing adenosine triphosphate (ATP) - the energy-storing molecule central to aerobic respiration. A series of beneficial changes followed. First, the reactivated mitochondria began spewing hydrogen peroxide, which blocked a substance called hypoxia-inducible factor 1. In cancerous cells, HIF-1 stimulates the growth of blood vessels that feed the tumour and is responsible for inhibiting cells' natural "suicide mechanism", apoptosis.

Blocking HIF-1 did seem to reactivate signals that encourage apoptosis in normal cells once they have reached the end of their lives. "The beauty of restarting the mitochondria is that it hits the command centre of the cancer, and hits multiple other pathways as a result," says Michelakis.

The beauty of restarting the mitochondria is that it hits the command centre of the cancer

DCA isn't the only way to switch on mitochondria in cancerous cells. Drugs which reactivate the cell's "energy sensor", an enzyme called AMP-activated protein kinase (AMPK), also looks promising, Evans says.

In normal cells, AMPK senses energy availability. If it is low, the enzyme promotes aerobic respiration in the mitochondria. Cancerous cells, in contrast, often contain genetic mutations that "blind" AMPK to a lack of energy. So the mitochondria don't get the signal, and glycolysis becomes the main energy producer. One way to fight cancer might therefore be via drugs that reactivate AMPK.

There is already evidence that this works. Diabetes is often treated using a drug called metformin, which ramps up AMPK activity in order to reduce blood sugar levels. While monitoring 850 people with lung cancer, David Small and his colleagues at McGill University in Montreal, Canada, noticed that 79 of them, who happened to have been on metformin for diabetes, had better survival rates. The researchers reported the finding in 2009 at an American Society of Clinical Oncology meeting.

Also, last month, Phillip Dennis of the US National Cancer Institute in Bethesda, Maryland, presented evidence at the American Association for Cancer Research meeting in Washington DC that metformin inhibited lung cancer in mice exposed to a cancer-causing compound.

Blocking mitochondrial function isn't the only event that triggers glycolysis. A protein called Cdh1 is involved too. Salvador Moncada of University College London has coaxed both human brain cancer and normal kidney cells into either overproducing Cdh1 or not making it at all. Cells with no Cdh1 switched

to glycolysis, whether or not they were cancerous, while cells that made too much did not turn glycolytic (*Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.0913668107).

Cdh1 acts as a "guardian" against glycolysis, Moncada says, and boosting its levels might be a way to fight cancer. However, he cautions that Cdh1 has other functions too, so its use might lead to side effects.

Cantley is focusing on yet another glycolysis switch. In 2008, he showed that pyruvate kinase M2, an enzyme that normally operates only in fetuses, seems to help switch on glycolysis in cancers. He and his colleagues have developed RNA molecules that block PKM2 in cultured cells and in animals (*Nature*, DOI: 10.1038/nature06734).

Another option is to neutralise the harmful, "downstream" effects of glycolysis, rather than the process itself. Gregg Semenza of Johns Hopkins University School of Medicine in Baltimore, Maryland, has isolated 23 compounds that block HIF-1 directly. He is screening them for their suitability as cancer drugs.

It's too soon to know which drugs will eventually make it into the clinic, but the hope is that they will be milder than radiation and chemotherapy, which can have nasty side effects.

Metabolic approaches might even be combined with traditional cancer treatments. Stephen Lippard and his colleagues at the Massachusetts Institute of Technology have attached DCA to the testicular and ovarian cancer drug cisplatin, creating mitaplatin (*Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.0912276106). In tests on cultured cancer cells, Lippard found that mitaplatin outperformed or equalled the cell-killing capacity of cisplatin itself, as well as a range of similar anticancer drugs.

DCA is no cure-all, however. Cantley cautions that the wide variation in metabolic pathways in different forms of cancer means it is unlikely that a single treatment will work across the board.

http://www.newscientist.com/article/mg20627603.500-cancers-sweet-tooth-becomes-a-target.html?DCMP=NLC-nletter&nsref=mg20627603.500

Mirror neurons seen behaving normally in autism

- 18:37 12 May 2010 by **Ewen Callaway**

Does that get everyone's brain going? (Image: Colin Gray/Getty)

People with autism seem to have normal "mirror" neurons after all. A popular theory has it that these neurons – brain cells that fire both when you perform an action and when you watch someone else doing the same thing – don't work properly in people with autism. Now it looks as though that isn't so.

The idea was that malfunctioning mirror neurons underlie the difficulties that people with autism have in interpreting the intentions of others. It seemed to be backed up by studies in which the brain activity of normal and autistic people was measured while they watched and performed simple actions, such as hand movements. In many, but not all of these studies, brain areas rich with mirror neurons proved less active in the people with autism.

But Ilan Dinstein, a neuroscientist at the Weizmann Institute in Rehovot, Israel, says other differences besides faulty mirror neurons could explain these results. For instance, if it turns out that people with autism imitate or detect hand movements more slowly than others, brain scans could mistake this delay for dysfunction in mirror neurons, he says.

No mirror dysfunction

So Dinstein and his colleagues at New York University turned to a more sensitive test for mirror neuron activity that he and others discovered recently in healthy people. Like brain cells that respond to sounds and smells, mirror neurons fire a little more weakly in response to repeated activation by an exactly repeated movement.

Dinstein's team asked 13 autistic adults and 10 controls to watch or perform a series of hand signals – thumbs up and miming holding a gun, for instance – while in a functional MRI scanner. In some trials they performed or watched the same hand movement over and over again, while in others they performed or watched successions of different signals.

Brain areas linked to the mirror neuron system – parts of the premotor and the parietal cortices – lit up in both groups, whether they watched or performed a hand-movement. What's more, the mirror neuron activity quieted when both groups observed or performed the same signal over and over, but not when they performed a succession of different movements, suggesting that the system was working normally in people with autism. "That argues against a mirror system dysfunction in autism," says Dinstein.

However, Marco Iacoboni, a neuroscientist at the University of California, Los Angeles, one of the first scientists to suggest that mirror neurons were dysfunctional in autism, says that 13 autistic and 10 normal subjects are too few to draw any conclusion about brain differences between these groups.

Noisy brains

Iacoboni's UCLA colleague Mirella Dapretto adds that even if the findings do hold in larger groups of people, they still don't rule out the idea that mirror neurons could be behaving abnormally in autism. She has previously argued that the more extreme a person's autism symptoms, the more problems they have in their mirror neuron system.

Dinstein stands by his team's conclusions. The number of participants he examined is typical for brain imaging studies, he says, and their autistic participants, though high-functioning, possessed the most extreme form of autism spectrum disorder, not milder forms such as Asperger's syndrome.

He supports a different theory for autism: that it is the product of "noisy brain networks" that don't communicate as predictably as those in normal people. He says his latest study offers support for this, as his team noticed more variability in the brain activity of people with autism, compared with controls.

He plans to probe this theory by searching for noise in other brain areas in people with autism.

Journal reference: *Neuron*, DOI: 10.1016/j.neuron.2010.03.034

http://www.newscientist.com/article/dn18837-mirror-neurons-seen-behaving-normally-in-autism.html

Ultrasound reveals breastfeeding mechanics

- 11:13 12 May 2010 by **Linda Geddes**

Nothing like a dairy (Image: Mike Kemp/Getty)

Sitting next to a breastfeeding mother on a flight to the US last week, I'll admit to feeling slightly queasy. I know that breastfeeding is one of the most natural things in the world and I hope to be able to feed my daughter this way, but I'm afraid the way babies suck on the nipple does put me in mind of a dairymaid milking a cow – and I can't help worrying that it is going to hurt.

However, research presented at the Medela breastfeeding and lactating symposium in Venice, Italy, last weekend suggests that I may have got it all wrong. Although it might look like a baby is chewing on the mother's nipple, ultrasound images show that the infant actually removes milk by creating a vacuum – also known as sucking.

The finding is important, as it could explain why some babies fail to take to the breast. It may also shed new light on why – for a minority of women – breastfeeding really can be a painful experience.

Squeeze or suck?

"There have been two theories about how breast milk is expressed," says Donna Geddes (no relation) of the University of Western Australia in Crawley.

"One is that the baby uses a peristaltic or compression motion to actually push the milk out of the nipple and breast. The other theory is that vacuum is primary in removing the milk."

Until now, most studies examining the mechanics of breastfeeding have focused on bottle-feeding infants, or on old X-rays that were of poor quality.

Instead, Geddes and her colleagues combined ultrasound imaging of infants suckling on the breast with measurements of the strength of the vacuum created by the baby's mouth in 20 infants aged 3 to 24 weeks as they breastfed (see video).

"What we see is that when the tongue is lowered and the vacuum is applied, that's when the milk is coming out of the breast, and that doesn't involve any compression of the nipple," says Geddes. "It's not a milking action at all."

Feeding failures

They also found that infants who struggled to breastfeed generated much weaker vacuums than successful breastfeeders. This may explain why babies with a cleft palate often fail to breastfeed, as do premature babies: preterm infants don't have strong enough mouth muscles to suck hard enough.

The next step is to devise a simple and universal test that could be used to assess babies' ability to suck. This could reassure mothers whose infants are struggling to feed that it's not their fault. "Currently there are no measurements to assure the mother or the clinician that things [in the breast] are working," says Geddes.

For such women, keeping the milk flowing using a breast pump and using this to top up breastfeeding until the baby is strong enough to suck effectively may be a better option than giving up on breastfeeding altogether.

When it's a pain

The team also looked at women who found breastfeeding painful and discovered that their infants had a particularly vigorous action.

"They're strong suckers," says Geddes. Some were also distorting or crushing the nipple. Further study of these infants may aid the development of better nipple shields to reduce pain during breastfeeding.

These finding haven't completely allayed my fears about breastfeeding, but it's nice to feel a little less like a dairy cow in training.

http://www.newscientist.com/article/dn18890-bumpology-ultrasound-reveals-breastfeeding-mechanics.html?full=true&print=true

The deep roots of genetic disorders uncovered

- 11 May 2010 by **Michael Le Page**
- Magazine issue 2759.

LOOKING back at half a billion years of gene evolution could help uncover the genetic basis of many disorders, including Down's syndrome.

As vertebrates evolved, the entire genome was duplicated not once but twice. In theory, excess genes are superfluous and should soon be lost, but in fact many of the duplicated genes survive to this day - around a third of our genes can be traced back to these two ancient events.

So Aoife McLysaght of Trinity College Dublin, Ireland, set out to investigate why so many duplicated genes were retained. One idea concerns how duplication affects the activity of some genes. Take a process that requires balanced amounts of dozens of different proteins. If the amount of each protein produced depends on the number of copies of a gene, or gene "dosage", then duplicating an entire genome will double the amount of each protein, keeping the process balanced. If one of the genes gains or loses a copy, however, it would disrupt the process.

To test this idea, McLysaght and her colleague Takashi Makino set out to identify dosage-sensitive genes in the human genome by searching for genes that haven't gained or lost copies since the ancient duplication events. Because it's common to lose or gain genes - many of us have one or three copies of some genes - dosage-sensitive genes should stand out. Sure enough, they found that 4600 of the 7000 genes left over from the genome duplications appear to be dose-sensitive (*Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.0914697107).

"This is where it gets even more interesting," says McLysaght. The pair also found that chromosome 21 has the fewest dosage-sensitive genes, which makes sense as people can survive with an extra copy of this chromosome, though they will have Down's syndrome. A third copy of any other chromosome is lethal, as a person gets 1.5 times the dose of the genes on it, knocking the chemical balance out of kilter.

Of those genes on chromosome 21 that McLysaght has identified as being dosage-sensitive, many have already been linked to Down's syndrome. But the team identified other dosage-sensitive genes, which could also contribute to the disorder. While Down's syndrome cannot be reversed, identifying the genes involved could help treat the health problems associated with it.

Identifying the genes involved in Down's syndrome could help treat related health problems

The findings are not just relevant to Down's syndrome. Dosage-sensitive genes are more likely than other genes to be involved in human disease, because it only takes a small change in their activity to cause problems.

It's an interesting and thought-provoking study, says James Lupski of Baylor College of Medicine in Houston, Texas, who studies the effect of variations in the number of gene copies. Disorders like schizophrenia and autism have recently been linked to huge chunks of missing DNA, Lupski says, and this approach might help pin down the precise genes involved.

http://www.newscientist.com/article/mg20627593.800-the-deep-roots-of-genetic-disorders-uncovered.html

Neanderthals not the only apes humans bred with

- 12 May 2010 by **Ewen Callaway**

Magazine issue 2760.

Meet the ancestor (Image: Kenneth Garrett)

A LONG-awaited rough draft of the Neanderthal genome has revealed that our own DNA contains clear evidence that early humans interbred with Neanderthals.

Such interminglings have been suspected in the past, but there's more: Neanderthals were probably not the only other *Homo* species early *Homo sapiens* mixed with.

These findings call into question the familiar story that modern humans left Africa around 100,000 years ago and swept aside all other *Homo* species as they made their way around the globe. "It was a very simple story," says João Zilhão at the University of Bristol, UK. "Its simplicity suggested it would not be true." A more likely scenario is that as *H. sapiens* migrated, they met and interbred with other *Homo* species that have all since died out.

The first definitive evidence of interbreeding comes from Svante Pääbo's team at the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany. They reported last week that the genome of humans today is roughly 1 to 4 per cent Neanderthal (*Science*, vol 328, p 710). This holds true for all non-Africans, suggesting that *H. sapiens* and Neanderthals interbred sometime between 100,000 and 45,000 years ago, after the first humans left Africa but before they split into regional populations.

Another genetic study confirms this. Jeffrey Long at the University of New Mexico in Albuquerque presented results from nearly 100 modern human populations at a meeting of the American Association for Physical Anthropologists in April. His team found evidence that Eurasians acquired genetic diversity from breeding with other *Homo* species after they left Africa.

Eurasians acquired genetic diversity from breeding with other *Homo* species after they left Africa

They also noticed a spike in genetic diversity in Indo-Pacific peoples, dating to around 40,000 years ago. This time, it's unlikely the diversity came from *H. sapiens* getting it on with Neanderthals, who never travelled that far south. That leaves a number of candidates, including *Homo erectus* and species related to *Homo floresiensis*, a small species which lived on an Indonesian island until about 13,000 years ago.

Neither Pääbo nor Long were able to show that when humans arrived in Europe they mixed with resident Neanderthals, but archaeological finds tell a different story, says Zilhão. In Portugal, his team discovered the 25,000-year-old bones of a child they are convinced is a human-Neanderthal hybrid. Zilhão says fossils from Romania and the Czech Republic also bear Neanderthal features, though others dispute this.

Moreover, decorative artefacts characteristic of humans have cropped up at Neanderthal sites, dated to around the time of contact with humans in Africa and the Middle East. Further east, 40,000-year-old human bones from a cave near Beijing, China, have features that recall other *Homo* species, says Erik Trinkaus of Washington University in St Louis, Missouri.

In March, Pääbo's team reported the discovery of DNA from a hominin that is probably neither human nor Neanderthal that lived 50,000 to 30,000 years ago in a cave in southern Siberia. They dubbed the creature X-woman, and sequencing machines are already decoding its genome, says Pääbo's colleague Ed Green of the University of California, Santa Cruz. Could X-woman or its kind have bred with humans, too? "Stay tuned," Green says.

http://www.newscientist.com/article/mg20627603.600-neanderthals-not-the-only-apes-humans-bred-with.html?full=true&print=true

Witness brain scan won't reveal whether the face fits

- 18:25 11 May 2010 by **Wendy Zukerman**
- Magazine issue 2760.

Having trouble picking out the guilty party? A brain scan won't help.

Jesse Rissman and his team at Stanford University in California have found that monitoring brain activity of witnesses reveals no more than what they say they remember.

The study comes amid controversy over whether to admit functional MRI scans as evidence in US courts.

Last week, an attorney in New York City attempted to use a brain scan to demonstrate the truthfulness of a witness in an employment case, but failed on a separate legal technicality. And this week, a judge in a federal case in Tennessee was due to decide whether to admit fMRI evidence in a fraud case; if successful, this would be the first time a court anywhere in the world accepted this type of scan.

The Stanford team asked 16 volunteers to view 200 mugshots.

An hour later, they were again shown pictures of faces, some of which they had seen before and others that were new. The researchers recorded fMRI scans of the volunteers' brains as they reported which faces they recognised.

While the brain scans matched the volunteers' decisions on whether the faces were familiar, they could not predict if the recollection was accurate. The team also don't know how easily a witness could cheat the system: remembering a recent event or fabricating a lie may look the same to the scanner.

Journal reference: *Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.1001028107

http://www.newscientist.com/article/dn18888-witness-brain-scan-wont-reveal-whether-the-face-fits.html

The secret of perfect pool

- 11 May 2010 by **Stephen Ornes**
- Magazine issue 2759.

Solve that one (Image: Charles Thatcher/Getty)

FUD's bar and grill in Shreveport, Louisiana, doesn't look like the kind of place where mathematical proofs are born. The jukebox is good, the beer is cheap and a smoky haze lingers over the pool tables where mathematicians from nearby Louisiana State University unwind after a hard day at the blackboard.

Rick Mabry recalls shooting pool with colleagues one midweek afternoon in the early 1990s when inspiration struck. So he did what any mathematician would do. He reached for a napkin and jotted down his thoughts. As he left that afternoon, Mabry tacked his napkin to the wall of the bar. It didn't linger there long - one can easily imagine one of Fud's patrons, haunted by school algebra, ripping it down.

No matter. His inspiration eventually led to a proof on the difficulty of certain shots in pool, published in this year's January issue of *The College Mathematics Journal* (p 49). Mabry admits that his results will come as no surprise to professional pool players. However, they might just give you the edge when you next hit the green felt, or want to hustle your friends with a spectacular-but-simple trick shot.

Hustle your friends with a spectacular trick shot: a combination shot with 39 balls is unmissable

Mabry was fascinated by what happens after your opponent accidentally sinks the white cue ball in 8-ball pool. The rules vary from country to country, but in most American bars, at least, you then get to set the cue ball anywhere behind the "head string". This is a line, often unmarked, that runs across the width of the table one-quarter of the way down its length.

Sharp shooter

Typical players tend to place the cue ball so that it makes a direct line with an object ball and a pocket. The appeal of this "straight-in" shot is clear: hit the cue ball dead-on and it hits the object ball dead-on, which drops in the pocket. A no-brainer of a shot.

Mabry noticed that for your average player, the shot seems easiest in one of two situations, when the cue ball and object ball are close together. Or when the object ball is close to the pocket and therefore far from the cue ball (see diagram). Somewhere between those extremes, he reasoned, must be the hardest possible set-up for the straight-in shot. The question is: where?

First Mabry had to define "difficulty" in mathematical terms. The easiest shots are the most forgiving; ones where a player can still sink the ball despite making a large "shooter error" with the cue. In difficult shots, even the smallest errant twitch sends the ball careening off course.

Using trigonometry, Mabry devised a formula to describe the object ball's deviation from its intended destination (the pocket) as a function of shooter error and the distance between the cue ball and object ball (see diagram). In that equation, the shooter error is represented as the angle between two lines: the direction the cue ball was supposed to travel in, and where it actually went. Small angles indicate accurate shooters, whereas large ones mean the shooter needs more practice, or fewer beers.

With this definition of difficulty in hand, Mabry could return to his original question: where is the hardest straight-in shot? He first considered the simplest case of a player who is so precise that Mabry could effectively ignore shooter error. Now the difficulty of the shot boils down to the distance between the cue ball and the object ball.

To find the answer, all Mabry needed to do was plot the difficulty function against distance. With shooter error out of the picture, the function is a quadratic equation, mathematical-speak for saying its graph is rainbow-shaped. Rather than pots of gold, the two ends represent the easiest scenarios, where the object ball is either adjacent to the cue ball or teetering over the pocket. And the graph's highest point reveals the hardest shot. It showed that the hardest shot was where the object ball sat in the middle between the cue ball and the pocket. It also showed that the easiest shot of all is when the cue ball and the object ball are closest together - touching and perfectly aligned with the pocket.

To seasoned players, these findings are common sense. To Mabry, they were reassuring. "I wanted everything to come out kind of the way I thought it should," he says. But that satisfaction was tinged with regret. He had been secretly hoping for a more exotic result.

Determined to find something interesting, Mabry plugged his equations into a computer program to model a range of scenarios.

His efforts paid off with a succession of cocktail-party-worthy factoids. He extended his original problem to a straight-in "combination shot", or combo, where the aim is to shoot the cue ball into an object ball, which then strikes a second ball, which in turns drops into the pocket.

Mabry found that the difficulty of the combo shot depends on the separation of the object balls. Large distances amplify the shooter's original error and make combo shots more difficult that single ball shots.

His calculations show that the hardest 2-ball combo is five times as hard as the hardest single-ball shot of the same length. And when Mabry added more balls into the mix, he found the hardest-possible straight-in combos involve 7 and 8 balls, all lined up and evenly spaced between the cue ball and the pocket.

More surprising, Mabry found that combos become easier with 9 balls, and more, because the separation is smaller. So much so, that a shot with 15 balls is even easier than a 1-ball shot, provided you can hit the cue ball hard enough (see diagram). And Mabry predicts that a combo with 39 balls is unmissable because the balls are touching and have no room to deviate.

After wandering through these other scenarios, Mabry tackled one final question: what is the hardest shot for a lousy player? Earlier he had assumed that his players were pretty accurate, but he wanted to know what would happen if he let his angle of error get larger - though not large enough to miss the object ball altogether.

As the angle of error grew, that "rainbow of difficulty" began to change shape and the maximum shifted its position. In fact, when he crunched the numbers, Mabry turned up an eerily familiar figure: 1.6180339887... To those in the know, and indeed to those who aren't, this number represents the "golden

ratio", the irrational number (1+√5)/2. 1:1.618 is celebrated by artists for its pleasing aesthetics and it frequently shows up in nature - from the spiral of a conch shell to the number of petals on a flower. You can even find it in your pocket, in the proportions of your bank cards.

Mabry found the same mysterious, underlying number on a pool table. The hardest possible shot for a lousy player occurs when the distance between the cue ball and the object ball is precisely 1.618 times longer than between the object ball and the pocket. Why this should be the case isn't clear - Mabry chalks it up to one of those things.

David Alciatore, a mechanical engineer at Colorado State University in Fort Collins and author of *The Illustrated Principles of Pool and Billiards*, gives Mabry's equations a thumbs-up for efficiency and elegance. "It's a case where the simple geometry led to a pretty interesting result," he says.

As for Mabry, he has moved onto other problems and no longer visits Fud's. "I don't shoot pool anymore," he confesses. Back in the day, he recalls, "I was a pretty decent player after a beer. But not after two."

Stephen Ornes is a writer based in Nashville, Tennessee. His website is stephenornes.com

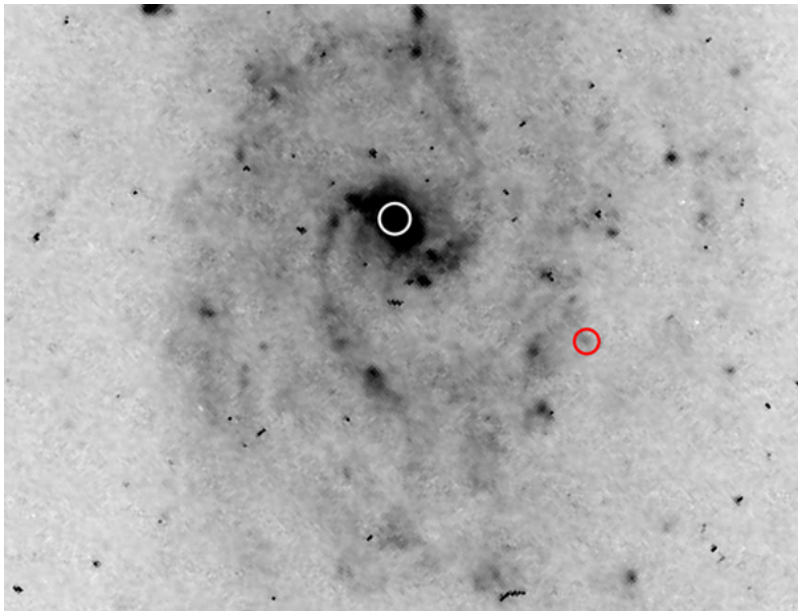
http://www.newscientist.com/article/mg20627591.400-trig-shots-the-secret-of-perfect-pool.html

Massive black hole thrown from galaxy

17:42 12 May 2010
Space

David Shiga, reporter

A massive black hole appears to be careening from its host galaxy, probably as a result of a violent merger with another black hole.



Most galaxies like the Milky Way host a giant black hole weighing millions or billions of suns. As a result of galactic mergers, some galaxies boast more than one of these supermassive black holes.

Occasionally, the black hole pairs merge. Gravitational waves produced in the merger can kick the larger, merged object at high speed from its galaxy.

In recent years, astronomers have identified several objects that may be black holes fleeing their host galaxies.

Marianne Heida of the University of Utrecht and colleagues have now found another candidate, which appears as a bright source of X-rays. Unlike most supermassive black holes, the source (red circle in image) is far from the centre of its galaxy (white circle), suggesting it is being thrown outwards at high speed. But the team has not yet ruled out other possible sources for the X-rays, such as a supernova triggered by the collapse of a massive star.

Ejected black holes provide indirect evidence for the gravitational waves needed to kick them out of their galaxies. Future observatories like the Laser Interferometer Space Antenna (LISA) may be able to directly detect gravitational waves from black hole mergers.

(Image: STScI/NASA)

http://www.newscientist.com/blogs/shortsharpscience/2010/05/massive-black-hole-thrown-from.html

Jupiter loses a stripe

- 21:49 11 May 2010 by **David Shiga**

A dark band in Jupiter's southern hemisphere is not visible in this 8 May snapshot, but it can be seen in earlier images (Image: Anthony Wesley)

Jupiter has lost one of its prominent stripes, leaving its southern half looking unusually blank. Scientists are not sure what triggered the disappearance of the band.

Jupiter's appearance is usually dominated by two dark bands in its atmosphere – one in the northern hemisphere and one in the southern hemisphere.

But recent images taken by amateur astronomers show that the southern band – called the south equatorial belt – has disappeared.

The band was present at the end of 2009, right before Jupiter moved too close to the sun in the sky to be observed from Earth. When the planet emerged from the sun's glare again in early April, its south equatorial belt was nowhere to be seen.

No cover

This is not the first time the south equatorial belt has disappeared. It was absent in 1973 when NASA's Pioneer 10 spacecraft took the first closeup images of the planet and also temporarily vanished in the early 1990s.

The bands may normally appear dark simply because pale, high-altitude clouds prevalent in other regions of the planet are missing there, revealing darker clouds below, says Glenn Orton of the Jet Propulsion Laboratory in Pasadena, California. "You're looking into different layers of the cloud structures of the planet," he told *New Scientist*.

According to this theory, the south equatorial belt disappears when whitish clouds form on top of it, blocking our view of the darker clouds. But it is not clear what causes these whitish clouds to form in the south equatorial belt at some times and not others, Orton says.

The disappearance of the belt comes at a time of widespread – but mysterious – change on Jupiter, which has seen changes to the colour of other bands and spots in its atmosphere. "There has been a lot going on," Orton says.

http://www.newscientist.com/article/dn18889-jupiter-loses-a-stripe.html

Plenty of wave energy to be harvested close to shore

- 11 May 2010 by **Colin Barras**

Magazine issue 2759.

Closer to home (Image: Pelamis Wave Power)

SINCE the oil crisis of the 1970s kick-started interest in wave power, it has become received wisdom that only offshore waves are worth tapping into. As a result, the varied designs competing to rule the waves have been banished to distant, deep waters where conditions are rougher and engineering costs highest.

Now a reassessment suggests that waves closer to shore are not such puny prospects after all, raising the hope that harvesting energy from waves will become easier and more economical than previously imagined.

Statisticians took to the seas in the 1970s. They used data from weather ships and buoys and calculated that the waves passing a 1-metre-wide slice of water at a 50-metre-deep "offshore" location carry an average power of 40 kilowatts, double the power density of waves in 10-metre-deep waters nearer the shore.

Ever since, the wave-power industry has focused its attention 2 to 10 kilometres offshore in the belief that the greater energy yield would offset the higher price of maintenance and of relaying the power back to land.

Now Matthew Folley at Queen's University Belfast, UK, says wave power can be brought closer to home. He calculated how much energy could realistically be extracted from waves using contemporary computer models of the world's oceans. He found that nearshore waves 0.5 to 2 kilometres from the coast carry 80 to 90 per cent of the usable energy of waves further out. Folley reckons offshore waves carry exploitable power at a density of about 18.5 kilowatts per metre-slice, compared with about 16.5 kW for nearshore ones.

Nearshore waves carry 80 to 90 per cent of the usable energy found in offshore ones

The standard figures overestimated the utility of offshore waves for two reasons, he says. They allowed severe storms to push up the average power figures, although wave-power devices generate little power in such storms because they would often have to switch into a self-preservation mode.

They also assumed that offshore waves have a prevailing direction, just as nearshore waves tend to move towards the coast. It is now understood that the latter is due to the shallowing sea floor refracting waves, says Folley - an effect not at work offshore. Instead, offshore waves come from all directions, meaning that some harvesters in an offshore wave farm would be blocked by others. Nearshore farms could be strung out in lines to avoid that.

The figures are convincing, says Ian Bryden at the University of Edinburgh, UK. "But many developers are now committed to deeper water and are unlikely to change their approach, given their investment," he says.

Few designs can simply be towed closer to shore, Folley notes, because offshore waves are best exploited by bobbing up and down, while nearshore ones have most energy in their back-and-forth movements. Some types of energy harvester are ready for shallow waters right now, he says, such as the Oyster, developed by Edinburgh-based Aquamarine Power, and the WaveRoller from Finnish firm AW-Energy.

http://www.newscientist.com/article/mg20627595.700-plenty-of-wave-energy-to-be-harvested-close-to-shore.html?full=true&print=true

Bertrand Piccard: Flying around the world on sunlight

- 12 May 2010 by **Clint Witchalls**

Magazine issue 2759.

Perpetually aloft (Image: Solar Impulse)

How did it feel to see Solar Impulse's maiden flight last month go so well?

It was a relief, and confirmation that our team has done really well in the last seven years. This is a completely new type of aeroplane. There has never before been a plane that is so big and at the same time so light. All the behaviour is different, all the construction is different.

How does Solar Impulse work?

It needs a very big wingspan with high aerodynamic efficiency in order to maintain a slow speed, which in turn cuts energy consumption. The aeroplane has a wingspan of 64 metres, comparable to that of an Airbus 340, but it weighs only 1600 kilograms, about as much as a car. This combination allows us to fly with the average energy consumption of a small motorcycle. Solar planes have existed in the past but they could only fly during the day: what they demonstrated was the limits of solar power, whereas we want to demonstrate the potential. We have 400 kilograms of lithium batteries to give us energy to fly at night.

You are planning a night flight later this year. What will that show?

The goal of the project is to show that we can stay in the air almost perpetually without fuel. The aeroplane will take off on solar power, climbing to an altitude of 27,000 feet. During the climb, the batteries will be charged and the engines will run simultaneously on solar power. This will allow the plane to fly through the night. At the next sunrise, the sun will take over for the next day. We can do as many cycles like this as we like, without using a drop of fuel.

In 2012 you are hoping to fly a larger version of the plane across the Atlantic. How long will that take?

It will probably take about four to five days. By 2013 we'd like to fly around the world.

How will you prepare yourself for the flight?

You need to be physically fit. You also need to be able to relax your body without sleeping. I use self-hypnosis techniques while my co-pilot, André Borschberg, uses yoga techniques.

Will solar-powered planes ever be anything more than a novelty?

There are two answers to this. The first is that Solar Impulse is a symbol and a demonstration of what is achievable today with renewable energy and energy-saving technology. The other part is that we don't know exactly what will happen with aviation in the future. When the Wright brothers flew 200 metres in 1903, no one could have imagined that 66 years later we would land on the moon.

Aviation will have to evolve and find new technologies to reduce fuel consumption. Fuel prices are going to increase, and in 20 years no passenger is going to be able to afford the cost of an airline ticket on planes like today's. So aeroplanes will need to decrease their weight and their fuel consumption, and they will probably need alternative fuels. We have to show where research needs to be done and how we can improve fuel efficiency.

Profile

Bertrand Piccard is a Swiss adventurer who in 1999 made the first ever non-stop round-the-world balloon flight. He is president of the Solar Impulse project

http://www.newscientist.com/article/mg20627595.900-bertrand-piccard-flying-around-the-world-on-sunlight.html

Maiden voyage for first true space sail

- 12 May 2010 by **Rachel Courtland**
- Magazine issue 2760. **Subscribe and save**
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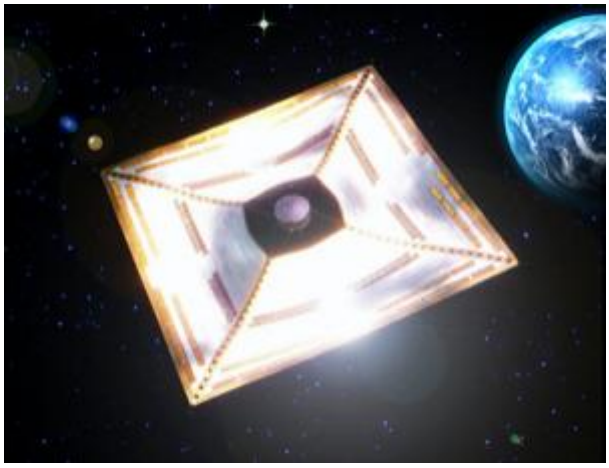


Sailing on a sunbeam (Image: Japan Aerospace Exploration Agency (JAXA))

ICARUS'S wings melted when he flew too close to the sun. Here's hoping a similar fate doesn't befall his namesake, the solar sail due to be unfurled by Japan's aerospace exploration agency (JAXA) next week. If all goes to plan, it will be the first spacecraft fully propelled by sunlight.

Solar sails like IKAROS, short for Interplanetary Kite-craft Accelerated by Radiation Of the Sun, aim to move forward by harnessing the momentum of photons colliding with it. The idea may be decades old, but solar sails have remained largely untested. Several sails have been unfurled in space to test deployment, and spacecraft like NASA's Mercury probe, Messenger, have used the pressure of sunlight to alter trajectories. But no spacecraft has used a sail as its primary means of propulsion.

Made of polyimide resin, IKAROS's sail measures 20 metres from corner to corner, but is just 0.0075 millimetres thick. To survive the launch and the trip into space, the gossamer sail will be folded accordion-style, then wrapped around the centre of the spacecraft.

To unfurl its sail, IKAROS will spin some 25 times per minute. The spacecraft's rotation will be used to extend four "arms" of folded material, and the rest of the sail will follow (see diagram). On 18 May, an H-IIA rocket will carry IKAROS into space along with its main payload, Japan's new Venus orbiter (see "Venus orbiter to fly close to super-rotating wind").By piggybacking on the Venus launch, IKAROS will be able to get out of Earth orbit, where testing should be relatively simple. Solar sails that are tested in Earth's orbit must adjust their orientation with the sun regularly to build energy, says Bruce Betts of The Planetary Society in Pasadena, California, which hopes to launch its own sail, LightSail-1, into orbit as early as next year, paving the way for an eventual interplanetary mission. "They're doing it the way we would like to do it," Betts says. "Interplanetary space is what solar sails are really designed for."

IKAROS's trip will probably last six months at the longest, says JAXA's Junichiro Kawaguchi. But it could pave the way for more missions. The spacecraft will carry thin-film solar cells on its sail to show that it can also generate power. If all goes well, the demonstration could lead to a "hybrid", sun-driven mission to Jupiter.

http://www.newscientist.com/article/mg20627603.800-maiden-voyage-for-first-true-space-sail.html

Why We Sigh (It's a Human Reset Button)

Taking the occasional deep breath keeps the respiratory system nimble, research shows.

By Larry O'Hanlon | Mon May 10, 2010 08:48 AM ET

Scientists studying breathing patterns think they have found the reason we sigh: To reset breathing patterns that are getting out of whack and keep our respiratory system flexible.

The study entailed rigging up eight men and 34 women with sensor-equipped shirts that record their breathing, heart rates and blood carbon dioxide levels over 20 minutes of quiet sitting.

What the researchers at the University of Leuven in Belgium were looking for were specific changes over one-minute periods encompassing sighs that could confirm or contradict the "re-setter hypothesis" for the function of sighing. And they think they found it.

"Our results show that the respiratory dynamics are different before and after a sigh," writes Elke Vlemincx and her co-authors in the latest issue of the journal *Biological Psychology.* "We hypothesize that a sigh acts as a general re-setter of the respiratory system."

The re-setter hypothesis is based on the idea that breathing is an inherently dynamic and rather chaotic system, with all sorts of internal and external factors changing how much oxygen we need and keeping our lungs healthy and ready for action.

This sort of system requires a balance of meaningful signals and random noise to operate correctly.

Occasional noise in a physiological system -- like the respiratory system -- is essential because it enables the body to learn how to respond flexibly to the unexpected, Vlemincx said.

"A sigh can be considered a noise factor because it has a respiratory volume out of range," said Vlemincx.

In this experiment, a sigh was defined as at least two times as large as the mean breath volume.

"A breath is defined by a specific volume (depth), the amount of air we breathe in and out, and a specific timing, the time it takes to breathe in and out," Vlemincx told Discovery News. "Both these characteristics vary: from one moment to the next we breathe slower, faster, shallower, deeper." Vlemincx explained that when breathing is in one state for too long, the lungs deteriorate. They become more stiff and less efficient in gas exchange.

So in times of stress, when breathing is less variable, a sigh can reset the respiratory system and loosen the lung's air sacs, or alveoli, which may be accompanied by a sensation of relief, Vlemincx said.

Knowing this, it would seem logical then to add some sighs to the breathing regimes of people on mechanical, ventilators. As it turns out, it has been tried.

"If you put in a few sigh breaths, people feel better," said Frank Wilhelm a clinical psychologist at the Universität Basel in Switzerland.

Wilhelm has studied the role of breathing in psychological disorders extensively.

On the other hand, too much sighing can add too much noise to the system and can also throw the system out of whack. This appears to be what happens to people experiencing panic attacks, said Wilhelm.

"Panic victims don't recover from sighing," said Wilhelm.

In fact, people experiencing panic attacks have been long observed to involve a great deal of sighing, and show all the symptoms of hyperventilation: dizziness, numbness in the extremities, etc., he said.

For that reason a training program involving biofeedback was developed to help panic disorder victims get control of their sighing. It works, said Wilhelm, and further confirms the re-setter hypothesis for sighs.

"It's like a miracle cure, when you think about it," said Wilhelm.

http://news.discovery.com/human/why-we-sigh-breathing.html

When Grading Papers, Red Ink May Mean Lower Scores

New research suggests the use of red ink by teachers to correct students' work may result in harsher evaluations.

By Tom Jacobs

The use of red ink by teachers to correct students' work may result in harsher evaluations, according to new research. (Matthew C. Wright / flickr.com)

Remember those gut-wrenching high-school moments when a teacher handed you back a test or assignment, having corrected your mistakes and rendered a harsh verdict in bold red ink? It may be small consolation now, but newly published research suggests your grades may have been higher if that ink had been blue.

A study in the *European Journal of Social Psychology* suggests the use of red pens may make teachers more likely to spot errors on tests and to be more critical when grading essays. "Despite teachers' efforts to free themselves from extraneous influences while grading," write California State University Northridge psychologist Abraham Rutchick, Tufts University psychologist Michael Slepian and Bennett Ferris of Phillips Exeter Academy, "the very act of picking up a red pen can bias their evaluations."

The paper describes three experiments testing the proposition that red pens trigger teachers' brains to focus on failure. The researchers note that red pens "have long been associated with errors," adding that many previous studies have found physical objects in one's immediate environment can influence behavior. (An earlier Rutchick study found voters whose polling places are in churches are more likely to support candidates and causes supported by the religious right.)

In one of the experiments, 103 volunteers read a two-paragraph excerpt from an essay. They were told it was written by a student who was learning English and instructed to mark any errors in punctuation, spelling, grammar or word choice.

Half used a red pen for the assignment, while the others used a blue pen. Those using red ink spotted significantly more errors than those using blue ink.

In another experiment, 129 students were instructed to evaluate a one-page essay ostensibly written by an eighth-grade student. The paper contained no grammatical or spelling errors, but the language was at a somewhat rudimentary level. Participants were instructed to point out words or phrases that could be improved and then grade the essay on a scale of 0 to 100.

Once again, half used a red pen and half used a blue one. Those marking the paper in red ink gave the essay lower grades than their counterparts using blue ink.

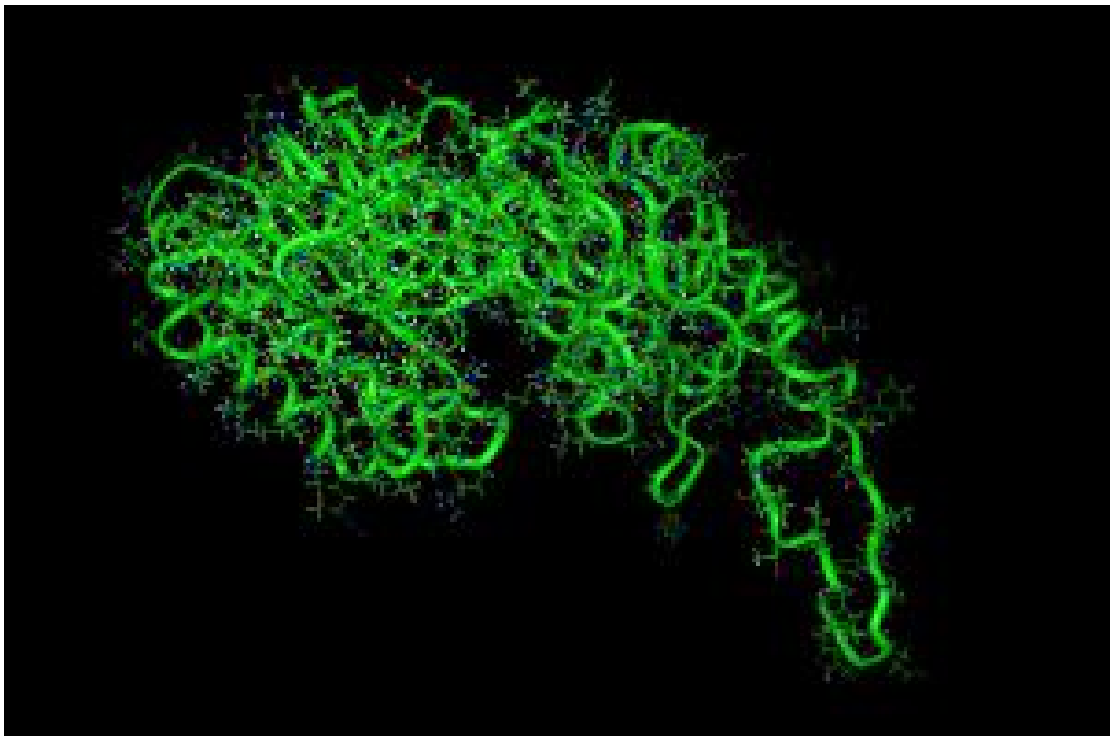
Rutchick and his colleagues argue this demonstrates "using red pens increases the cognitive accessibility of failure-relevant concepts." However, they concede that other factors could be at work. Being associated with aggression, the color red could conceivably increase graders' testosterone level, making them more assertive and critical.

They also note that the test participants were not trained teachers. Nevertheless, they conclude that "it seems sensible to avoid presenting students' work covered in a color automatically associated with failure and negativity." (The *Boston Globe* reported some school districts are switching to purple ink for that very reason.)

"Red pens, ubiquitous in academic settings, are not inert objects," they add. "They are laden with meaning." Perhaps the phrase "the power of the pen" needs to be taken more literally.

http://www.miller-mccune.com/blogs/when-grading-papers-red-ink-may-mean-lower-scores-15809/

Fatty Acid to Enhance Anticancer Drug



Computer model of the enzyme methyltransferase. (Credit: Frank Lyko, German Cancer Research Center)

ScienceDaily (May 12, 2010) — Scientists of the German Cancer Research Center (Deutsches Krebsforschungszentrum, DKFZ) have discovered that bioavailability and efficacy of the blood cancer drug azacytidine increase when the substance is coupled to a fatty acid.

Chemical changes in the genetic material, known as epigenetic modifications, regulate the activity of many genes. Thus, attachment of methyl groups to DNA often inactivates important cellular growth brakes. Therefore, this process called methylation is believed to be a major cause of uncontrolled division of cancer cells. Specific enzymes, the DNA methyltransferases, are responsible for methylation.

Unlike changes in the blueprint of the genetic material, epigenetic mutations are reversible and, thus, cancer cells can be restored to their "normal state." Substances causing this re-programming are already being used as anticancer drugs. Examples are azacytidine and decitabine, which are used in the treatment of a specific type of blood cancer called acute myeloid leukemia. Both substances are incorporated into the cell's genetic material, where they act as a trap for methyltransferases. They form permanent chemical bonds with the enzyme, thereby catching the methyltransferases one by one, so that no more genes are being silenced.

Scientists in Professor Frank Lyko's team at DKFZ were searching for azacytidine variants with enhanced efficacy, because the drug still remains ineffective in many cases even when it is has been established that tumor brakes have been put out of effect by methylation. Researchers believe that this therapy resistance is frequently caused by the fact that not enough of the agent gets into the interior of the cells, because cancer cells lack particular transport molecules in the cell membrane.

The Norwegian company Clavis Pharma produced the azacytidine variants with modified chemical properties. Among the substances studied was CP-4200, a coupled product of azacytidine and a fatty acid (elaidic acid). CP-4200 showed particularly good results. When cancer cells in the culture dish are treated

with CP-4200, the amount of methyltransferase molecules in the interior of the cells is reduced. At the same time, the methyl groups bound to the DNA of cancer cells disappear and silenced tumor brakes are reactivated. The investigators assume that the elaidic acid makes it possible even for cells without special transport proteins to take up CP-4200; the substance might reach the cell interior directly through the membrane.

The effectiveness of azacytidine was previously proven only for acute myeloid leukemia. To find out whether CP-4200 shows an increased efficacy range, the investigators compared the two substances in mice suffering from another form of blood cancer, acute lymphatic leukemia. In all treatment tests investigated, the effectiveness of CP-4200 was superior to that of azacytidine. "Coupling to elaidic acid improves the bioavailability of the agent without impeding its epigenetic effect," explains project leader Frank Lyko."Therefore, we see chances of reversing methylation in far more cancer patients in the future and arresting tumor growth in this way."

Story Source:

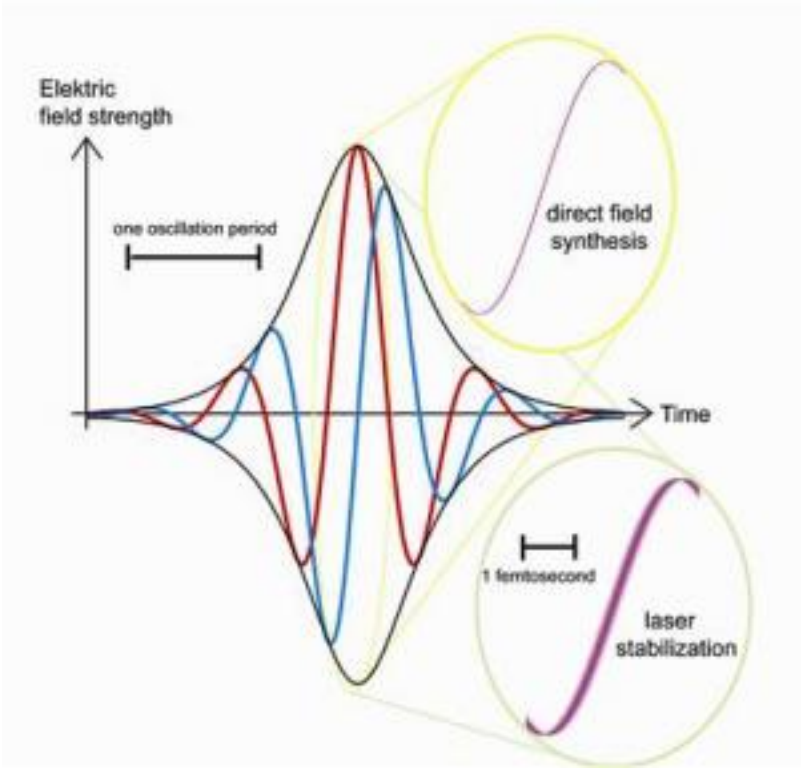
Adapted from materials provided by Helmholtz Association of German Research Centres, via EurekAlert!, a service of AAAS.

Journal Reference:

1. B. Brueckner, M. Rius, M. R. Markelova, I. Fichtner, P. A. Hals, M. L. Sandvold, F. Lyko. **Delivery of 5-Azacytidine to Human Cancer Cells by Elaidic Acid Esterification Increases Therapeutic Drug Efficacy**. *Molecular Cancer Therapeutics*, 2010; DOI: 10.1158/1535-7163.MCT-09-1202

http://www.sciencedaily.com/releases/2010/05/100507101851.htm

World Record for Shortest Controllable Time Using Laser Pulses



Ultrashort light pulse with stabilized optical phase. An ultrashort laser pulse is comprised of a few of these oscillations. (red or blue curve). Black curves: field envelope of the pulse. Maximum field strength is obtained if the field maximum coincides with the pulse center. (red curve). The newly developed method stabilizes the field pattern of the pulse. Two zoom-ins visualize smallest temporal fluctuations previously demonstrated (green frame, laser stabilization, 100 attosecond jitter) in comparison to those demonstrated with the new method of direct field synthesis (yellow frame, 12 attoseconds jitter). (Credit: Image courtesy of Forschungsverbund Berlin e.V. (FVB))

ScienceDaily (May 11, 2010) — Lasers can now generate light pulses down to 100 attoseconds thereby enabling real-time measurements on ultrashort time scales that are inaccessible by any other methods. Scientist at the Max Born Institute for Nonlinear Optics and Short Time Spectroscopy (MBI) in Berlin, Germany have now demonstrated timing control with a residual uncertainty of 12 attoseconds. This constitutes a new world record for the shortest controllable time scale.

Light is an electromagnetic wave of very high frequency. In the visible domain, a single oscillation of the electric field only takes about 1200-2500 attoseconds. Consequently, an ultrashort laser pulse is comprised of a few of these oscillations. However, pulses from conventional short-pulse laser sources exhibit strong fluctuations of the positions of the field maximum relative to the pulse center. For maximum field strength, the center of the pulse has to coincide with a maximum of the electric field, as shown in Fig. 1 as a red curve. Consequently, methods have been developed to stabilize the position of the field maximum, i.e., the phase of the pulse.

Together with Vienna based laser manufacturer Femtolasers, MBI researchers in the group of Günter Steinmeyer have now developed a new method to control the phase of the pulse outside of the laser. In contrast to previous approaches, no manipulation inside the laser is necessary, which completely eliminates fluctuations of laser power and pulse duration and guarantees a strongly improved long-term stability. Correction of the pulse phase relies on a so-called acousto-optic frequency shifter, which is

directly driven by the measured signal. Dr. Steinmeyer is convinced: "This direct correction of the phase dramatically simplifies many experiments in attosecond physics and frequency metrology."

Previously, stabilization of the position of the field maxima was only possible with a precision of about 100 attoseconds (10^{-16} s, corresponding to 1/20 of the wavelength), which is comparable to the shortest duration of attosecond pulses demonstrated so far. The new method allowed to push this limitation down to 12 attoseconds (1.2×10^{-17} s, 1/200 of the wavelength), which surpasses the atomic unit of time (24 attoseconds) by a factor of two. As the atomic unit of time marks the fastest possible time scale of processes in the outer shells of an atom, the new stabilization method will enable significant progress in the research on the fastest processes in nature.

This success strongly relied on a close collaboration with laser manufacturer Femtolasers who provided a specifically optimized laser for the joint experiment and is currently developing products based on this new method.

Story Source:

Adapted from materials provided by Forschungsverbund Berlin e.V. (FVB), via AlphaGalileo.

Journal Reference:

1. Sebastian Koke, Christian Grebing, Harald Frei, Alexandria Anderson, Andreas Assion, Günter Steinmeyer. **Direct frequency comb synthesis with arbitrary offset and shot-noise-limited phase noise**. *Nature Photonics*, 2010; DOI: 10.1038/NPHOTON.2010.91

http://www.sciencedaily.com/releases/2010/05/100511173855.htm

New Insights Into Genomics of Speciation

New experimental and genomic evidence suggests that contrary to the prevailing assumption, speciation in the classic apple maggot fly system Rhagoletis pomonella involves genome-wide differentiation driven by natural selection. (Credit: Image courtesy of University of Notre Dame)

ScienceDaily (May 12, 2010) — A new study by a team of researchers led by University of Notre Dame biologist Jeffrey Feder could herald an important shift in thinking about the genomics of speciation.

The paper appears in the *Proceedings of the National Academy of Sciences*.

The prevailing assumption among scientists about how the genomes of newly forming species should differ during the earliest stages of divergence with gene flow speciation is that it will be characterized by a few regions of strong differentiation, amidst a remainder of the genome that remains unaffected by natural selection and thus relatively undifferentiated. This analogy of "genomic islands of speciation" has come to dominate the evolutionary genetics community.

"The island concept has crystallized around an attractive hypothesis termed 'divergence hitchhiking,' in which selection on one or a few genomic regions drives speciation," Feder said.

In the new paper, Feder and his colleagues report experimental and genomic evidence that contrary to the prevailing assumption, speciation in the classic apple maggot fly system Rhagoletis pomonella involves genome-wide differentiation driven by natural selection.

"Our result in Rhagoletis conflicts with the current thinking about how the genomes of newly forming species could differ during the earliest stages of divergence-with-gene-flow speciation," Feder said. "Rather than finding just isolated 'genomic islands' of genetic divergence, we instead discovered 'continents' of divergence encompassing large swaths of the genome."

He points out that past work on the genomics of speciation lacked experimental data and thus may have been unable to detect genomic regions under weaker natural selection, establishing a view of speciation involving genetic divergence in just a few, isolated genomic islands.

Rhagoeitis pomonella fruit flies originally attacked the fruit of hawthorn trees. But about 150 years ago, a portion of the hawthorn fly population shifted and began to feed on apples. In ecologically adapting to apples as a new host plant, apple flies are becoming genetically distinct and reproductively isolated from hawthorn flies. Apple and hawthorn flies are therefore considered to represent "host races" in the early stages of actively diverging into species. As such, the apple and hawthorn races of Rhagoeitis pomonella provided Feder and his fellow researchers a unique opportunity to conduct a direct experimental test of the island versus continents hypotheses.

"This type of comprehensive data, particularly the experimental results, are missing from the bevy of genome scan studies performed in the last few years lending support to the island hypothesis," Feder said. "Without experimental data on responses to selection, these genome scan studies alone can be biased toward identifying isolated outer loci, supporting the island hypothesis.

"We foresee that as mass genotyping techniques continue to advance, it will be these types of inquires and questions that come to dominate the emerging field of population genomics and speciation. We hope our study offers a glimpse of what the future may look like."

The research was funded by the National Science Foundation and the United States Department of Agriculture.

Story Source:

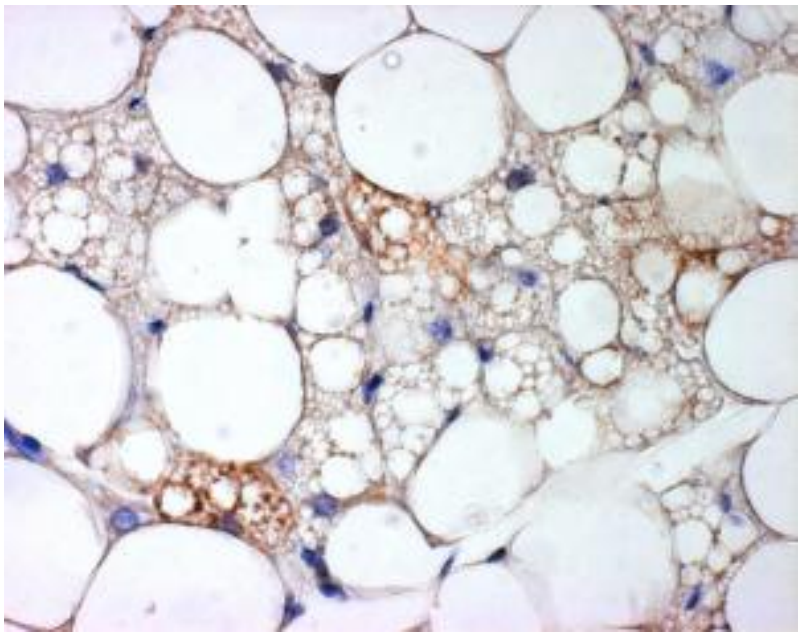
Adapted from materials provided by University of Notre Dame. Original article written by William G. Gilroy.

Journal Reference:

1. Andrew P. Michel, Sheina Sim, Thomas H. Q. Powell, Michael S. Taylor, Patrik Nosil, Jeffrey L. Feder. **Widespread genomic divergence during sympatric speciation**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.1000939107

http://www.sciencedaily.com/releases/2010/05/100510161336.htm

Slimming Aid from the Cell Laboratory? Inflammation Enzyme Regulates the Production of Brown Fat Tissue



Brown fat cells within white fat tissue. (Credit: Karin Müller-Decker, Deutsches Krebsforschungszentrum)

ScienceDaily (May 12, 2010) — Scientists of the German Cancer Research Center (Deutsches Krebsforschungszentrum, DKFZ) have published an article in *Science* revealing that the COX-2 inflammation enzyme stimulates the formation of new brown fat tissue in mice. Brown fat tissue transforms energy into heat. Therefore, mice with increased COX-2 production have a higher energy consumption and are slimmer. On the basis of these results scientists might develop a novel weight loss method for pathogenic obesity.

Love handles, muffin tops and stomach tires -- white fat tissue forms the typical curves in the notorious problem areas to store energy. Exactly the opposite happens in brown fat tissue: Instead of being stored, energy gets transformed into heat. To the dismay of many people, adults have only small amounts of this energy burner. By contrast, babies and animals in hibernation have lots of it in their bodies where it serves for heat regulation.

Researchers know that external influences can stimulate the production of brown fat tissue in animals. If rodents are kept at low temperatures, clusters of brown fat cells form amid the white fat tissue. A DKFZ research team headed by Dr. Stephan Herzig, jointly with colleagues from Munich, Marburg, Frankfurt and Lausanne, has investigated the molecular causes of this phenomenon. They discovered that the production of the COX-2 inflammation enzyme is increased in white fat tissue of mice after exposure to cold temperatures. COX-2 is well known to scientists: It regulates the key step in the biosynthesis of prostaglandins -- inflammation-promoting hormones which are also responsible for activating pain.

"Our recent results prove that COX-2 and prostaglandins are crucial for the formation of new brown fat tissue and, thus, also for regulating body weight," said Stephan Herzig summarizing his data. Parallel to the increase in COX-2 production in white fat tissue, there is also a rising level of the protein which biochemically transforms energy into heat and is therefore considered the most important biomarker for brown fat cells. When the investigators switched off COX-2 in the white fat tissue, however, the typical appearance of brown fat cells could no longer be stimulated by the cold.

Even without using cold temperatures the scientists were able to stimulate the formation of brown fat cell clusters in white fat tissue by boosting the COX-2 production in mice using a molecular-biological trick. The body weight of these animals was 20 percent lower than that of normal animals. Even on a calorie-rich diet they did not put on weight.

Previous studies by researchers from Finland suggest that in humans, too, the activity, i.e. heat production of brown fat tissue can be stimulated by regular stays in the cold. Stephan Herzig now plans to investigate whether COX-2 also plays the biochemical key role here. Since the formation of brown fat cells can also be stimulated in the culture dish, Herzig sees a possibility for practical use of his results. His vision is to take white fat tissue from severely obese individuals, to stimulate the formation of brown fat cells using prostaglandins in the culture dish, and then transplant them back to the patient. Thus it would be possible to help people by boosting their energy metabolism and thus making weight loss easier. Scientists estimate that a small amount of about 50 grams of brown fat tissue would be sufficient to increase a person's energy metabolism by 20 percent. This would be equal to a reduction of body weight by 20 kilograms over a period of one year.

Clinical trials with cancer patients have already indirectly revealed that COX-2 has an influence on body weight. Thus, the body weight of patients suffering from severe cancer-related wasting stabilized due to COX-2 inhibiting drugs. But a number of common pain relievers also act by inhibiting COX-2. Does that mean that users have to accept weight gain as a side effect? Herzig has good news: "So far, we have found no evidence suggesting that one has to fear gaining weight from taking these drugs."

Story Source:

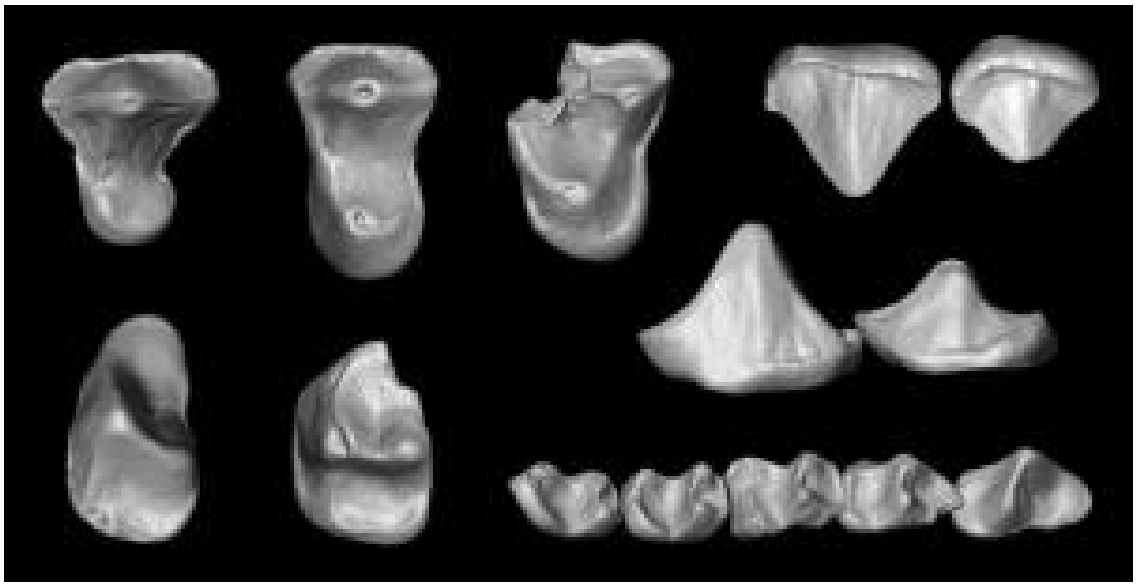
Adapted from materials provided by Helmholtz Association of German Research Centres, via EurekAlert!, a service of AAAS.

Journal Reference:

1. A. Vegiopoulos, K. Muller-Decker, D. Strzoda, I. Schmitt, E. Chichelnitskiy, A. Ostertag, M. B. Diaz, J. Rozman, M. Hrabe de Angelis, R. M. Nusing, C. W. Meyer, W. Wahli, M. Klingenspor, S. Herzig. **Cyclooxygenase-2 Controls Energy Homeostasis in Mice by de Novo Recruitment of Brown Adipocytes**. *Science*, 2010; DOI: 10.1126/science.1186034

http://www.sciencedaily.com/releases/2010/05/100507111835.htm

Odd Dental Features Reveal Undocumented Primate: Previously Unknown Species Complicates Understanding of African Evolution



A 3D reconstruction of the isolated upper and lower teeth of the 37 million-year-old primate Nosmips, from northern Egypt. (Credit: Erik Seiffert, Stony Brook University)

ScienceDaily (May 11, 2010) — It's in the teeth. An odd mosaic of dental features recently unearthed in northern Egypt reveals a previously undocumented, highly-specialized primate called *Nosmips aenigmaticus* that lived in Africa nearly 37 million years ago.

Because it is only known from its teeth, the paleontologists who discovered it don't know what its body looked like, but the find likely represents an ancient African lineage whose discovery makes early primate evolution on that continent more complicated.

"It comes as a bit of a shock to find a primate that defies classification," said lead researcher and assistant professor of Anatomical Sciences Erik Seiffert of New York's Stony Brook University.

Seiffert says during the last 30 years or so, three major primate groups were established as being present in Africa some 55 to 34 million years ago: early monkeys, lemur-like primates, and an extinct group called adapiforms. But the newly discovered primate's teeth place *Nosmips* in Africa at the same time. What's more, its teeth suggest it could be an evolutionary oddity that is not closely related to any of these groups.

Nosmips' discoverers report the finding in *Proceedings of the National Academy of Sciences*. The National Science Foundation supported the research.

"When you find the teeth of a fossil primate, it's usually pretty clear where it fits into the family tree," said Seiffert. "There are only a few species that nobody agrees about and that really can't be placed into any of the major primate groups. These mystery fossils must have something important to tell us about primate evolution."

Right now *Nosmips* is one of those rare mystery fossils and so far is only known by 12 teeth, most of which were found in isolation at a site in the Fayum Depression about 40 miles outside Cairo, Egypt. The discoveries result from work during several field seasons over nine years.

Paleontologists usually identify primate fossils by their teeth because teeth are the most durable parts of the body and are most likely to fossilize, and so are most likely to be recovered.

"We were lucky to find even two teeth of *Nosmips* in each field season over the course of the nine years," said Seiffert. "That amounts to over nine months of continuous work. Only through working over such a long time span were we able to piece together the arrangement of *Nosmips'* teeth."

Analysis shows *Nosmips* had a rare combination of enlarged and elongated premolars with simple upper molars. It also had premolar teeth that had taken on the form of molars, instead of being relatively simple as in most other primates.

"*Nosmips* appears to be a highly specialized member of a previously undocumented and presumably quite ancient endemic African primate lineage" Seiffert said.

The researchers note that *Nosmips* lived alongside another specialized primate named *Afradapis*, which the same team described last year in a paper in the journal *Nature*. Seiffert and colleagues compared the teeth of these extinct species with those of living primates, and determined that *Afradapis* had adaptations for eating leaves, whereas *Nosmips* probably ate more fruits and insects.

"As time goes on and more discoveries are made, it will be fascinating to see how different lineages contributed to primate diversity in the Eocene of Africa," Seiffert said.

Researchers from the Duke Lemur Center, Midwestern University, Penn State University and University of Oxford also contributed to this research.

Story Source:

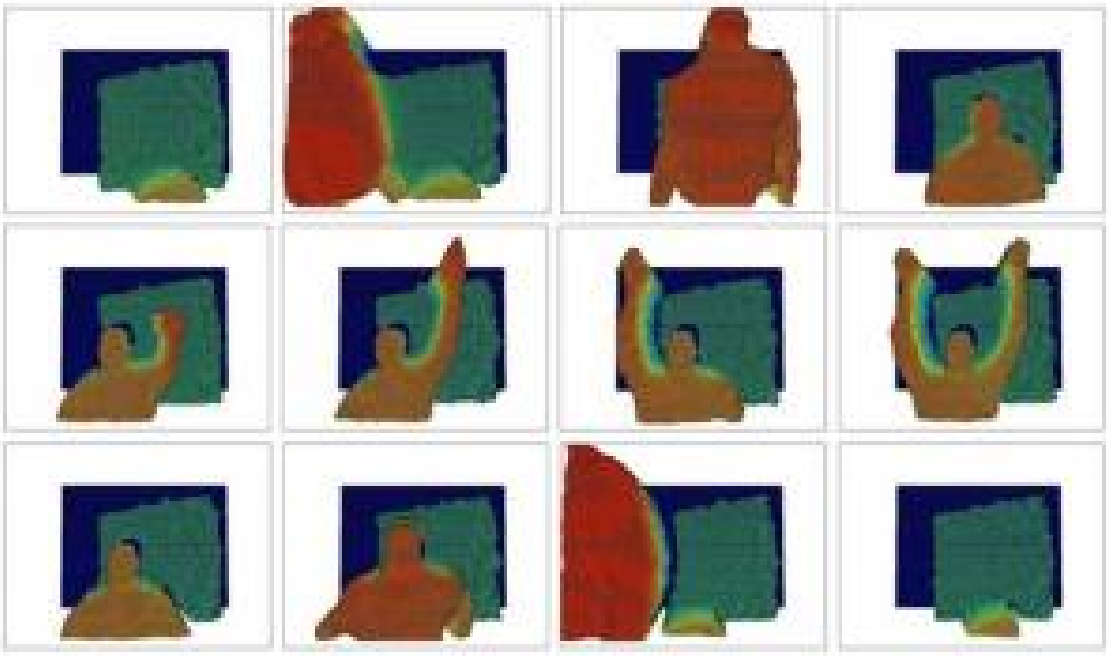
Adapted from materials provided by National Science Foundation.

Journal Reference:

1. Erik R. Seiffert, Elwyn L. Simons, Doug M. Boyer, Jonathan M. G. Perry, Timothy M. Ryan, and Hesham M. Sallam. **A fossil primate of uncertain affinities from the earliest late Eocene of Egypt**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.1001393107

http://www.sciencedaily.com/releases/2010/05/100511092149.htm

Here Comes the 3-D Camera: Revolutionary Prototype Films World in Three Dimensions



Examples of 3-D images acquired using the new 3-D camera. (Credit: Image courtesy of Fondazione Bruno Kessler)

ScienceDaily (May 11, 2010) — It's no pun: we are truly entering a new dimension in technology with the 3-D digital camera developed by the researchers of Fondazione Bruno Kessler (FBK) in Trento.

Virtual reality, security and surveillance, monitoring of the homes of the elderly, videogames. These are just some of the possible application of the patented prototype to be presented for the first time ever tomorrow in Eindhoven (The Netherlands), on the occasion of the scientific conference regarding the European project Netcarity.

Designed by David Stoppa and his colleagues at the SOI (integrated optical sensors) Research Unit of Fondazione Bruno Kessler, the new technology also represents a new record for Italian research: the physical dimensions of the reading cell that captures the light on the camera's sensor has the smallest pixel currently in existence in this field (10 µm, i.e. ten millionths of a metre, approximately one tenth the size of a human hair) which provides the prototype with the capacity to capture images with the largest quantity of details possible.

The SOI Unit researchers, headed by Lorenzo Gonzo of FBK, have developed the prototype with the financial support of the European Union within the context of the Netcarity project, dedicated to improving home living via new technologies.

Compared to the digital cameras currently available on the market that provide only a 2-D projection of the scene to be shot, FBK's new camera also recovers the third dimension. The device illuminates the scene with ultra-short laser light pulses (in the order of a few billionths of a second) that "hit" the subjects being shot and then return to the starting point where they are detected by a sophisticated micro-sensor known as "CMOS" (Complementary Metal Oxide Semiconductor), capable of computing the distance of the various subjects, i.e. the third dimension.

With this camera it is therefore possible to approach the stereoscopic vision of humans who have a three-dimensional perception of the subjects in their field of vision. The FBK researchers are among the first to

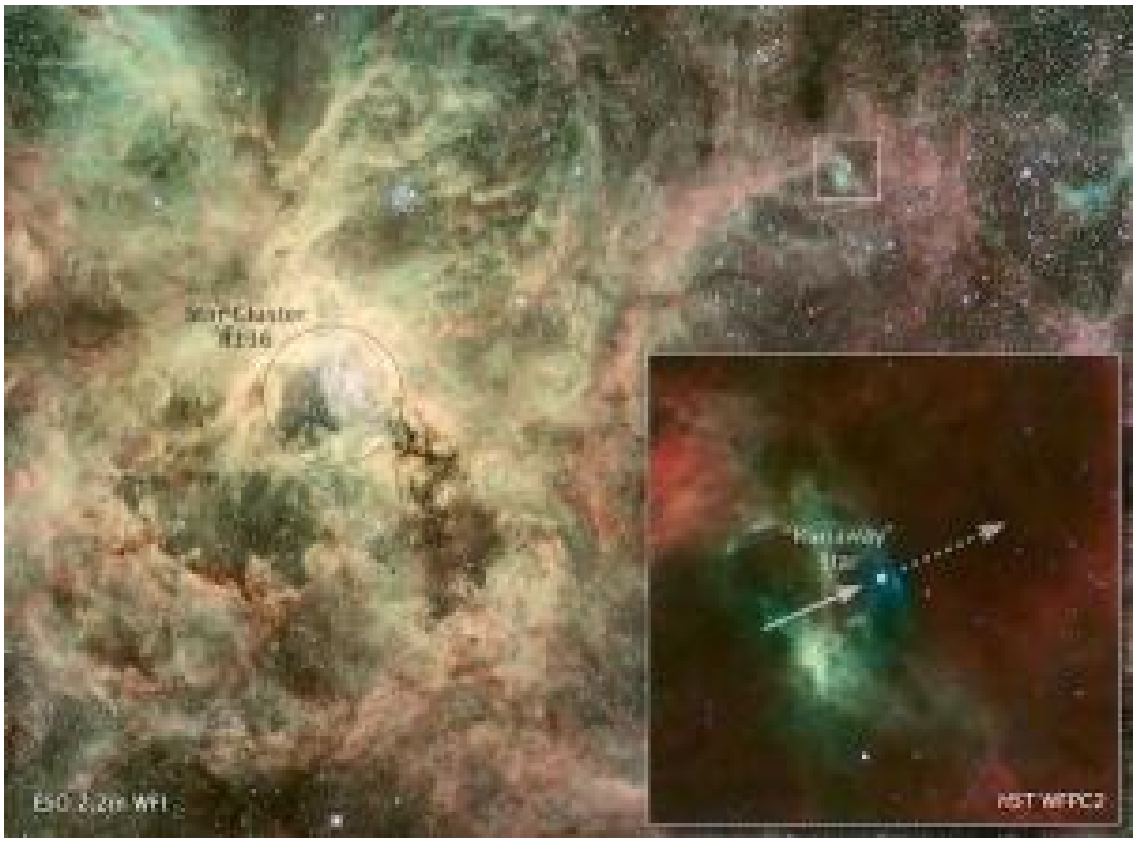
have created a sensor of this kind using standard CMOS technology, the same used for making microprocessors and most electronic components and that, among other things, allows savings in production costs.

The sensor can be applied to the assistance to and for the security of the elderly and the disabled. Indeed, the perception of the 3-D scene allows extreme reliability in detecting any danger situations, such as accidental falls, and therefore can help reduce the risks for people living alone or without assistance. Next generation videogames could also benefit from a large step forward in their evolution, since the 3-D vision system can directly "read" the player's movements. This means the player can freely move about in the camera's field of vision, simulating a sports challenge or a game without the need to hold or wear a device that transmits the player's movements to the computer. The new camera could be applied to intelligent navigation and interaction systems to be used as sophisticated electronic guides inside museums, for example.

Story Source:

Adapted from materials provided by Fondazione Bruno Kessler, via AlphaGalileo.
http://www.sciencedaily.com/releases/2010/05/100510075413.htm

Hubble Catches Heavyweight Runaway Star Speeding from 30 Doradus



This image of the 30 Doradus Nebula, a rambunctious stellar nursery, and the enlarged inset photo show a heavyweight star that may have been kicked out of its home by a pair of heftier siblings. In the inset image at right, an arrow points to the stellar runaway and a dashed arrow to its presumed direction of motion. The image was taken by the Wide Field and Planetary Camera 2 (WFPC2) aboard the NASA/ESA Hubble Space Telescope. The heavyweight star, called 30 Dor #016, is 90 times more massive than the Sun and is travelling at more than 400 000 kilometres an hour from its home. In the wider view of 30 Doradus, the homeless star, located on the outskirts of the nebula, is centred within a white box. The box shows Hubble's field of view. The image was taken by the European Southern Observatory's (ESO) Wide Field Imager at the MPG/ESO 2.2-metre telescope on La Silla, Chile. (Credit: NASA, ESA, C. Evans (Royal Observatory Edinburgh), N. Walborn (STScI) and ESO)

ScienceDaily (May 11, 2010) — A heavy runaway star rushing away from a nearby stellar nursery at more than 400 000 kilometers per hour, a speed that would get you to the Moon and back in two hours. The runaway is the most extreme case of a very massive star that has been kicked out of its home by a group of even heftier siblings.

Tantalizing clues from three observatories, including the NASA/ESA Hubble Space Telescope's newly installed Cosmic Origins Spectrograph (COS), and some old-fashioned detective work, suggest that the star may have travelled about 375 light-years from its suspected home, a giant star cluster called R136.

The homeless star is on the outskirts of the 30 Doradus Nebula, a raucous stellar breeding ground in the nearby Large Magellanic Cloud. The finding bolsters evidence that the most massive stars in the local Universe reside in 30 Doradus, making it a unique laboratory for studying heavyweight stars. 30 Doradus, also called the Tarantula Nebula, is roughly 170 000 light-years from Earth. Nestled in the core of 30 Doradus, R136 contains several stars topping 100 solar masses each.

The observations offer insights into how massive star clusters behave.

"These results are of great interest because such dynamical processes in very dense, massive clusters have been predicted theoretically for some time, but this is the first direct observation of the process in such a region," says Nolan Walborn of the Space Telescope Science Institute in Baltimore and a member of the COS team that observed the misfit star. "Less massive runaway stars from the much smaller Orion Nebula Cluster were first found over half a century ago, but this is the first potential confirmation of more recent predictions applying to the most massive young clusters."

Runaway stars can be made in a couple of ways. A star may encounter one or two heavier siblings in a massive, dense cluster and get booted out through a stellar game of pinball. Or, a star may get a "kick" from a supernova explosion in a binary system, with the more massive star exploding first.

"It is generally accepted, however, that R136 is young enough that the cluster's most massive stars have not yet exploded as supernovae," says COS team member Danny Lennon of the Space Telescope Science Institute. "This implies that the star must have been ejected through dynamical interaction."

The runaway star research team, led by Chris Evans of the Royal Observatory Edinburgh, UK, published the study's results on 5 May 2010 in the online edition of *The Astrophysical Journal Letters*.

Astronomers have been on the trail of this rogue star since 2006 when a team led by Ian Howarth of University College London, UK, spotted it with the Anglo-Australian Telescope at Siding Spring Observatory. The observation revealed that the stellar misfit is an exceptionally hot, massive blue-white star and relatively far from any cluster in which such stars are usually found.

Hubble astronomers unexpectedly picked up another clue when they used the star as a target to calibrate the COS instrument, installed in May 2009 during Servicing Mission 4. Those ultraviolet spectroscopic observations, made in July 2009, showed that the wayward star is unleashing a fury of charged particles in one of the most powerful stellar winds known, a clear sign that it is extremely massive, perhaps as much as 90 times heavier than the Sun. The star, therefore, also must be very young, about one million to two million years old, because extremely massive stars only live for a few million years.

Sifting through Hubble's archive of images, astronomers found another important piece of evidence. An optical image of the star taken by the Wide Field Planetary Camera 2 in 1995 revealed that it is at one end of an egg-shaped cavity. The cavity's glowing edges stretch behind the star and point in the direction of its home in 30 Doradus.

Another spectroscopic study from the European Southern Observatory's Very Large Telescope (VLT) at the Paranal Observatory in Chile revealed that the star's velocity is constant and not a result of orbital motion in a binary system. Its velocity corresponds to an unusual motion relative to the star's surroundings, evidence that it is a runaway star.

The study also confirmed that the light from the runaway is from a single massive star rather than the combined light of two lower mass stars. In addition, the observation established that the star is about ten times hotter than the Sun, a temperature that is consistent with a high-mass object.

The VLT observations are part of a legacy program called the VLT-FLAMES Tarantula Survey. The survey, conducted by an international team led by Chris Evans of the Royal Observatory, comprises more than 900 stars in the 30 Doradus region. Like the COS observations of the star, the FLAMES results also were serendipitous. The star's location is far from the nebula's central region, placing it at the edge of the FLAMES survey field.

The renegade star may not be the only runaway in the region. Two other extremely hot, massive stars have been spotted beyond the edges of 30 Doradus. Astronomers suspect that these stars, too, may have

been ejected from their home. They plan to analyze the stars in detail to determine whether 30 Doradus might be unleashing a barrage of massive stellar runaways into the surrounding neighborhood.

The wayward star will continue to streak across space, says team member Paul Crowther of the University of Sheffield in England, and will eventually end its life in a titanic supernova explosion, likely leaving behind a remnant black hole.

Story Source:

Adapted from materials provided by European Space Agency.

Journal Reference:

1. C. J. Evans, N. R. Walborn, P. A. Crowther, V. Hénault-Brunet, D. Massa, W. D. Taylor, I. D. Howarth, H. Sana, D. J. Lennon, J. Th. van Loon. **A Massive Runaway Star from 30 Doradus**. *The Astrophysical Journal*, 2010; 715 (2): L74 DOI: 10.1088/2041-8205/715/2/L74

http://www.sciencedaily.com/releases/2010/05/100511092402.htm

Power Play
May 13, 2010

A plan to eliminate 15 faculty positions regardless of tenure status might hit some speed bumps if Albion College's faculty handbook were followed, but the college's trustees have decided to ignore that minor inconvenience.

When Albion faculty said the dismissals might violate the handbook, the board promptly passed a resolution washing their hands of the guidelines. Indeed, the board didn't even bother to say which parts of the book they would change; the trustees simply declared that anything standing in their way was "amended effective immediately."

"RESOLVED that exercising the authority of the Board of Trustees under the Charter of 1857, the Faculty Handbook is amended effective immediately in all ways necessary to permit the reduction of 15 full time equivalent (FTE) existing faculty positions, which may include tenured faculty positions, by the beginning of the 2010-11 academic year," the resolution states.

The trustees requested plans for cuts from faculty and administrators after they received enrollment projections that suggested further declines, and they are expected to approve a plan today or Friday. Most of the students at Albion, a private liberal arts college 90 miles west of Detroit, are Michigan residents, and the college's falling fortunes are closely tied to the state's own fiscal challenges, administrators say.

The board's March 30 resolution has shown Albion faculty just how powerless they are in the college's governance structure, and many now say they are afraid to express their concerns publicly amid talk of dismissing tenured professors. While the handbook outlines specific guidelines for removing tenured faculty, those regulations all amounted to nothing when the board exercised its stated authority to both suggest and approve handbook revisions.

"The handbook is a governance document that's widely respected on campus by the trustees and the administration and the faculty themselves, but the board does have the authority (to amend it) and it's stated within the handbook that it is the ultimate decision maker," said Donna Randall, the college's president.

Indeed, the handbook [*See relevant excerpts here*] does give the board the "final" authority to approve changes. It also states, however, that "every effort will be made by appropriate consultation and conference to resolve any differences." There's no evidence suggesting any such consultation occurred, at least with faculty.

The handbook only allows for the dismissal of tenured faculty for misconduct, after the declaration of financial exigency or in the event of complete program elimination. Financial exigency has not been declared and no one is targeting faculty for misconduct in this instance. And while the board has welcomed faculty and administrative suggestions for program cuts, the trustees have not said the dismissals should be limited to faculty in eliminated programs.

At a Feb. 19 meeting, Albion trustees invited professors to submit suggestions for 15 faculty position eliminations -- about 10 percent of the faculty. The board said it needed the plans by May 3, and faculty argued the roughly 10-week time frame was insufficient to conduct a thorough analysis of programs. Even so, faculty did approve a March resolution that promised a strategy of position cuts through attrition, retirements and non-renewal of adjuncts. The board's response? Too little, too slow.

"We truly understand your response as presented in the faculty resolution. However, the problems we collectively confront cannot, in our judgment, be solved by incremental remedies," Paul Tobias, chair of the board, wrote to faculty. "The issues require more prompt and fundamental attention than you propose."

Randall acknowledged "there's a difference of opinion" on whether the trustees' timetable allowed for a rigorous and thorough faculty review of programs.

"The board felt it was in the best interest of the college to have a decision made in a reasonable period of time," said Randall, who declined repeatedly to say whether she personally felt the time allotted was "reasonable."

The college has already put non-tenured faculty on notice, sending out letters to all of them stating that their appointments will not be renewed. Those faculty may not know their employment status until June, according to the letter.

Trustees Once Backed Faculty Growth

There is no doubt that Albion's enrollment has faltered, dropping from 1,938 full-time students in 2007-8 to 1,709 in 2009-10. In an analysis of population and other demographic trends, Albion officials projected enrollment would fall to about 1,635 students in the next couple of years – marking a 16 percent decline from the college's peak enrollments of the mid-2000s.

"What's motivating this change is a structural imbalance," Randall said. "What we need to do is have an appropriate number of faculty for the size of the student body. That's what's motivating the change."

The change, however, is really just a return to Albion's enrollment and staffing levels of about 10 years ago. Randall's predecessor, Peter Mitchell, announced a plan in 2002 to increase the size of the college's freshman class from 450 to 600, adding about 14 faculty members to help address the increase. Some of the very trustees who now want to cut the faculty were cheerleading faculty growth eight years ago, despite some public objections from faculty who questioned the wisdom of the hires at the time, said an Albion professor who asked not to be identified.

As for the college's financial state, some question whether it's as dire as the trustees describe. For the fiscal year ending June 30, 2008, the college reported $5.7 million of revenues in excess of expenses on its Form 990. The college also reported $19.5 million in unrealized losses, which likely refer to the falling value of stocks that Albion has yet to sell for a loss and that could still rebound in the future.

Howard Bunsis, who has conducted independent audits of several colleges undergoing budget cuts, informally reviewed Albion's public financial documents at the request of faculty, and said he saw little to justify concern.

"There is absolutely no need to be eliminating positions at Albion College, given what I see here," said Bunsis, chair of the Collective Bargaining Congress for the American Association of University Professors and a professor of accounting and finance at Eastern Michigan University.

While citing concerns about finances, Albion officials have not declared financial exigency or suggested the college faces an economic crisis that threatens the institution's survival -- the AAUP's standard for such a declaration. But if Albion dismisses tenured faculty as has been suggested, the college will join a growing number of institutions that have done so amid the economic crisis without declaring exigency. That's a disturbing trend for defenders of tenure, who say layoffs without a stated dire financial emergency undermine the tenure system and its intended protections.

The AAUP has made known its concerns about the process unfolding at Albion. The organization's own standards for dismissing tenured faculty closely mirror those set out in Albion's handbook, and the AAUP sent a letter to Randall reiterating its position that such protocols should be followed.

"Our association would view with serious concern any actions taken to reduce the size of the faculty that departed significantly from our recommended standards, regardless of any amendments to the faculty

handbook," wrote Gregory F. Scholtz, associate secretary and director of the AAUP's Department of Academic Freedom, Tenure and Governance.

Albion trustees, however, have clung to the position that tenured faculty dismissals should remain on the table. One Albion professor said it was surprising that trustees specifically mentioned potential dismissals of tenured faculty, even after Albion professors voted in favor of crafting a plan that would reduce positions through attrition and the dismissal of adjuncts.

"That was very, very provocative," the professor said. "They have to know the laying off of tenured faculty is a significant escalation of the stakes."

— Jack Stripling

http://www.insidehighered.com/news/2010/05/13/albion

The Entrepreneurial Grad Student
May 12, 2010

The other day a colleague and I were discussing how to best prepare graduate students for life after graduate school. On many occasions we've discussed the job market graduate students face and how many are unprepared. In our discussions we keep coming back to a common theme: today's graduate students need to be entrepreneurial in their approach to their studies.

In my work with Ph.D. candidates I've found they can be grouped into two broad categories. Category I includes those who are focused, determined and have a clear vision of their career path. Category II holds those who are lost, confused and rudderless. Both groups are comprised of students seeking academic and non-academic positions, so the career path is not the mitigating factor. Some have very involved advisers and others have hands-off advisers, so effective mentoring is not the mitigating factor. So what accounts for the difference? I believe it has to do with the students' ownership of their career path.

The students I meet in Category II tend to have taken a more passive role in preparing for the careers they wanted, following the path of least resistance, waiting for things to happen, relying heavily on their advisers to provide them with all the answers and thinking their degrees would be enough. Many of them have known for a few years that they were unprepared for what comes next, but they waited and hoped things would work out in the end. The students I meet in Category I are what we might call the entrepreneurial graduate students. They created a plan for success, followed the plan while it worked, made modifications when necessary and had multiple mentors to help them create their career plan. They know the key to a smooth transition from academic life to a professional life is having plans — Plans A, B and C. If you're considering a Ph.D. program, or are currently in one, you definitely want to be an entrepreneurial graduate student. There are three principles of entrepreneurship that graduate students should adopt: 1) brand yourself, 2) seek opportunity, and 3) adapt.

Brand Yourself

To be successful both inside and outside academe you need to build your brand, defining yourself and your unique qualities in all you do and say, so when someone hears your name they know what you are about. If you think about it, a Ph.D. program really is about branding yourself. You specialize in a particular subfield and search for a topic within that area where you can shine. At the completion of your program you should be a content expert in your area and, if you branded yourself well, everyone in your broader field will know who you are and what you study. An effective branding campaign begins with knowing who you are and what you do exceptionally well. Unfortunately this can be a challenge for many graduate students. Many of the students I see who want to seek nonacademic employment lack a clear sense of their strengths. I constantly hear Ph.D. candidates tell me they have no skills. I understand this because I felt the same way the first time I began my search for a nonacademic career. If you are in this situation, try taking Gallup's *Strengths Finder*. It's an online assessment that will help you identify your top five strengths. The book *Career Distinction* by Arruda and Dixon comes with an online workbook of exercises designed to help you build your brand.

Once you've developed your brand, look for opportunities to share it with a wider audience. Within the academic community you can accomplish this by attending conferences, presenting your work and publishing. To connect with a nonacademic audience you can develop a blog, write nonacademic articles for publications in your field of interest, or give presentations to groups that might be interested in your area of expertise. Consider including elements of your brand in your communication. Create several elevator-speech versions of your brand you can use when you meet people face to face; consider using elements of it in your e-mail signature, and seek other ways to promote your brand.

A successful brand should focus attention on your unique characteristics rather than pigeonholing you into a narrow career track. And if you want to keep your options open to both academic and nonacademic careers, you may need to target your brand to each audience. For example, your academic brand might closely mirror your dissertation topic and your nonacademic brand might not. Like the Ph.D. student who

became an expert on the history of colonial education in West Africa for his faculty brand and an expert in improving teacher's classroom performance for his non-faculty brand -- who is now an instructional development specialist at a research university. Or the Ph.D. in microbiology with academic expertise in radiation research who is developing her industry brand as an expert in regulatory affairs. For many fields it's unlikely you'll find a nonacademic position that allows you to research the same topic as your dissertation, so think more globally about the contribution you want to make and start exploring opportunities in that area.

Seek Opportunity

The more successful students I've worked with are those who have taken advantage of opportunities presented to them and have sought out additional opportunities on their own. Those who are successful in their academic searches tend to have experiences beyond the typical TA and RA positions. Many college campuses have teaching centers that offer opportunities for pedagogical development to help you be more competitive for teaching-focused colleges. These experiences may also give you more qualifying experiences for positions within a teaching center at a university. And if you enjoy teaching, try developing specialized workshops as that will give you some credibility and possible opportunities to teach other faculty or business leaders. For example, some of the hot topics in both higher education and business are e-learning, learning organizations, and leadership development. Look for opportunities to present on those topics to graduate students in your institution's education department, or to faculty at a local public school. Or if you're a scientist, consider creating a workshop series about how to communicate scientific principles to a lay audience. Find a community group to speak to or try proposing a short course on the topic at a professional conference.

Graduate degree holders who are more successful in their nonacademic pursuits held internships and or volunteered so their work history included more than just academic work. One student I recently met was involved with campus outreach programs and community and civic engagement. These experiences helped to build her credibility for academic jobs on campuses with strong service learning programs, and for non-faculty positions within centers for community engagement and service learning on university campuses. And her volunteer work and internships were with nonprofits, giving her the credentials to attain a good position in nonprofit and governmental sectors.

If you want options in business or industry you must get experience. It's not uncommon for Ph.D.s looking for that first industry job to discover they're considered overeducated yet underqualified. You might even be able to get industry experience that advances your academic career. At my university, as at many, there are partnerships between faculty and industry, so when choosing your advisor you might want to seek out a person who has broad connections and opportunities for you to branch out beyond academe. And if your advieor doesn't have those connections, find another faculty mentor who does. Look around your campus to see which businesses have ties to your university and approach them about opportunities. For example, I worked with a student who got her Ph.D. in French literature and philosophy and is now the product and development manager for a video game company because she was open to applying for a position the company advertised on our campus for someone to translate video games from English into French. Or the social ecology Ph.D. with a specialty in environmental analysis and design who actively pursed nonprofit and governmental agencies conducting climate change research until she successfully landed a position with the National Research Council as an associate program officer/study director.

Adapt

The job market will continue to change. The key to success is to remain open to the possibilities that are out there. For example, I've heard stories that physics and mathematics Ph.D.s were highly sought after by financial companies to do modeling, but that was pre-recession. And last year the academic market was hot for Ph.D.s who studied Chinese and African history, and there were several stories suggesting that was a growth area. But since it takes five to seven years to earn a Ph.D., what was hot when you entered your program might not be in demand when you're on the market, which is one of the reasons

your brand shouldn't be overly focused on a single subject specialization (of course, the degree of specialization that's "too" focused will depend on your discipline.)

A good way to increase your adaptability is to analyze your current transferable skills and explore where you need skill development. This exercise is important for both academic and nonacademic job seekers. Develop a wide range of skills while you're still in a graduate program so you'll have more options when you're on the market.

If you're entering academe and aren't well-versed in educational technology and e-learning principles, you need to develop skills in those areas. More universities are offering online courses and need people who know how to effectively teach in that format.

If you're interested in nonacademic careers, you need to identify jobs of interest and discover the skills required for those positions. You also need to keep up with current innovations and trends in your desired field. You can use online sources like the Bureau of Labor Statistics to track industry trends for nonacademic careers. And the Occupational Information Network is a good resource for exploring and researching different occupations. There are also professional organizations for nearly every career, and their publications/newletters are good sources for tracking trends and seeking open positions.

Traditionally Ph.D. candidates have been encouraged to trust that their advisers will guide them through their program, prepare them well for their career path and "place" them in a tenure track position at a good university. But many graduate students have discovered too late that this is more myth than reality. Career success comes from taking ownership of your career path, and you never want to leave something that important in someone else's hands.

Christine Kelly is a graduate career consultant at the University of California at Irvine.

http://www.insidehighered.com/advice/2010/05/12/kelly

Disappearing Departments
May 7, 2010

Kean University department chairs have spent a year on the endangered species list, and now they appear headed for all-but-certain extinction.

A rough plan to eliminate chairs took shape last May amid heavy protest, and administrators now have a draft proposal they say could be carried out as early as July. The plan, which would replace departments with schools headed by presidentially-appointed "executive directors," has been met with renewed furor from faculty, who view it as a power grab that leaves the future of many disciplines uncertain. The university has already moved to eliminate such departments as philosophy and social work, but this plan would kill even large departments like English and biology, dividing faculty members into new organizational structures they played no role in creating.

"The university has become a battlefield, [where administrators] do as they see fit, when they see fit without any academic justification," said Bryan Lees, a chemistry professor.

The reorganization has been couched in part as a cost-saving measure, but faculty critics say there's been precious little evidence to support that claim. A nine-page document outlining the plan, which would add 14 new executive directors to an existing four, does not give any estimated savings numbers or explain what the new directors will be paid.

Administrators have publicly mentioned potential savings in the neighborhood of $430,000, but faculty say there's no rationale to support the figure. And if there is a rationale, it's certainly not covered in the draft document – the only written account thus far distributed. Moreover, faculty say eliminating 38 chairs only to pay 18 executive directors – at salaries of $80,000 to $90,000, officials have said publicly – might even increase costs.

"This new structure is adding an entirely new layer of administrators that never used to exist," said James Castiglione, who teaches physics at Kean and is president of the Kean Federation of Teachers.

The union, which is part of the American Federation of Teachers, will challenge the plan on several grounds, Castiglione said. Most notably, union officials fear one of the plan's chief goals is to convert department chairs into executive managers, who will then be removed from the bargaining unit, even though they'll still carry some teaching duties.

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The document you have is a Frankenstein's monster with missing parts and no way to animate it." -- Maria Montaperto, assistant professor of English.

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"It will allow the upper administration to exert increased control over faculty work lives," Castiglione said. "That's what this whole thing is about. This whole thing is about control. The union will fight. You can't have someone who is teaching classes and just call them a manager."

Mark Lender, Kean's interim provost and vice president for academic affairs, was not made available for an interview Thursday. A spokesman for the university, however, said via e-mail the plan "is not final."

"We continue to review our budget situation and state funding levels," Stephen Hudik, a university spokesman, wrote. "However, it is clear that we cannot maintain our current levels of service without steps that include consolidation of departments, privatization and layoffs."

While the reorganization plan was not prompted by budgetary concerns, the downturn requires Kean to "streamline our operations," Hudik added.

The university expects a $17.7 million deficit next year, given $8.5 million in expected expense increases and a nearly $2 million loss of furlough savings, Hudik said. Faculty have challenged that figure, however, noting that Gov. Chris Christie's proposed budget shows only a $6.6 million decrease in state appropriations.

"To suggest that Kean University, for whatever motive, is somehow immune from New Jersey's severe budget crisis is irresponsible and not in line with economic reality," Hudik wrote.

Accreditation Concerns

As currently understood by faculty, who are admittedly in the dark, reorganization would eliminate or marginalize valued programs. Concerns are particularly acute for English faculty, who would see a composition program they say they've tried to nurture moved into a "School of General Studies" alongside remedial math.

The plan stipulates that two composition faculty would be placed in general studies, while other English professors would work in a "School of Literature and Communication." In so doing, the plan apparently divorces two composition faculty who helped launch a new master's in writing program from their colleagues in the program. Who will teach the courses they designed? That's unanswered. Indeed, the document leaves wholly unmentioned the fate of the writing program. Such an omission not only concerns faculty who helped to build the program, but also illustrates the fact that administrators crafted a plan without consulting professors at all, said Maria Montaperto, an assistant professor of English.

"The document you have is a Frankenstein's monster with missing parts and no way to animate it," she said.

Other departments that now exist are similarly concerned with the implications of being split apart. The plan stipulates, for instance, that bachelor of arts programs in science will be placed in one school, while bachelor of science programs in the same disciplines will be housed in another school. Since faculty frequently teach courses in both degree programs, there's a practical concern about how to cover the teaching if faculty are divided between B.A. and B.S. programs.

Dividing faculty between degree programs also presents potential concerns for accreditation. The independent national accreditation for the B.S. program in chemistry, for instance, hinges in part on full-time faculty numbers. Those numbers would presumably be reduced if some chemistry professors were devoted purely to the B.A. program, as the plan appears to prescribe.

"How do you maintain accreditation if one part of your program is in one school and another part of your program is in another school? We're absolutely aghast and we're very concerned about accreditation and losing it," said Lees, who helped the school secure accreditation with the American Chemical Society nearly 30 years ago.

Kean is also in the middle of an accreditation renewal with the Middle States Commission on Higher Education, and some are concerned that reorganizing after the university has conducted a self-study will interfere with the process.

The only department that would continue to exist and retain a chair under the plan would be history. When the university purchased Liberty Hall, a historic property, Kean committed to cataloging and archiving documents there, and the department's "integral role" in that process is part of the agreement, university officials said.

Inside Higher Ed requested documentation of the agreement with Liberty Hall, but it was not provided. Some faculty have taken note that the lone surviving department under the plan happens to be the home department of Lender, the interim provost who has been promoting the plan.

Budget Data Disputed

About half a dozen programs would be phased out under Kean's reorganization plan, and several others would merge. Among those eliminated are graphic communications and educational psychology, both of which are deemed to have problematic enrollment trends.

Of the university's 38 graduate programs, 18 "bear scrutiny" because of insufficient or inconsistent enrollment and graduation numbers, the document states."The most vulnerable" programs are those unable to maintain enrollments of 25 students per year over five years and graduating fewer than 10 students per year over three of the past five years, according to the document.

Faculty and administrators, however, can't even agree on data as fundamental as enrollment numbers. Indeed, a number of faculty say their trust in administrators is so fragile that they don't have faith in any of the data put before them to justify changes. That lack of trust is coupled with some professors' outright contempt for Dawood Farahi, the university's controversial president. Faculty accuse Farahi of getting worked up over matters as trivial as someone walking on campus grass -- and he has accused critics of standing in the way of progress.

When administrators closed the philosophy and religion department last year, they cited running budget deficits in the department. But faculty conducted an independent analysis of the figures and determined that the budget data administrators produced hadn't accounted for state appropriations. Once the state dollars were included in the budget, the department was found to be operating at a surplus in excess of $460,000, the analysis determined.

Bert Wailoo, a professor of accounting at Kean, said the administration consistently cherry picks numbers to justify its agenda. Wailoo, who analyzed the philosophy and religion department's budget through public records, said the administration exploits the fact that many faculty don't have the necessary expertise to challenge budgetary assumptions. "Most of the faculty are not numbers people, but this is my business," he said.

Kean officials were provided with Wailoo's analysis for this story, but did not respond to its contention that an eliminated department was operating in the black.

Mervyn D'Souza, a professor of philosophy, also disputes the accuracy of the budgetary data used to shut down his department. D'souza contends that departments that have challenged the administration are punished, noting that professors in philosophy and social work – a department also being phased out – have been consistent critics.

"Data has been misused," he said, "and I have never witnessed such vindictiveness."

— Jack Stripling

http://www.insidehighered.com/news/2010/05/07/kean

Remediation Worries and Successes
October 9, 2009

SAN FRANCISCO -- At one session on remedial education here, a speaker asked the audience of community college trustees how many of them knew their institution's graduation rate. A minority of hands -- maybe 20 percent -- went up. But if trustees are not as well versed on student success at their institutions as the question suggested they should be, that doesn't mean that they aren't interested. The session was standing room only, and other sessions on remedial education here at the annual meeting of the Association of Community College Trustees were also not only well attended, but full of trustees with lots of questions -- about why so much remediation is needed and what can be done to make it work.

There was a strong undercurrent of frustration to many of the questions, with many saying that community colleges were unfairly seen by many in the public as being only remedial institutions, even though they have little control of the factors that lead to remediation. One trustee noted that in her state, scholarships are awarded to students who achieve certain grade levels in high school, effectively making the community college free. About 20 percent of those who enroll through the program need at least some remediation, she said.

If that share of what the state considers top students aren't ready for college-level work, is it any surprise, she asked, that the percentages are even higher for other students?

Trustees offered a range of reasons for focusing more on this issue. Some cited more idealistic motivations, related to wanting every student to have a shot at success. Others were more practical, noting the huge costs of remediation and the political pressure to show success with these programs.

John E. Roueche, director of the Community College Leadership Program at the University of Texas at Austin, offered some historical perspective about just how long remedial education has been a tough issue for community colleges. He said he first did a major study of remedial education at community colleges in 1968 and found terrible rates of success -- defining success as completing remediation at levels sufficient for college-level work. At many colleges he studied, only 1 in 10 students could be judged a success by that standard, and that's still the case today.

The major change in the last four decades? The top course at community colleges has switched from remedial English to remedial mathematics.

One part of the problem, he said, is that colleges aren't asking tough enough questions about their own performance in making remediation work. He gave as an example a college where he was brought in to do a workshop for the faculty members providing remedial courses. The instructors boasted to him that they had won awards for their work in achieving a 50 percent success rate. But this didn't mean that 50 percent of students were reaching college-level work (which would indeed be better than many colleges' track records).

What the figure meant was that 50 percent were completing a remedial course successfully. Because most students needed multiple courses to get ready for college-level work, and the 50 percent applied to each course, this meant that only about 12.5 percent of those starting remediation were ever reaching college-level work.

Trustees, he told the audience, need to start asking more questions. Beyond his question about graduation rates, he said every trustee should be asking administrators the following (and judging from the note-taking in the audience, there may be new questions at many colleges' next board meeting):

- What percentage of students need remedial work?
- What percentage pass their remedial courses?
- What percentage reach college-level work?

- How do these percentages change for different demographic groups?
- Are placement policies enforced? (He said too many community colleges let "well intentioned faculty members or counselors" help students bypass remediation that they need, only to watch the students fail.)
- Does the college have attendance policies? (Roueche said too many colleges say that their policy is to let faculty members decide, which is essentially "not having a policy." He advocated strict policies, telling students they can't miss class or register late.)

While Roueche's talk was depressing to many in the audience, he stressed that there are strategies that are working, and said that the first thing colleges need to do is start trying approaches that are being used successfully elsewhere.

One of the colleges praised at Roueche's session -- Parkland College, the community college in Champaign, Ill. -- was the subject of another session for the way it has revamped remedial education, and is starting to see some results.

Since 2006, the college has restructured a series of programs for remedial students and for all students -- in fact grouping them together in a new Center for Academic Success. Randall Fletcher, dean of academic services, said it was important to group services together and not to create a stigma around seeking help. At the same time, he said, it was necessary for the college to try a range of new strategies to try to get more students through courses. All of these new efforts were faculty designed, he said, and a faculty member behind many of the ideas -- Pam Lau -- was recruited to head it.

One initiative she described as important was the creation of a tutoring program for math involving faculty members who teach remedial math, not a separate academic support staff. Lau said that three hours a day, space is available for students to do their homework -- and they are told that they won't be quizzed or bothered if they know what they are doing, and that the faculty help is only there if needed.

Typically they do need some help, but the arrangement makes students more comfortable coming, Lau said. This "just in time" learning is what students don't get if they do their homework at home, without anyone to ask for help. The faculty members (who have time in the center counted toward their course load obligations) get to see exactly which concepts are taking hold and which aren't.

This seemingly small idea is having results. The pre-algebra course completion rate has been 51 percent. But 63 percent of those pre-algebra students who visit the tutoring center at least five times during the semester successfully complete the course, and the percentages go up further for those who visit more. Similar improvements are showing up for those who are in other remedial math courses.

Another innovation is the division of remedial math courses into five modules. Students can continue to take the modules as a single, one-semester course, or they can take the same material (and take the same final exam) divided into five, with topics covered at a slower pace. Typically, she said, a one semester course becomes two semesters of five modules. The slower pace and narrower focus seem to be reaching students with math anxiety, many of whom have previously been unable to get through a single remedial course. Students must also successfully master one module before going to the next, which is key in math, Lau said, since the ideas build on one another.

Started with a few students three years ago, the module approach is now attracting 50 students a semester. And that's even with tough conditions, such as requiring all homework to be done in the student center, with faculty members and others around to assist. Lau said this isn't going to be the way the next generation of engineers is trained, but that this is keeping in the pipeline many students who need some basic math skills.

The college's center has numerous other programs, and also is rigorous about tracking students, all of whom have a swipe card that they use when they come to the center. As a result, the college of 10,500

students knows that it is attracting more than 36,000 visits to the center a year and starting to see improvements in course completion rates.

Fletcher, the dean, said he realizes that the college is making a real investment in time and money and is only starting to see the impact it would like. But he said that it is far more expensive to admit students and never have them progress at all. "If we lose them in the sequence of developmental education, we've lost them as students," he said.

— Scott Jaschik

http://www.google.com.mx/url?sa=t&source=web&ct=res&cd=1&ved=0CBkQFjAA&url=http%3A%2F%2Fwww.insidehighered.com%2Fnews%2F2009%2F10%2F09%2Facct&rct=j&q=Remediation+Worries+and+Successes+&ei=KRAETPqSMpSQMsutjTs&usg=AFQjCNERzi2eicn-Wm-GUJH37ge8DsnBrw&sig2=wssVzVscGIzCQgbXHskmZQ

The DNA Assignment
May 18, 2010

The University of California at Berkeley is an experimental place, and sometimes those experiments start as early as the summer before new students set foot on campus.

This summer, the university's College of Letters and Science -- home to three quarters of Berkeley's 25,000 undergraduates -- will ask freshmen and transfers to return a cotton swab covered in cells collected from their inner cheeks in an effort to introduce them to the emerging field of personalized medicine.

Like so many other institutions, the college usually asks students to read a specific book or watch an assigned movie in the weeks before classes start, to inform discussion during orientation and throughout the fall. But a reading assignment didn't make sense for something as cutting-edge and personalized as genetic analysis.

"Science is moving so fast right now," said Alix Schwartz, director of academic planning for the college's undergraduate division. "If we assigned them a book, it would be out-of-date by the time they read it." Last year's assignment for the program, called "On the Same Page," was Michael Pollan's account of food chains, *The Omnivore's Dilemma.*

This year, said Mark Schlissel, the college's dean of biological sciences, a look at personalized medicine made sense. "For now, it's mostly a research tool, but in the coming years it's going to become part of everyday medical practice, based on your very personal genetics."

Geneticists will analyze each sample for three genes: metabolism of folate, tolerance of lactose and metabolism of alcohol, all relatively innocuous and perhaps useful in students' daily lives. Students will be able to use that information to learn if they should eat more leafy green vegetables, steer clear of milk products or limit alcohol intake.

The idea is not to identify potentially dangerous genes in students' samples, but to point out traits that can be managed through behavior, said Jasper Rine, a professor of genetics, genomics and development. "We want to get people to appreciate that there are things you can do that enhance your health based on the genes you have," he said. "There are concrete, actionable, specific steps that do enhance quality of life. This is the message of the post-genomic era."

Samples will nonetheless be kept confidential. Students will be sent two barcode stickers, one to attach to the submitted sample and the other to keep. "This is all going to be done with institutional safeguards for privacy," Schlissel said. The university's Committee for Protection of Human Subjects scrutinized the plans closely to ensure that the project would be "ethical and private and the like."

Students will be able to check the analysis of their own samples on a website by entering the barcode they have kept. "This is a very participatory way to get them to engage in the conversation, to have something to talk about with their fellow students and with the faculty," Schwartz said. The college will host a website with optional readings, a public lecture delivered by Rine and a series of panel discussions on legal and ethical issues related to the emergence of personalized genomic technologies.

Schwartz said that faculty from throughout the college "are pretty excited about exploring all the issues around personalized medicine because it's so controversial." Regardless of "what kind of disciplinary leanings the students have, we think there will be something that connects them to this at an intellectual or personal level."

Jennifer Keup, director of the National Resource Center for the First-Year Experience and Students in Transition at the University of South Carolina, said Berkeley's project is "the most atypical I've heard about."

Most institutions with an assignment for incoming students choose to assign readings, while a few opt for films or a common service activity over the summer, she said. "There's this idea that you're creating community and introducing students to higher level college thought, and those are the usual ways colleges choose to do it," she said. "But it definitely doesn't surprise me that Berkeley is doing something like this.… It's in line with the culture and ethos and history of the place."

Even so, Schwartz said that, like any good experiment, it's a one-time thing. "I don't think we'd do it again or twice in a row," she said. "Who knows what creative thing the deans will come up with next."

— Jennifer Epstein

http://www.insidehighered.com/news/2010/05/18/berkeley

Why Grading Is Part of My Job
May 18, 2010
By Leonard Cassuto

It's May again. The flowers are growing, the birds are singing, and I'm getting ready to comment on my last stack of student papers of the term. When I finish, I'll assign my students their grades. I'd love to be able to skip that last task and wish them all good luck, so it was with great interest that I read about Professor Cathy Davidson's bold experiment with having her students grade one another. Let me say first that I'm all for the experimentation and the creative study of learning that Davidson is doing at Duke University, and I've long been interested in innovative teaching by Davidson's former colleague Jane Tompkins (who also tried student self-grading) and research by educators like Alfie Kohn, who argues that competition interferes with the learning process. I admire Davidson's scholarship, and I'll look forward to her findings.

But Davidson, Kohn, and others can't increase the number of spots available at medical schools, and they can't allot a company more job openings than its revenue allows. Those entities depend on professors for our judgment of students, and until we can come up with a different way to apportion limited resources, we have to work within the system we have.

Grading certainly has its problems, and I've never met a teacher who enjoyed it. But just as Winston Churchill described democracy as "the worst form of government" except for all the others, so too with grading.

Let me put it more directly. I think avoiding grading (or some comparable form of rigorous evaluation by the instructor) shirks necessary responsibility, avoids necessary comparison, and puts the humanities at even greater risk of bring branded "soft" than they already face.

It doesn't surprise me that 15 of Davidson's 16 students signed off on others' work, eventually entitling them to As. Such an outcome brings to mind Garrison Keillor's description of Lake Wobegon as a community where "all the children are above average."

The bottom line question is this: if everyone gets As, does that mean that Yale Law School will simply accept them all?

If an average class grade is an A, then graduate and professional schools will have to look elsewhere to find out how applicants differ. If I were an admissions officer, the first place I'd look would be to other courses with wider grade distributions, where the instructors rank and compare. Those other courses would weigh more heavily, and the professors who teach them would gain disproportionate influence in the decision process. Put simply, Professor Davidson's colleagues who grade their students would be helping them more than she would.

Perhaps Davidson plans to make distinctions in the recommendations that she'll write for the students when they apply for professional schools and jobs. But isn't that the grading that she was supposed to be avoiding in the first place, now done in secret? Davidson's practice also fuels grade inflation, which disproportionately harms a college's best students by devaluing their high marks. We need to be wary of such trends, and many colleges already are. Harvard recently moved to limit the percentage of its students who graduate with honors, which had swollen to a watery seventy-plus percent. Columbia University includes on a student's transcript the percentage of students who got As in each class that the student took. Dartmouth and McGill are two universities that also contextualize their students' grades. These elite institutions want to create a basis for discernment.

That discernment is personal, and it starts in each classroom. We need to be able to say to students in effect, "You did good work, but not the best in the class." It's a way to be fair to the students and allow them to gain from their achievements.

The goal is not, of course, to make the classroom red in tooth and claw. I work harder at creating learning communities for my undergraduate and graduate students than at anything else I do, and it's been well worth my effort over the years. I know that I have to keep seeking new ways to do this, because I agree with Davidson, Kohn, and others that students learn better when they can share the enterprise with each other.

There's plenty of value to Davidson's collaborative experiment, then — but grading is still part of her job, and mine, and all professors'. If we stop doing it, colleges and universities will eventually lose the esteem of the society that funds us. The humanities, already at risk, will be the chin that absorbs the direct hit.

Parents know that our children respect us when we save our highest praise for the achievements that merit it. I'm a big fan of Cathy Davidson's work, and I've taught it to my own students. But abstaining from giving grades to students isn't one of her better ideas. I say this with all due respect — and discernment. And that's the same respect and discernment that we owe to the work of our students.

Leonard Cassuto is a professor of English at Fordham University, where he was named Graduate Teacher of the Year in 2009.

http://www.insidehighered.com/views/2010/05/18/cassuto

A Difficult Quandary
May 17, 2010
By Eliza Woolf

About a decade ago, shortly after finishing my B.A. at Western Regional State University, I gleefully quit my part-time job as a leasing agent at an apartment complex, packed what little I possessed, said farewell to friends and family, and drove cross country with my cat.

Young, motivated, and naïvely optimistic, I struck out on my own in hopes of hitting intellectual pay dirt as a graduate student in a history doctoral program at the desirably located and overpriced Comprehensive National University (CNU). For me, starting grad school at CNU was as much about living the life of the mind as it was about moving on and finding a change of scene, and I didn't care how much money I had to pay or borrow to get to my destination.

It sounds hopelessly immature now, but at the time I believed that my acceptance into a top 50 humanities Ph.D. program, even *without* funding, was the best thing — career-wise — that had ever happened to me.

I saw my admittance to CNU as a stroke of luck, despite the warnings of a well-meaning academic adviser who cautioned me about the growing shortage of tenure-track jobs in history. Intent on my plan to enter the ivory tower at any cost, this piece of news simply went in one ear and out the other; I was too busy wondering how my application had survived the rigors of the graduate admissions process. Plenty of other undergraduate seniors had only piles of rejection slips from graduate studies' offices to show for their efforts. But not me — I was one of the lucky ones.

By the time I started graduate school I had acquired a long and checkered list of unimpressive part-time and temporary jobs ranging from pet store cashier (duties included cleaning up in-store "accidents"), newspaper delivery driver, and bow tie- and cummerbund-clad university caterer to waitress at a dingy college town diner and medical office receptionist. My nonacademic career, such as it was, as well as that of most of my friends who held a B.A. yet were stuck living with their parents, waiting tables, mopping floors, and acquiescing to customers' whims, led me to the following conclusion: life's too short to work at a miserable job.

At the age of 22 I'd had it with the nonacademic world of low-paid drudgery; it was the life of the mind or bust.

Fast forward to 2010 and I find myself somewhere closer to busting. After many years earning my history doctorate while working as a teaching assistant, hundreds of post-Ph.D. job applications and several futile trips on the global academic job market, a string of temporary postdoctoral fellowships, and a combined student loan and credit card debt large enough to buy a condo, I'm now neither naïve nor optimistic about my future employment prospects.

I still believe in the intrinsic worth of graduate education in the humanities, but it isn't a straightforward route to a professorship and certainly doesn't pay well — surprise, surprise.

Although I began this circuitous path as a doe-eyed 20-something, academia has successfully knocked the rawness of youth out of me. Just as it has given me something to strive for and taught me to be vocal and self-confident, so too has it crushed my spirit, emptied my bank account, and sent me in pursuit of anti-anxiety medication. I've had more sleepless nights, existential and financial crises, and tearful meltdowns in the past 10 years than in the rest of my life combined.

Like many Ph.D.s and A.B.D.s seeking tenure-track employment during the current recession, I have a love-hate relationship with academe. I love it when my efforts are rewarded and hate it when they are trod upon. And most of my efforts are trod upon. But I keep coming back for more.

What gives? Am I a glutton for punishment? Why don't I just find a nonacademic job and be done with it? These are questions I have asked myself on a number of occasions.

The simple answer is: I'm on the fence, torn between my twin desires to pursue the academic dream and to save myself from a life of poverty and uncertainty.

Each moderate success, each small step forward, keeps me in the academic game. I have yet to find a tenure-track job, but I refuse to give up. Still, I'm starting to think it might be wise to come up with a plan B — or two — in the near future.

And I know I'm not alone. A casual survey of adjuncts, visiting professors, postdoctoral fellows, teaching assistants, and chronically un- or underemployed Ph.D.s reveals a striking trend of insecurity, fear, and disillusionment among the newest generation of would-be academics. By now we're aware that our chances of securing tenure-track positions in our various fields are pretty bleak; nonetheless, we haven't deserted the ivory tower in droves. We're pondering our options to be sure, but the vast majority of us are still plugging away on the adjunct track, the visiting professor track, the postdoctoral fellow track, or the A.B.D. track, hoping it will eventually pay off.

Why? What's so great about academe?

I can think of quite a few things, but my inability to abandon ship boils down to these five factors:

1) Academe is the devil I know, and being a professor is what I've trained to do.

2) The promise of autonomy and a flexible schedule is awfully tempting.

3) Research and teaching feel like a career, not a job (service not so much).

4) How else will I pay off my hefty student loan debt?

5) I am terrified of starting over when a tenure-track job could be around the corner.

In this bi-monthly column I intend to pick apart my own and others' preconceptions about both academic and non-academic jobs and to contemplate the social and psychological reasons why it is so hard to walk away from the ivory tower. Along the way I'll also offer career suggestions for those of us caught between a rock and a hard place as we gear up for another academic job-market cycle and dabble in the realm of plan Bs.

I'm hoping to attract a diverse readership and to incorporate readers' thoughts, concerns, personal anecdotes, and questions into future columns. I pledge to be brutally honest with you and hope you'll do the same.

Eliza Woolf (a pseudonym) holds a Ph.D. in history and is currently a freelance writer and postdoctoral fellow at a prestigious British university.

http://www.insidehighered.com/advice/on_the_fence/woolf1

Invasive Weeds? There's An App for That

How is Thoreau like an iPhone? Both gather data about natural phenomena that allow scientists to better protect the environment.

By Enrique Gili

There's an app for that: Scientists and park resource managers have joined forces to create a mobile application to help locate and eradicate harmful non-native plants found in environmentally sensitive public areas.

Cell phone users not content to text and chat can put their minutes to good use for the National Park Service.

Resource managers working in national parks have a new tool in their arsenal to monitor and control invasive weeds. The Center for Embedded Networked Sensing lab at the University of California, Los Angeles, and the Santa Monica Mountains National Recreation Area, have joined forces to create a mobile application to help locate and eradicate harmful non-native plants found in environmentally sensitive public areas.

Commonly referred to as apps, mobile applications have turned handsets into personal information managers with enough whiz-bang technology to make a '60s James Bond villain gasp. The ability to record and document information has transformed cell phones into valuable tools for sharing information among peers and social networks.

"What's Invasive" is an app designed to help rangers locate invasive plants with an assist from amateur naturalists. Nature lovers will be able to identify invasive plants and share that information with park staff. Two full-time park employees dedicate their time to eradicating weeds.

The app can be downloaded to iPhone or Android handsets, enabling park visitors to snap photos, log the location and automatically send files to the "What's Invasive" server. The app identifies a hit list of the worst offenders — six highly invasive weeds that need to be eradicated.

"What's Invasive" is not the only app under development at CENS meant to engage people with the natural world. "Smart phones are making it much easier to collect data and upload with the push of a button; it's kind of revolutionary," said principal investigator Eric Graham.

In the future, Graham hopes information will flow both ways. He wants to build interactive tools directing park visitors to little known or underutilized sections of the 153,000-acre park, places where little information has been gathered on invasive weeds. That, in turn, will make the database more valuable for land managers. "I would love to get people getting involved in the modeling," he said.

CENS plans to partner with National Park Service officials nationwide. Authorized personnel can create a park-specific weed list. Once uploaded to the CENS server, the end user can then enter their park location, download the list, and go for a stroll. Testing of the app has begun in California's Channel Islands National Park and Rock Creek Park in Washington, D.C., among others.

Not every plant with a pretty flower is welcome at public parks. Ecologists note invasive weeds aren't bothersome plants land managers just happen to dislike, but plants that pose a significant threat to native habitats and wildlife.

Bordering Los Angeles presents unusual challenges for land managers at Santa Monica Mountains National Recreation Area, the world's largest urban national park. An extensive network of roads — conduits for invasive weeds — courses through the Santa Monica Mountains; bedroom communities abutting the park bring even more invaders.

The region is home to 1,000 native plants, while an estimated 1,000 non-native plants — brought here via human intervention — grow in Southern California. A small subset of non-native plants, mostly weeds that displace native species or increase the intensity of wildfires, are considered harmful.

"We have a real need for new and up-to-date mapping information," said Christy Brigham, staff ecologist at the park.

In 2006, park officials began a $250,000 survey to identify where invasive weeds could be found; the survey took two years to complete. "Once it's done, it's immediately out of date, and we don't have the have the money or the resources to redo the map every year," she said.

"What's Invasive" is designed to address that problem. With it, park staff can revise maps in real time, incorporating data that can be used to provide a snapshot of where invasive weeds are popping up and where intervention is necessary.

Brigham believes the app's benefits are threefold, as an early detection device, engaging citizen scientists, and as an educational tool for decision-makers. "The great thing about 'What's Invasive' is the more data you have, the better it gets."

During a two-week trial run in 2009, park staff added 1,000 entries to the "What's Invasive" database in a fraction of the time it took to complete the invasive weed map.

But even with that, sifting through scads of data wouldn't rid public lands of invasive weeds. At some point, resources will have to be allocated to remove them from affected areas inside the park, which can be a backbreaking and daunting task.

The apps aren't all about decline. CENS is also developing "What's Blooming," so park visitors can catalogue the diversity of plant life in the Santa Monica Mountains. In tandem, both apps represent useful tools for recording and tracking subtle seasonal changes taking place in nature, a scientific discipline known as phenology.

Phenology has long drawn citizen scientists. The poet Henry David Thoreau cribbed extensive notes on the plants of his native New England, taking meticulous records on bud bursts, range and the appearance of 600 native species.

Today the progeny of Thoreau abound, now equipped with cell phones and digital cameras gathering factoids downloaded to Web-based and mobile applications. Their empirical data on the date and time that buds bloom, insects hatch and migratory birds fly southward can help professional scientists determine whether plant and animal populations are robust or in decline, or when spring is beginning. Citizen observations provide the raw data necessary to build accurate models of the effect climate change is having on local ecosystems.

Although the correlation between climate change and invasive plants is not clearly understood, patterns are beginning to emerge linking warmer weather to the proliferation of non-native plants.

A recently published Harvard study indicated non-native plants in the New England region are germinating 11 days earlier than do native species. Those findings are based in part on the plant diaries Thoreau kept 150 years ago.

In 2007 the federal government got involved, founding the USA National Phenology Network under the aegis of the U.S. Geological Survey. Partnering with universities, conservation groups and state agencies, the network is developing guidelines for collecting digital data.

"Animals," said Jake Weltzin, a USGS scientist and director of the recently established program, "are taking the pulse of the planet."

http://www.miller-mccune.com/science-environment/invasive-weeds-theres-an-app-for-that-15823/

Rerouting Gray Whales By Audio

Researchers are testing a new technology to protect whales from human enterprises by rerouting them.

By Elisabeth Best

Human enterprises and nature often don't mingle well. To that end, researchers are testing a new technology to protect whales by rerouting them. (Dave Weller / ICUN)

Although the government's approval of the nation's first offshore wind project, Cape Wind, has stolen the green-energy spotlight as of late, another renewable energy source has been (literally) making waves off the coasts of Ireland, Hawaii and Australia.

Wave power is a growing industry, albeit one that doesn't yet provide competitively priced green energy. It is very capital intensive, which has prevented its implementation on a broad scale. Still, by one World Energy Council estimate, the solar-power derivative (waves are generated by winds, which are themselves a result of temperature changes) could one day generate up to 2 terawatts of electricity — a significant chunk of the world's current 15-terawatt-per-year appetite.

As with any emerging technology, wave power isn't without drawbacks, such as fears that wave platforms and cables could hurt marine mammals in their habitat. Common concerns involve whales and dolphins getting tangled in cables (unlikely, given the rigid nature of the cables and the pressure on them, but definitely seen in other human endeavors) or colliding with the equipment itself.

New wind-energy endeavors could be harmful to whales, so scientists are testing a new sonar technology to reroute migrating whales. (Dave Weller / ICUN)

"So far, folks think that the prevailing concern for large baleen whales may be blunt trauma from collision with the large cables," Bruce Mate, director of Oregon State University's Marine Mammal Institute and internationally recognized whale expert, told Miller-McCune.com in a phone interview. "The animals don't have the kind of sonar capabilities that dolphins and large toothed whales have, and the visibility isn't good in the waters where these technologies may be deployed."

Mate and his colleagues are working to pre-empt this problem. They plan to use a low-power acoustic device to deter migrating gray whales from cruising in a particular section of their normal path off the coast of Oregon. If successful, the device would add only one one-hundredth of 1 percent to their migration distance, pushing the whales about 500 to 750 meters off their normal route. But it could have far-reaching implications for directing whales out of dangerous situations, ranging from an accidental foray into too-shallow water to into the heart of an oil spill.

Wednesday, the university's Hatfield Marine Science Center hosted a community forum to answer questions about the four-month pilot project, which is funded by U.S. Department of Energy. The experiment will begin in December and will take place in a near-shore area of the ocean west of Yaquina Head that could eventually be the site of a wave-energy plant.

(Although much wave-power research has focused on well-offshore locations, research by Matthew Folley suggests that more power can be harnessed from near-shore waves than was previously thought: He estimates that near-shore waves carry up to 80 or 90 percent of the usable energy found in offshore waves.)

The first wave-energy project off the Oregon coast has already been approved, and, as Mate points out, almost all of the proposed projects fall within the whales' migration paths.

"Right now there are no mitigation tools in place for whales if they are faced with an environmental issue. If you think about the present migration, which allows 80 percent of the population to pass by the West Coast of the United States, it's apparent that the entire population could be at risk for a major calamity, like the Exxon Valdez oil spill," Mate argued. "The equipment that we're testing here could provide a means for deflecting these animals away from these calamities."

The Oregon State scientists' device emits a low-pitched one-second "whoop" sound three times per minute, six hours per day. According to Mate, the sound will probably not even be audible to the whales unless they swim within 500 to 750 meters of the device, but it should be loud enough to subtly change their paths.

Because the whales primarily travel in straight-line trajectories (as Mate found in a 2008 study he conducted with Joel Ortega-Ortiz), the researchers will measure whether they deviate from a straight path when the device is on.

The team is not the first to use whales' reliance on echolocation to protect them. As a 2008 Miller-McCune story documents, Christopher Clark, the director of the Bioacoustics Research Program at Cornell University, has been tracking right whale noises for more than 30 years. Auto-detection buoys in the Massachusetts Bay relay ocean noises to his lab in Cornell; after a right whale has been positively identified in an area, the lab sends out advisories suggesting that ships passing through slow down and look for whales.

Unfortunately, the advisories aren't always followed, and a 2005 study showed that less than 2 percent of ships voluntarily followed them. This is especially troubling considering that the right whale is endangered, and its population numbers between 300 and 400.

Scientists at OSU discovered last year that several right whales exist in an area off the southern tip of Greenland where they were previously thought to be extinct, but their finding is both good and bad news for the whales. Continued polar ice cap melting could lead to the permanent opening of a Northwest or Northeast passage, placing these whales and perhaps other unknown or relocating populations of whales at a greater risk of ship strikes, which already kill 1.2 whales per year on average. (And grays apparently have itchy feet, or fins — one's just been spotted off Israel.)

If successful, Mate's acoustic deterrent device could ease environmental concerns about the wave parks of the future and direct whales away from unsafe waters, be they ship routes or oil spill sites.

http://www.miller-mccune.com/science-environment/rerouting-whales-by-audio-15868/

Extending the Sin Tax to the Tanning Bed

Research has shown that "sin taxes" help reduce consumption of addictive substances like cigarettes and alcohol. Could the same be true for tanning?

By Elisabeth Best

Research shows that 1 million people visit a tanning salon on an average day. (txspiked / flickr.com)

The case against indoor tanning is a strong one: According to the American Academy of Dermatology, indoor tanning before the age of 35 is linked to a 75 percent increase in the risk of developing melanoma, the deadliest form of skin cancer. But the cancer risk hasn't been bad for business — on an average day, more than 1 million people visit indoor tanning salons, and research conducted in 2008 found an average of 42 tanning salons per city in the United States.

Tanning aside, there are more than 1 million new cases of skin cancer diagnosed every year, and an estimated $300 million is spent annually treating melanoma.

If indoor tanning poses such a substantial health risk, why do people — especially teens — keep doing it?

A recently published report by Catherine E. Mosher of Memorial Sloan-Kettering Cancer Center in New York and Sharon Danoff-Burg of the University of Albany, State University of New York, offers one explanation for the rampant use of tanning beds by people who should know better: For some, indoor tanning could be addictive.

The researchers gave 421 study participants two questionnaires traditionally used to test for alcohol and substance abuse that had been modified to measure tanning addiction. They also assessed participants' anxiety, depression and substance use.

For the 229 participants guilty of "fake-baking," the average number of visits made to a tanning salon in the past year was 23. But the scientists found that 90 of these participants met the criteria for tanning addiction on one measure used, and 70 did on another. These "tanaholics" were also more likely to report anxiety and substance use than other study participants.

Meanwhile, in a study released today in the *Archives of Dermatology*, for at least some tanning addicts, clearly pointing out the leathery skin that frequent tanning is likely to produce may be sufficient to cut down on their visits.

There may be a (non-UV) light at the end of the tunnel: A little-known provision in the United States' divisive new health care reform package might be effective in reducing tanning bed use. The legislation imposes a 10 percent tax on indoor tanning to help pay for health care reform. The bill originally taxed

cosmetic surgery at 5 percent — a so-called "Bo-tax" — but opposition from medical and dermatological circles led Congress to a tanning tax instead.

The tanning tax has faced opposition from the industry and tanning aficionados alike. Research suggests that if it resembles other so-called "sin taxes," it just might reduce the use of tanning beds.

Taxes on environmental and social ills, from plastic bag use to obesity, do reduce consumption; one study found that taxing junk food was more effective at improving diet quality than subsidizing fruits and veggies.

And there's plenty of research to support the contention that sin taxes reduce substance use, even for addicts.

One study in the February 2009 issue of *Addiction* found that the more alcoholic beverages cost, the less likely people are to drink. Researchers analyzed 112 studies spanning nearly 40 years and found a concrete relationship between the cost of alcohol and how much of it people consume. Tax or price increases on alcohol reduced use for heavy and light drinkers, young and old, which suggests that a tanning tax might reduce use for casual tanners and tanaholics alike.

Another paper published this year reviewed 72 studies to determine whether making it more expensive to drink might reduce the bad effects of drinking. The researchers found that as the tax or price on alcohol increased, both excessive drinking and poor health due to drinking decreased.

Raising taxes on tobacco also appears to curb use. A fact sheet from the Campaign for Tobacco-Free Kids quotes a 1985 Philip Morris document, "Of all the concerns, there is one — taxation — that alarms us the most. While marketing restrictions and passive smoking [restrictions] do depress volume, in our experience taxation depresses it much more severely."

The same fact sheet suggests that every 10 percent increase in the real price of cigarettes reduces consumption by 3 to 5 percent. However, research from Columbia University suggests that while cigarette taxes do reduce smoking, they also grow the black market for cigarettes in poor neighborhoods. (Imagine a back-alley black market for indoor tanning: suburban housewives sneaking their friends into their garages for tax-free tanning somehow doesn't seem likely.)

Whether or not the tanning tax reduces indoor tanning, it might make tanners feel better about their habit. The National Bureau of Economic Research found that smokers are actually happier when cigarette taxes are higher. James Sadowsky, professor of philosophy at Fordham University, writes, some smokers and moderate drinkers like sin taxes because they make them feel less guilty for their actions.

Still, while it appears that a tax on tanning may be just what the dermatologist ordered, it's important to remember the irony inherent in taxing sin: If the taxes actually discourage "sinful" behavior, they stop being lucrative. In other words, if the tanning tax actually helps addicts kick the habit, it probably won't succeed in raising the $2.7 billion it's supposed to generate.

http://www.miller-mccune.com/health/extending-the-sin-tax-to-the-tanning-bed-16001/

Blondes Have More Funds

If money equals fun, the adage that blondes have more of it appears to be true. Research suggests that blond women make more and marry richer than women with a different hair color.

By Elisabeth Best

Study indicates there's a "pretty premium" for blondes in the workplace. (hidsey/istockphoto)

As a (natural) blonde, I have heard my fair share of "dumb blonde" jokes, ranging from the insidious to the relatively harmless. "How do you keep a blonde busy for hours?" (Write 'Please turn over' on both sides of a piece of paper.) "What do you call a blonde behind the steering wheel of a car?" (An air bag.) The list goes on.

But a new study suggests that blondes are the ones having the last laugh. Research by David W. Johnston, a postdoctoral fellow at the Queensland University of Technology, School of Economics and Finance, indicates that there is a "pretty premium" for blondes in the work force.

As the stereotype goes, blond women are thought to be more attractive but less intelligent than other women. Johnston wondered if these perceived traits had an impact, positive or negative, on blondes' wages.

Using the 1979 cohort of the National Longitudinal Survey of Youth, which interviewed 12,686 Americans annually from 1979 to 1994 and biennially from 1994 to 2006, Johnston looked at the incomes of Caucasian women over the age of 25 who self-identified as naturally light blond or blond. He found that naturally blond women (regardless of their current hair colors) both make more than other women and marry richer than other women.

In fact, blondes make on average 7 percent more than non-blondes, about equal to the income boost attained by an extra year of education. And blondes marry people who make approximately 6 percent more than the spouses of women with other hair colors.

Johnston found few other clear differences between women: There were no systematic differences in educational attainment, immigrant status or marital status based on hair color. He argues that productivity-related characteristics don't appear to drive the differences in wages by hair color; rather, there appears to be a beauty premium for blondes.

Previous research by Markus M. Mobius and Tanya S. Rosenblat attributes the beauty premium to attractive workers being more confident, having greater communication and social skills, and being considered by employers as more productive.

Johnston argues that if the increased earnings are related to attractiveness, blondes would be more productive workers if they have jobs that require them to frequently interact with co-workers or customers. (A 2008 study found that blondes were more successful fundraisers, dollar for dollar, than their brunette counterparts.) He didn't find evidence that the wage premium was occupation-specific, but admits that without a solid determination of which jobs can be done more productively by good-looking people, he cannot be certain.

The effect of hair color on income and spousal income could be even greater than this study shows, Johnston points out, because current blondes who are naturally brunettes could be making more money than the other women in the brunette category. Presumably, there are more brunettes masquerading as blondes than there are blondes hiding their roots.

On the marriage front, he says, it is reasonable to assume that because blond women are more attractive and make more money, they are more successful in marrying more desirable men.

Perhaps "dumb blondes" do pretty well for themselves after all.

http://www.miller-mccune.com/business-economics/blondes-have-more-funds-15665/

Musical Beat Enhances Visual Comprehension

New research finds a link between musical rhythm and visual processing, and offers a tantalizing clue to the art form's origins.

By Tom Jacobs

Research suggests that a musical beat facilitates the visual processing of information. (istockphoto.com)

The origins of music are, necessarily, speculative. Charles Darwin guessed it grew out of courtship rituals, which would explain the continuing popularity of love songs. But a more recent school of thought suggests it emerged to enhance group cooperation and synchronization.

As neuroscientist Steven Brown put it, "Music is a powerful device for promoting group identity, cognition, coordination and catharsis." All of which would come in handy when a party of prehistoric humans headed out in search of food or when one tribe was threatened by another.

Indirect support for this thesis is provided in a study just published in the journal *Acta Psychologica*. In it, a research team led by psychologist Nicolas Escoffier of the National University of Singapore provides evidence that a musical beat "both synchronizes and facilitates concurrent stimulus processing."

Their research suggests rhythm (say, in the form of a drum beat, which continues to play a role in military rituals) helps you to quickly understand what it is you're looking at. This could save your life if you spot a shape that could be either a lion or a rock, and its advantages multiply if you and your hunting partners come to such crucial realizations simultaneously.

Escoffier and his colleagues recruited 36 undergraduates (all of Chinese ancestry) to participate in a visual discrimination test. They were shown a series of photographs — half featuring faces, the other half houses — and instructed to indicate as quickly as possible (by pressing one of two buttons) whether an image was right side up or upside down.

They were told to ignore the music playing in the background, but those sounds were in fact the key to the experiment. For one-third of the test, the appearance of the images was synchronized with the beat. For another third, the images were shown out of sync with the music. The other third were shown in silence.

The results: The students responded faster when there was music playing, and still faster when the appearance of a new image matched the beat of the music. They were able to identify the direction of the faces more rapidly than that of the houses in all three conditions, but the same ratio held: Their swiftest reactions took place when the musical rhythm and the change in image were in sync. (The accuracy rate was around 95 percent for all three conditions; what varied was the speed of the realization.)

Why would hearing music affect visual processing? Escoffier and his colleagues suggest two possible processes. Auditory rhythms have been shown to enhance physiological arousal, which could lead to heightened attention. Alternatively, an insistent rhythm may trigger "changes in attention allocation policies," alerting the brain to focus its limited resources on the matter at hand.

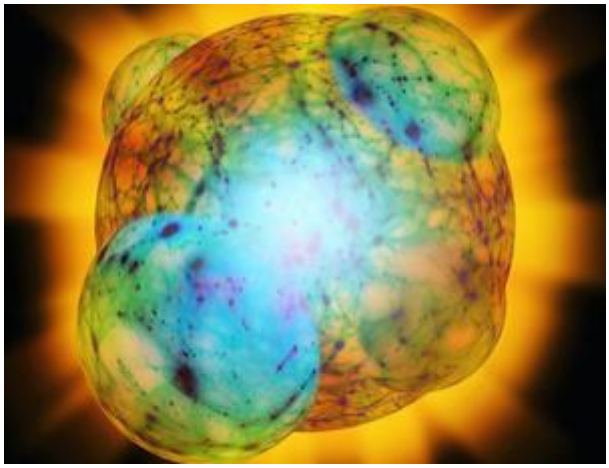
Either way, "musical rhythm appears to be a powerful modulator of human cognitive processes, enhancing their efficiency and allowing synchronization across a group of individuals," they conclude. "Through this synchronization, individuals collectively experience their environment and are able to feel, think, and act as one."

Thus the thrill of sitting in a concert hall and engaging in a mass brain-bond with Beethoven or Bono. To paraphrase George and Ira Gershwin: I got rhythm/And clear vision/We're all in sync/Who could ask for anything more?

http://www.miller-mccune.com/culture-society/musical-beat-enhances-visual-comprehension-15871/

Big bang, part 2: the second inflation

- 19 May 2010 by **Rachel Courtland**
- Magazine issue 2761.



Double bubble (Image: Detlev Van Ravenswaay/SPL)

DID the big bang boil? The birth of our universe could have seethed with hot bubbles and, perhaps, a second period of rapid expansion. Such an episode may have left an imprint on the universe that persists to this day and might mean we're on the wrong track in our hunt for dark matter.

Just 10^{-37} seconds or so after its birth, a period of inflation is thought to have caused the universe to balloon in size. This process is thought to have amplified tiny quantum fluctuations in the vacuum, giving rise to the megastructures we see all around us in the universe today.

A second profound transformation is thought to have followed hot on the heels of inflation. Just microseconds old and at trillions of degrees, the universe condensed from a superhot soup of sub-nuclear particles called a quark-gluon plasma (QGP) into particles such as protons and neutrons. But exactly how this happened is far from clear.

Just microseconds old, the universe condensed from a superhot soup of sub-nuclear particles

Decades ago, physicists suspected the change could have been abrupt and violent. In that scenario, the universe expands through inflation, then the QGP cools down to the point that bubbles spontaneously start to form. These bubbles release spectacular amounts of energy once stored in the vacuum, and particles composed of quarks and gluons are formed. The idea was attractive, not least because as these bubbles collided and merged, their interaction could have sown the seeds of intergalactic magnetic structures that persist today but whose origins are a mystery.

Yet computer simulations of conditions in the early universe soon began to hint that the transition from the superhot QGP to the matter we see today wasn't nearly so dramatic. This culminated in 2006, when Yasumichi Aoki, then at the University of Wuppertal in Germany, and colleagues, reported the results of rigorous simulations that showed that the transition must have been smooth. "That was supposed to be the final word on the subject," says Thomas Schaefer of North Carolina State University in Raleigh.

Now some physicists are arguing that we ought to reconsider whether the cosmos had a bubbly "boiling" birth after all: new analyses suggest the QGP could have bubbled violently as it cooled and might even have been preceded by an additional phase of rapid expansion of the universe.

Aoki and colleagues had simulated a QGP in which matter and antimatter are found in equal amounts. That closely matches conditions in the early universe, which is thought to have contained a billion-and-one particles of matter for every billion particles of antimatter. Almost all of these particles annihilated each other, leaving the relatively small amount of matter that makes up all the stars and galaxies we see today.

Yet last year, Dominik Schwarz and Maik Stuke at Bielefeld University in Germany calculated that the universe could have bubbled and boiled if the initial number of leptons - particles which are not made of quarks, such as electrons and neutrinos - was sufficiently higher than their antiparticle partners (*Journal of Cosmology and Astroparticle Physics*, DOI: 10.1088/1475-7516/2009/11/025).

Now Tillmann Boeckel and Jürgen Schaffner-Bielich at the University of Heidelberg in Germany propose an even more exotic way in which the nascent universe could have boiled. Based on estimates from previous models, they reckon the universe could have bubbled if the quarks outnumbered antiquarks by a ratio of about 2 to 1. Since this asymmetry is significantly greater than generally assumed for the initial state of the universe, the pair suggest that something must have wiped out the evidence. They have dubbed this something a "little inflation".

The pair posit that in a brief period of secondary inflation, the interactions of quarks and gluons drove the universe to expand exponentially before bubbles formed and the transition was complete. This secondary "little inflation" would have washed out signs of a high matter-antimatter asymmetry, they claim (arxiv.org/abs/0906.4520).

That's because our knowledge of the relative levels of matter and antimatter in the moments after the big bang comes from the ratio of matter to the number of photons radiated by the cosmic microwave background, the universe's oldest visible radiation. In Boeckel and Schaffner-Bielich's scenario, extra photons, matter and antimatter released by the bubbles at the end of a little inflation would have resulted in the ratio we observe.

Based on current observations, the universe could only have expanded by a factor of 1000 or so during a second period of inflation. But even this comparatively small inflation could have big implications for the hunt for dark matter, Boeckel warns. Since matter will have been diluted by the additional expansion, more dark matter would have needed to exist in the early universe than is currently thought.

That means the best dark-matter candidates may have different properties from those that are currently favoured. If dark-matter particles were more abundant in the early universe than we thought, they must have a lower likelihood of annihilating with other dark matter particles.

Problematically, these less-interactive dark-matter candidates, if they exist, may be beyond the range of detection of experiments such as the Large Hadron Collider at CERN, says Boeckel. Conversely, if the LHC does find a dark-matter candidate, then his scenario "is probably ruled out automatically", he says.

Right now, the two new studies raise more questions than they answer. The physics of QGPs that contain more matter than antimatter is difficult to calculate, so little is known about how they behave. A big uncertainty is how long the universe would expand and cool before bubbles began to form. "Nobody has calculated that in a reliable way," Schwarz says.

A big uncertainty is how long the universe would expand and cool before bubbles began to form

The universe may well have bubbled, but for now the idea is speculative, says Schaefer, who is not associated with either study. To proceed, he says, physicists must first understand what conditions lead to a such violent, bubbly "first-order phase transitions" in QGPs. New laboratory experiments aim to probe the behaviour of QGPs to hunt for this transition (see diagram). Although QGPs can be created by

colliding heavy atoms like gold, the high energies involved tend to produce equal and abundant amounts of matter and antimatter.

By lowering the energy of collisions - reducing the noise in the data - a team at the Relativistic Heavy Ion Collider at Brookhaven National Laboratory in Upton, New York, hopes to probe the behaviour of the plasmas in scenarios in which quarks outnumber antiquarks by a significant degree. The Facility for Antiproton and Ion Research in Darmstadt, Germany, will begin collisions as early as 2016, hunting for the QGP's phase transition.

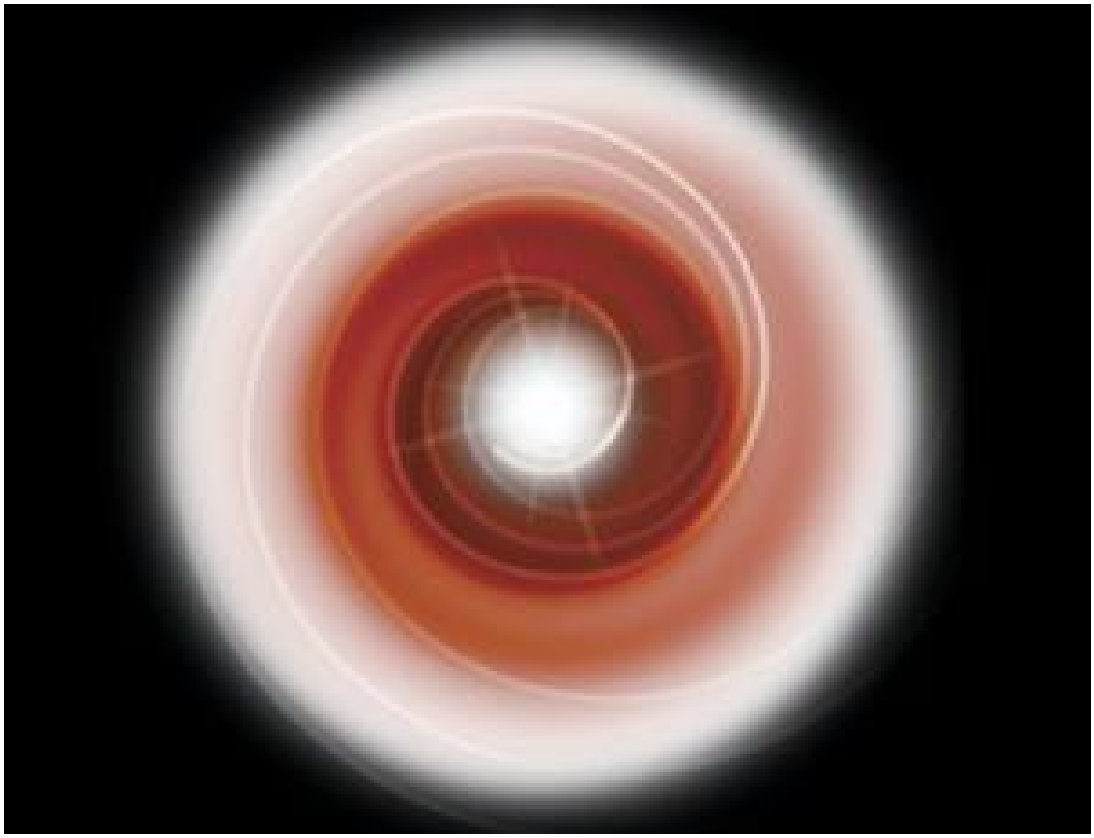
Spotting it is one thing. Demonstrating that a bubbling transition occurred in the early universe is an altogether tougher proposition. One avenue will be to hunt for slight deviations in the rhythmic timing of spinning stars called pulsars. These searches could turn up evidence of gravitational waves created when the bubbles collided.

It had seemed that the nail was in the coffin of boiling-universe hypotheses in 2006, says Schwarz. "It just shows that the story might not be as simple as we think."

http://www.newscientist.com/article/mg20627614.200-the-big-bangs-sequel-contains-scenes-of-violence.html?DCMP=NLC-nletter&nsref=mg20627614.200

Quantum space monster leaps from a gravity well

- 17 May 2010 by **Kate McAlpine**
- Magazine issue 2760.



Having a knock-on effect (Image: M. Weiss/CXC)

GRAVITY may have the power to create quantum monsters. A strong gravitational field can induce a runaway effect in quantum fluctuations in apparently empty space, resulting in a burgeoning concentration of energy that may explode stars or create black holes. So say Daniel Vanzella and William Lima at the University of São Paulo in Brazil.

Quantum phenomena are not thought to have any significant influence over processes on the astrophysical scale, such as the compression of gas clouds into stars. That's the domain of gravity, which in turn is not supposed to be much affected by quantum events, like an elephant unaware of the microbes on its skin. In only a few exotic cases, such as singularities inside black holes, do gravity and quantum-level forces influence the same processes.

Gravity is not supposed to feel quantum events, like an elephant unaware of the microbes on its skin

Now calculations by Vanzella and Lima suggest gravity can trigger a powerful reaction in the fluctuating quantum fields of forces in apparently empty space, and that this reaction may be enough to influence the evolution of large objects like stars.

According to the uncertainty principle, virtual particles quickly pop in and out of existence throughout the vacuum of space. The pair calculate that a sufficiently powerful gravitational field, such as that created by

a dense object like a neutron star, could create a region near the star where these virtual particles become densely packed. Their calculations suggest that the overall energy density of this region will grow exponentially until it dwarfs the energy of the object that generated the gravitational field - a monster of virtual particles that exceeds the strength of its creator.

What that monster could do is still unknown, but Vanzella and Lima speculate that the amassed energy could conceivably explode a neutron star, collapse it into a black hole, or some combination of the two.

However, none of the quantum fields based on known forces, such as electromagnetism, would be capable of causing a neutron star to collapse. Only an as-yet undiscovered quantum field would react to the gravity of a neutron star.

Nevertheless, the pair say that known quantum fields may have an influence on astrophysical processes if they were triggered by gravitational effects on much larger scales - across clusters of galaxies or in superclusters, for example (*Physical Review Letters*, vol 104, p 161102).

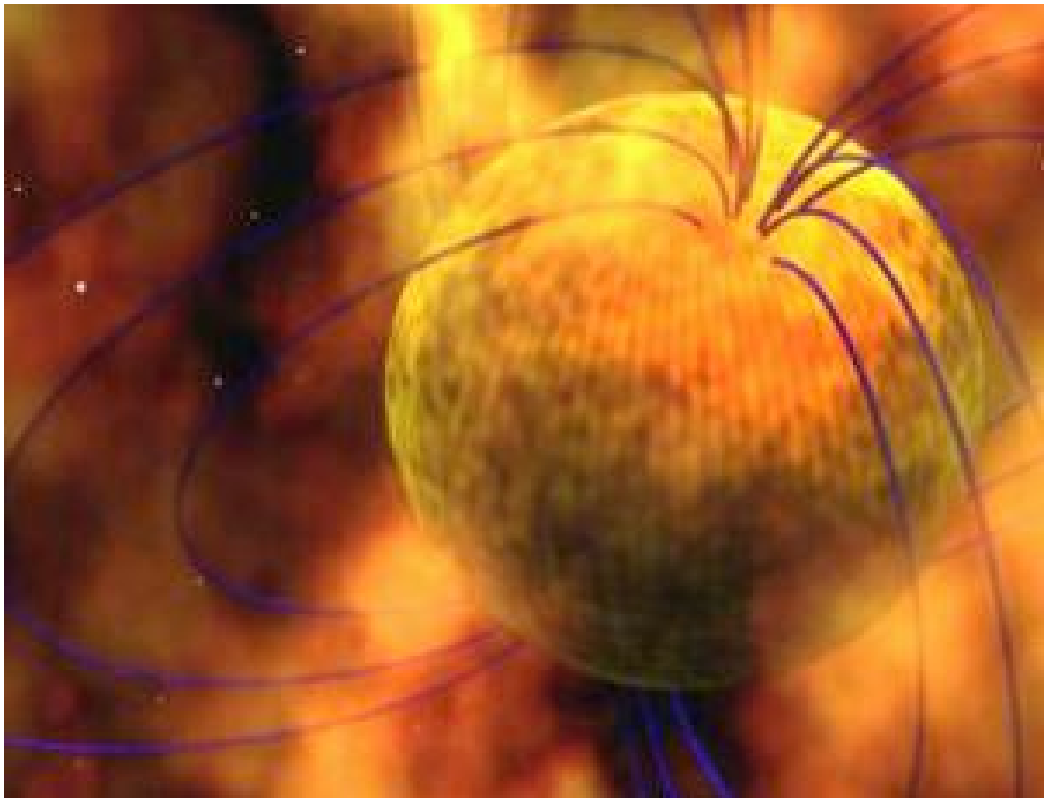
David Toms at the University of Newcastle, UK, is intrigued by the idea. "It is surprising that it was not noted earlier," he says.

Paul Anderson of Wake Forest University in Winston-Salem, North Carolina, is also impressed by the pair's demonstration that quantum fields may occasionally rival gravity as the dominant force on large scales. But he says it is unclear whether the process could have significant astrophysical effects.

http://www.newscientist.com/article/mg20627603.700-quantum-space-monster-leaps-from-a-gravity-well.html

Did exploding stars shatter life's mirror?

- 19 May 2010 by **Marcus Chown**
- Magazine issue 2760.



Explosive twist (Image: Robert Mallozz/Marshall Space Flight Center)

MR SPOCK is dying. Fortunately for the crew of the USS Enterprise, the Spock in question is not the real one, but an evil mirror-image version created in a freak transporter malfunction. This Spock's back-to-front body can digest only right-handed amino acids; meanwhile, like all organic matter, the food around him is made of left-handed amino acids. He is starving in the midst of plenty.

This plot line from the 1970 novel *Spock Must Die!* - the first literary spin-off from the *Star Trek* TV series - highlights one of life's fundamental mysteries. Why does biology use only one of two mirror-image forms in which most complex molecules can occur? The latest pop at an answer weaves astrophysics, particle physics and biochemistry into a startling proposal: that the stellar explosions known as supernovae are to blame.

"It is an intriguing idea," says Daniel Glavin, an astrobiologist at the NASA Goddard Flight Center in Greenbelt, Maryland. It is certainly a novel turn in this twistiest of tales: the story of how life came to be left-handed.

The property of handedness, known to chemists as chirality, is a feature of many molecules whose arrangement of atoms is not completely symmetrical. A chiral molecule comes in two forms that are rather like a pair of gloves. Right and left-handed gloves are essentially identical, with the same basic components, four fingers and a thumb, and the same function of keeping our hands snug and protected. They are not exactly the same, however: you cannot rotate or flip a glove of one type so that it will superimpose perfectly on the other. But look in a mirror, and a left-handed glove becomes right-handed.

Similar molecular mirror-image forms are called enantiomers. They are made from the same atoms and have the same chemical and physical properties. Most chemical reactions produce equal quantities of both.

That makes nature's predilection for one form - its "homochirality" - all the more strange. Only left-handed or "l" amino acids make up the proteins that provide our cells with structure and regulate their functions, and only right-handed or "d" sugars play an active part in biochemistry. It is like keeping a drawer full of only one sort of glove, while stubbornly refusing to wear the other.

Star turn

Perhaps homochirality is the result of a chance asymmetry in life's early history on Earth, amplified by time and evolution. In that case, you might expect it to be non-existent or even reversed elsewhere. Yet the builder's rubble left over from the construction of the solar system tells a different story. "For every type of amino acid found in meteorites there is an excess of the left-handed form over the right-handed of between 2 and 18 per cent," says Uwe Meierhenrich of the Nice Sophia Antipolis University in France. "An excess of the right-handed form has never been found."

Life's asymmetry might have started on Earth - but rubble left over from the solar system's construction tells another story

That alone does not prove anything: meteorites might have become contaminated when they came into contact with the Earth's surface and before they were picked up. But the strong implication is that the left-handed bias pre-dates the existence of life, our planet and indeed our solar system, even if life on Earth amplified it to an extreme.

So is the asymmetry simply a question of basic physics? That is certainly a possibility (see "Disturbance in the force"), but there are other attractive suggestions too. One was identified in 1998, when a team led by Jeremy Bailey of the University of New South Wales in Sydney, Australia, discovered regions in the Orion nebula, a star-forming zone 1300 light years away from Earth, that are suffused with circularly polarised infrared light (*Science*, vol 281, p 672).

Light becomes circularly polarised when its associated electric field vibrates in a plane that rotates clockwise or anticlockwise about its direction of travel. In a nebula, such polarisation could happen when light is scattered off the atoms and molecules, including amino acids, floating around in the gas clouds.

Circularly polarised light interferes with the arrangement of electrons that bind atoms together in such a way that it can selectively break up molecules of one or other chiral form, depending on which way it is rotating. The regions of the Orion nebula identified by Bailey and his colleagues could therefore have an excess of one form of amino acid. A similar situation in the cloud from which our solar system formed could have been the chiral seed from which asymmetric life on Earth grew.

It is a seductive possibility, but it has its problems. The selective destruction of amino acids only kicks in if the light has enough energy to trigger the necessary chemical reactions - in practice requiring the presence of ultraviolet light, rather than the less energetic infrared light seen in the Orion nebula. "No one has detected any of this light yet," says Meierhenrich - although this might be because the gas clouds scatter ultraviolet light so effectively that little of it makes it to our telescopes.

The new scenario sketched by Richard Boyd of the National Ignition Facility in Livermore, California, along with Toshitaka Kajino and Takashi Onaka of the University of Tokyo, Japan, sidesteps this problem. It too starts with a cloud in which molecules, including amino acids, have already formed. But light is not the catalyst for change; instead, it is the combined effect of the immense magnetic fields and the vast fluxes of high-energy particles that are produced in a supernova explosion.

A core-collapse, or type II, supernova occurs when a massive star, its fuel spent, collapses within seconds under its own weight to form a superdense neutron star just tens of kilometres across. This remnant generates an incredibly intense magnetic field, with field lines emerging from its north pole and returning to its south pole, as is the case with Earth's magnetic field.

Atomic nuclei have a quantum-mechanical property known as spin which, all things being equal, aligns itself with a magnetic field. The crux of Boyd's idea is the effect such magnetic fields have on nitrogen-14 nuclei in an amino acid, where a nitrogen atom attaches the defining amine (NH_2) group to a carboxyl group. Within a molecule, nitrogen spins do not have the latitude of movement they would if they were free, and calculations performed by the chemist A. D. Buckingham of the University of Cambridge in 2004 show how switching on a magnetic field in fact produces a rotational effect in different directions for molecules of opposite chiralities (*Chemical Physics Letters*, vol 398, p 1).

As a result, Boyd suggests, when the magnetic field of a supernova remnant starts up, amino acids of one chirality end up with their nitrogen spins pointing along the magnetic field lines, away from the star at the north pole and towards it at the south, while those of the opposite chirality will be forced to align with their nitrogen spins in the opposing direction.

This sets the stage for fireworks as the dying star collapses in on itself, sending an intense blast of neutrinos and antineutrinos spewing out radially in all directions, including along the magnetic field lines. Antineutrinos in particular react readily with nitrogen-14 nuclei, producing a carbon-14 nucleus and a positron. In a similar, energetically less-favoured reaction, neutrinos turn nitrogen-14 into oxygen-14 and an electron. In both cases, once the nitrogen nucleus in an amino acid is hit, the amine group is blown apart and the amino acid disintegrates.

Black hole sun

There is a caveat. Reactions in nature like to conserve spin: they occur more readily if the total magnitude and direction of the spin is equal before and after the reaction. Nitrogen-14 nuclei have a spin of magnitude 1, whereas carbon-14 and oxygen-14 nuclei have no spin. Electrons, neutrinos, positrons and antineutrinos have a spin of magnitude ½. To add to that, the spin of an antineutrino always points in its direction of travel, whereas that of a neutrino points against.

A few more quantum niggles complicate the calculations, but in essence spin conservation means that a neutrino or antineutrino is more likely to blast apart an amino acid whose nitrogen spin points in the opposite direction to its own. The end result is that around one pole, amino acids of one chirality are preferentially shot apart by antineutrinos while neutrinos do something similar to amino acids of the opposite chirality gathered around the other pole, but to a lesser extent as this reaction is energetically less likely. That creates an overall chiral imbalance in the environment of the supernova remnant (arxiv.org/abs/1001.3849).

This, think Boyd and colleagues, is the origin of the chiral preference shown not just in life, but also in the meteorites that have landed on Earth. "The stuff from which our solar system formed was processed by neutrinos from many supernovae," says Boyd. "But they all selected more left-handed amino acids than right-handed ones."

The mechanism is not without its catches. One is that a hail of high-energy gamma-ray photons produced by the supernova explosion could blast apart all the amino acids far and wide, leaving nothing from which to create a chiral imbalance. There is a way round this problem, though, if the remnant created in the supernova is not a neutron star but an even more extreme entity - a black hole.

"This happens in plenty of cases," Boyd says. A black hole simply sucks in light as it forms, eliminating the gamma-ray problem. "If we are right, we owe the left-handedness of amino acids on Earth to the action of black holes."

It is a daring suggestion, but one that so far has raised surprisingly few objections. One is that the size of the asymmetry produced is small. But that might be all that is needed, says Meierhenrich. He points out that experiments have shown that an initial chiral asymmetry of between 1 and 5 per cent can be amplified by "autocatalytic" chemical processes, in which a small excess of one chiral form encourages the production of more of that form.

This is unlikely to happen around a supernova. "The amplification requires a liquid environment like that found in watery asteroids or on the early Earth," says Glavin. So a process that started in a supernova would still have to be finished closer to home.

But are all the chiral twists and turns of this story strictly necessary? A mechanism that involves creating a chirally balanced sample of amino acids, and then selectively destroying them, does seem excessively complex. Why can't we just make a chirally imbalanced amino-acid sample in the first place?

Perhaps we can. One promising alternative explanation for life's handedness is based on the fact that, for every 99 atoms of the isotope carbon-12 that go into making organic molecules, there is one atom of the heavier carbon-13. In April 2009, Tsuneomi Kawasaki and colleagues from Tokyo University of Science in Japan showed that this small natural asymmetry could trigger an autocatalytic process that resulted in an organic product with noticeable chiral asymmetry - although it remains to be seen if this is also true for amino acids (*Science*, vol 324, p 492).

Meierhenrich is following another possible lead. Asked by the European Space Agency in 1997 to design an instrument that could distinguish the two chiral forms of amino acids for its Rosetta probe, which blasted off for a nearby comet in 2004, he and his team tested it by making a "microcomet" from carbon monoxide, carbon dioxide, methanol, ammonia and water. When they mimicked the conditions of outer space by irradiating it with ultraviolet light in a vacuum chamber held at a temperature of 12 kelvin, they found they created 16 different amino acids, in a mixture of right-handed and left-handed forms (*Nature*, vol 416, p 403).

Core question

The team is now planning to blast the samples with circularly polarised ultraviolet light from the newly constructed Soleil synchrotron light source near Paris, France. They hope this will make a chirally imbalanced sample, adding evidence to the idea suggested by Bailey and his colleagues 12 years ago.

With several mechanisms still in the running, it is too early to call an end to the homochirality debate. The next round should begin in 2014, when the Rosetta probe is due to rendezvous with the comet 67P/Churyumov-Gerasimenko. It will dispatch a lander that will drill and analyse a 20-centimetre-deep ice core from the comet, providing a sample of material from the solar system's beginnings guaranteed to be free of contamination, unlike a meteorite that has landed on Earth.

If the amino acids it finds all show a left-handed bias, that would be grist to the mill of Boyd and others who suggest supernovae are behind the asymmetry. If some amino acids are predominantly left-handed and some right-handed, then it might be possible to find a single energy of circularly polarised ultraviolet light that is to blame, putting Bailey's model squarely back in the frame.

Secretly, however, Meierhenrich hopes for another outcome. "Wouldn't it be great if all the amino acids we found were right-handed?" he says. "None of the proposed mechanisms would work then."

Someone else would be pleased with that, too. If homochirality really is a twist specific to life on Earth, somewhere out there a mirrored Mr Spock might find a world in which he could live long and prosper. n

Disturbance in the force

Is homochirality just an illusion? That could be the message from calculations of molecular energies that take into account all the details of basic physics.

When calculating the energy of molecules, chemists usually consider only one of four fundamental forces: the electromagnetic force. That produces no difference between chiral forms, or enantiomers. Some theoretical calculations, however, incorporate the effects of the weak nuclear force, which operates on the level of atomic nuclei. These produce an extremely small difference between left-handed and right-handed molecular forms.

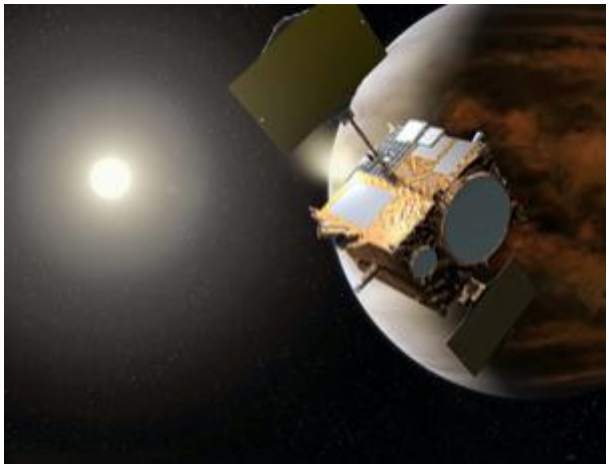
Such calculations are fiendishly complex, and 40 years after they were first performed arguments still rage over their details. Different energies would mean different physical and chemical characteristics, so enantiomers presumed to behave identically would not do so. "If they don't have identical properties, strictly speaking enantiomers do not exist," says Ulrich Meierhenrich of the Nice Sophia Antipolis University in France. In that case, the homochirality problem might melt away on an issue of definition.

Marcus Chown is the author of Afterglow of Creation (Faber & Faber, 2010)

http://www.newscientist.com/article/mg20627601.300-did-exploding-stars-shatter-lifes-mirror.html

Venus orbiter to fly close to super-rotating wind

- 08:00 14 May 2010 by **Rachel Courtland**
- Magazine issue 2760.



Flying close to the wind (Image: Akihiro Ikeshita)

Talk about flying close to the wind. A Japanese interplanetary spacecraft will begin its travels to Venus next week, to get the clearest ever view of massive gusts in the planet's atmosphere.

The Venus Climate Orbiter, called AKATSUKI, aims to find out why blistering winds zip around the planet at speeds of up to 400 kilometres per hour. The upper clouds can circle the planet in four days or even less, and no one knows why. The effect is called "super-rotation", because the bulk of the atmosphere is rotating much faster than the planet itself. Venus takes 243 Earth days to make one rotation.

To investigate, AKATSUKI will move roughly in sync with the winds during part of its orbit, so it can track a patch of atmosphere for about 24 hours at a stretch. Five cameras will snap the planet at different wavelengths. "By combining the images from these cameras we can develop a three-dimensional model of the Venus atmosphere," says mission scientist Takeshi Imamura. This will be the first time such measurements have been taken on a planet other than Earth, he adds.

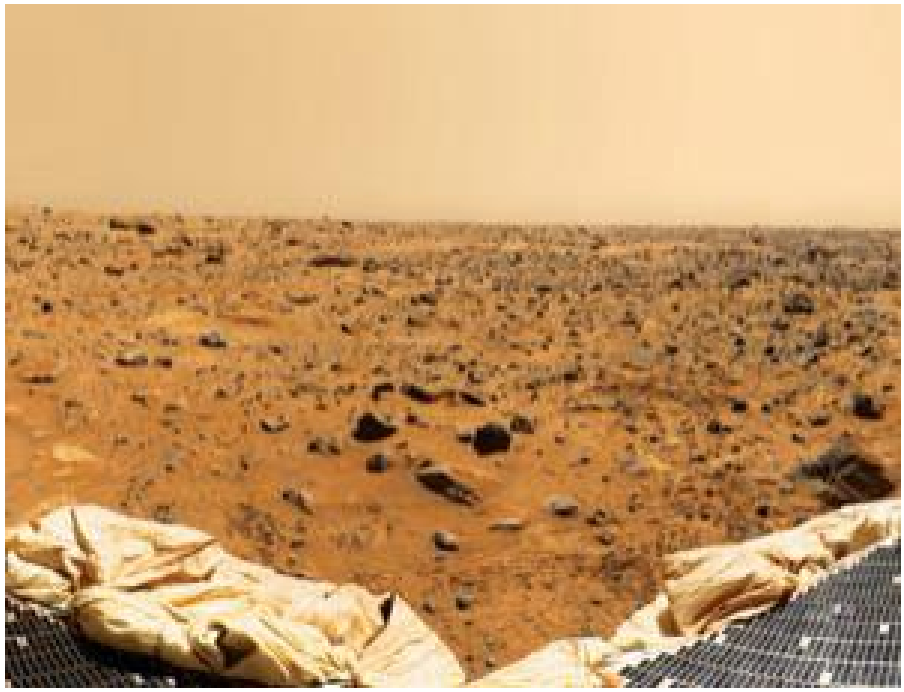
AKATSUKI will be particularly well equipped to study slower winds that move north and south from the planet's equator, which may well play a significant role in the atmosphere's rotation. The European Space Agency's Venus Express, which is in orbit around the planet, can already see these meridional winds. "But the error bars are quite wide," says ESA's Håkan Svedhem. "We can't really tell anything about the seasonal or day-to-day variability."

Plans for joint observations using the two spacecraft are in the works.

http://www.newscientist.com/article/dn18892-venus-orbiter-to-fly-close-to-superrotating-wind.html

Designing greenhouses for the Red Planet

- 29 April 2010 by **Rowan Hooper**
- Magazine issue 2758.



No home-like place, yet (Image: JPL/NASA)

The creation of a human outpost on Mars is still some way off, but that hasn't stopped us planning the garden. At Kennedy Space Center on April 15, President Barack Obama announced the intention to send humans to Mars by the mid-2030s. If all goes to plan, NASA will kick off an era of space exploration not seen since the Apollo moon programme in the 1960s.

If getting to Mars is a big step, ultimately staying there will be a giant leap. But already, experiments conducted in space and in simulated Martian conditions on Earth have yielded micro-organisms that will eventually help turn Martian rocks into soil, generate oxygen for us to breathe, purify water and recycle waste. Think of these microbial colonies as the first gardens on Mars.

Karen Olsson-Francis at the Planetary and Space Sciences Research Institute of the Open University in Milton Keynes, UK, is part of a team that subjects terrestrial organisms to extreme stresses. The group has conducted experiments on the International Space Station (ISS) and as part of the Biopan VI mission run by the European Space Agency (ESA).

Biopan was a capsule loaded with - among others - samples of rocks from the sea cliffs at Beer on the south-west coast of England. It was carried by a Soyuz rocket into low Earth orbit in 2007. Once there, the capsule exposed its contents to the vacuum of space. The Beer rocks are home to a broad spectrum of microbes, including photosynthesising cyanobacteria. "We thought it would be fun to send Beer into space," says Olsson-Francis.

By the time the Biopan samples were recovered, they had endured 10 days of space exposure, though the sun's lethal UV radiation had mostly been filtered out. The team discovered a cyanobacterium new to science that had survived the ride (*Applied and Environmental Microbiology*, DOI: 10.1128/aem.02547-

09). The experiments were not designed with space gardens in mind, but their findings are relevant. The high levels of UV radiation on Mars essentially sterilise anything left on the surface, so space gardens would need the protection of greenhouses (see diagram). "The experiments demonstrated that we can use low Earth orbit to select for resistant organisms that could potentially be used in space applications," says Olsson-Francis.

Rocks placed into orbit also provide support for the lithopanspermia hypothesis - the idea that living cells can be transported through space in meteorites. Meteor impacts onto a life-bearing planet may throw rocky debris containing living micro-organisms into space, and if those organisms can survive the vacuum of space then they can start to grow again if they ever find themselves landing on a barren planet with otherwise suitable conditions.

The organisms in the planned Martian gardens will, of course, be transported by spacecraft. Nevertheless, astronauts will need them to be tough enough to survive in a compact, dormant state - as seeds and spores, for instance - and able to tolerate equipment failure and exposure to unshielded extremes.

Cyanobacteria photosynthesise, so they are good candidates for use in long-term space missions or on crewed outposts. That's because colonists will need organisms that are "primary producers", which are able to directly use the energy of sunlight to grow. For this reason, cyanobacteria are part of the self-contained recycling system being designed by ESA. The MELiSSA loop, or Micro-Ecological Life Support System Alternative, recycles human waste into water, oxygen and nutrients that astronauts and Martian colonists can use. Cyanobacteria are used to make the protein-rich food supplement spirulina, which ESA has named as one of its nine essential crops to grow on Mars.

As non-terrestrial locations for gardens go, Mars isn't too bad. On the Martian equator in midsummer, the temperature can reach 20 °C, and the atmosphere is 95 per cent carbon dioxide, which is fabulous news for photosynthesisers. But there's one fundamental garden ingredient missing: soil.

The first Mars gardener could just slop fertiliser onto pulverised Martian rocks; experiments using rocks from Antarctica have shown that plants can grow in this way. In the longer term, though, we need a way of turning the volcanic basalt that makes up most of the Martian surface into a plant-supporting structure.

Basalt-eating bacteria could be the answer, suggests Paul Wilkinson, also at the Open University. He is hunting inside Icelandic basalts for organisms capable of surviving on a diet of Martian rocks. "The [terrestrial] rocks are positively teeming with microbial life," he says. "If these microbes were on Mars and capable of surviving and growing, they would go some way to conditioning the rock for higher-order plant life."

If these microbes were on Mars, they could help to condition the rock for higher-order plant life

Wilkinson, who presented his results in April at the Astrobiology Society of Britain meeting at Royal Holloway, University of London, used genetic profiling to identify some of the organisms in the Icelandic rocks. He also managed to grow them in media rich in heavy metals such as copper, nickel, zinc and chromium. This suggests space gardeners will be able to call on bacteria tolerant of the iron prevalent in the rust-hued rocks of the Red Planet.

The real kings of rock processing, though, are the lichens, says Wilkinson. Happily, rock-colonising lichens were also among the organisms that survived exposure to space in the Biopan experiment. What's more, a team led by Jean-Pierre de Vera at the Institute of Planetary Research in Berlin, Germany, has subjected lichens to conditions similar to those found on some parts of Mars - but without the lethal levels of UV radiation. The lichens were able to photosynthesise (*Astrobiology*, DOI: 10.1089/ast.2009.0362).

None of this is to say that astrobiologists are seriously talking about terraforming Mars, not in the immediate future at least. But, piece by piece, the elements of a starter kit for the first colonists are

coming together. Housed in a pressurised greenhouse and populated by vats of micro-organisms that will supply oxygen and food, and transform Martian rocks into fertile soil, the first alien garden is not as far off as it appears.

Beware the sun and protect the locals

When it comes to gardens, Earth's red neighbour has way too much of a bad thing: ultraviolet radiation. With no ozone layer, Mars cannot screen the lethal amounts of UV emitted by the sun. Two schemes can overcome this.

In one scenario, Mars is terraformed to make it more Earth-like. This could involve putting potent greenhouse gases like CFCs into the atmosphere to warm it up, and also making a UV screen, perhaps from ozone, says Lewis Dartnell of University College London. This is a long-term planet-sized engineering scheme, and is not something scientists are even considering at the moment. Much more manageable, then, would be biosphere-based greenhouse gardens.

Any scheme will involve exporting life to Mars. This would immediately bring into play planetary protection guidelines that aim to prevent other planets from being contaminated with terrestrial life.

The international Committee on Space Research (COSPAR), which provides guidelines for space agencies, classes a trip to the Martian surface as a category IV mission. This means it considers that Mars may already host life which could be contaminated by Earth life. COSPAR's rules mean that spacecraft landing on Mars must be virtually sterile, carrying no more than 300 spores of *Bacillus* bacteria per square metre. In reality, the Mars rovers and Polar Lander missions have probably already contaminated Mars with terrestrial life.

http://www.newscientist.com/article/mg20627583.700-designing-greenhouses-for-the-red-planet.html

Modern cars vulnerable to malicious hacks

- 05:00 14 May 2010 by **Jim Giles**

Hackers may be able to seize control of a driving car (Image: erbag/Stock Xchng)

The idea of hackers breaking into your personal computer is alarming enough. But what if they could seize control of your car's control systems while you are driving? Using a laptop and custom-written software, security researchers have hacked into the control systems of a family car, disabled the brakes and turned off the engine while the vehicle was moving.

Fortunately, the hack is technically difficult and the risk to drivers is low – for now. But the benign hackers, led by Tadayoshi Kohno at the University of Washington in Seattle and Stefan Savage at the University of California, San Diego, have revealed the details to encourage car makers to make future vehicles more secure.

Computers help control many systems in modern vehicles, from anti-lock braking systems to the timing of ignition. Each system typically has its own dedicated computer controller, which is connected to a network that can be accessed by mechanics via a socket under the dashboard.

Disabled brakes

Kohno and Savage's team tested two 2009 sedans of the same make and model, which they decline to name. In a paper to be presented next week at the IEEE Symposium on Security and Privacy in Oakland, California, they describe how they plugged a laptop into the control socket and used software called CarShark to send signals into the car's networks. By sending random commands and observing the effect of each, they were able to decipher the language used by the control systems.

In tests on a disused airfield in Washington state, with the laptop plugged into a control network, the researchers were able to kill the engine and disable the brakes of a car moving at 65 kilometres per hour. They were also able to instantaneously lock the brakes.

Clearly, drivers would notice a laptop plugged into their car's control systems. But it would be possible to achieve the same result with less obtrusive hardware that could be controlled remotely. Still more alarmingly, the researchers say they also took control of a car using wireless signals and operated it via the internet, but would not provide further details of this part of the study.

'Car tuning'

Although the attacks sound alarming, they require a high level of knowledge to carry out. "Car tuning" enthusiasts have similarly discovered how to control many of the systems the researchers compromised – although there is no evidence of anyone using these methods to malicious ends. Industry experts say they have never seen such attacks being used outside of the new experiment.

Savage says that the car industry's attitude to system security is similar to that of the computer industry prior to the internet – which exposed computers to attack and revealed many vulnerabilities.

"This industry hasn't had to deal with adversarial pressure, so its defences haven't had to be that strong," Savage says. He hopes that industry and regulators will come together to develop a consensus on how to protect cars before such attacks are attempted.

http://www.newscientist.com/article/dn18901-modern-cars-vulnerable-to-malicious-hacks.html

Innovation: Teaching robots some manners

- 13:07 17 May 2010 by **Colin Barras**
- For similar stories, visit the **Robots** , **Innovation** and **The Human Brain** Topic Guides

Be nice to the robot (Image: Capital Press Agency/Rex Features)

Innovation *is our regular column that highlights emerging technological ideas and where they may lead*

Where PCs are concerned, faster is invariably better. But things aren't so clear-cut in human society. The next generation of social robots will be better loved if they adopt more human-like behaviour – even if that means losing some of their raw efficiency.

Norihiro Hagita and colleagues at the ATR laboratories in Kyoto, Japan, asked 38 volunteers to click on a PC mouse to enlarge an image. The response was programmed to be delayed by 1 to 3 seconds. As expected, an immediate response was most favoured, and participants expressed more and more dissatisfaction as the delay lengthened.

But a version of the experiment that involved a humanoid robot threw up a surprising result. The volunteers were asked to tell the robot to take out the rubbish, and the robot verbally acknowledged the request. This time an immediate response – beginning the moment the volunteer finished talking – was considered less welcome than one that was delayed by a second.

Bilge Mutlu at the University of Wisconsin-Madison, who studies social human-robot interactions, finds that result informative. "In the interaction with the PC, what is efficient is that the system does a given command as soon as possible," he says. "In the interaction with the robot, what is efficient is that the robot follows the norms of the conversation, which includes a seemingly inefficient 1 second delay."

Don't butt in

Mutlu's work also suggests that robots should modify their behaviour, often in apparently inefficient ways, to be appreciated. He asked local hospital workers for their thoughts on their latest mechanical colleague, a box-like robot called TUG. Those who said they resented the robot objected primarily to its lack of social graces. Where a human trying to deliver a message to a colleague might pause if the other is on the phone, for instance, TUG – seeking efficiency – minimises the time taken to deliver the message by blurting it out.

Aethon, the company that builds TUG – based in Pittsburg, Pennsylvania – says it's learning from Mutlu's work. The robot can now be programmed to talk in hushed tones at night, for example – but teaching it when to hold its tongue could be more difficult. Although psychologists have explored social norms for decades, roboticists have not needed to. "We often don't know what these socially acceptable norms and rules are," says Mutlu. So expecting their robots to display them is asking a lot.

Don't barge in

Some researchers are, however, trying to do just that. One accusation levelled at TUG was that it "just barrels right on" through a crowd of people rather than moving to one side to let patients pass. Peter Henry and Christian Vollmer's team at the University of Washington, Seattle, think they can help robots learn to move through a crowd as humans do.

Rather than pre-programming fixed instructions, the team thinks it's simpler to drop a robot untrained into the real world but equip it with the smarts to study and mimic the behaviour of those around them.

They have developed an algorithm that allows a virtual robot to navigate a crowd as a human might by first monitoring how the properties of the crowd – density and flow – affect the way virtual crowd members move through the throng.

"If a human takes a geometrically longer route avoiding the crowd, our planner would learn to do the same thing," Henry says (see video). That contrasts with the typical approach adopted by robots – taking the shortest and thus most efficient route to a goal, which, as Mutlu's study shows, can lead to resentment.

Mutlu thinks Henry's study is a step in the right direction. As robots become increasingly integrated with the everyday world, what constitutes "efficient robotic behaviour" looks set to change, he says. "Even if it is inefficient based on other criteria, 'socially acceptable' behaviour is what is efficient for technology that interacts with people."

References: Hagita's robot study is in the *Proceedings of the Third ACM/IEEE International Conference on Human-Robot Interaction*; Henry and Vollmer's study was presented at the IEEE International Conference on Robotics and Automation in Anchorage, Alaska, this month

http://www.newscientist.com/article/dn18913-innovation-teaching-robots-some-manners.html

Quantum snooper could make positive ID from one photon

- 13:44 19 May 2010 by **Colin Barras**

Spooky snooping (Image: Jed Share/Getty)

It could be the ultimate snooping tool: a single photon that can identify objects without interacting with them. So say a group of physicists who have developed a way to detect the presence of a known object without seeing it.

Physicists have been experimenting with ghost imaging – identifying objects without directly looking at them – for over a decade. They split a laser beam and use half to illuminate the target object, behind which a high-precision photon detector is placed. The other half is sent to a second photon detector acting as a camera – both detectors equidistant from the laser source.

The laser occasionally kicks out two identical photons at precisely the same time, which occupy the same position in the laser beam, even if the beam is split. Thus by only collecting the spatial information when both photon detectors register a simultaneous hit, a virtual shadow of the target object gradually appears on the "camera" detector, because only the identical photons that pass by the target object rather than ping off it will reach the detector behind.

But the need for many identical photons to build up the shadows makes ghost imaging ill-suited to dark conditions, says Robert Boyd at the University of Rochester, New York.

"We could of course illuminate the object with a search light, but doing so announces the fact that we're looking, and gives away our location," he says. With colleagues, he has suggested an alternative method, which can theoretically identify an object from a single photon pair and thus avoid detection even in low light.

Ghost in the machine

Boyd's system relies on a holographic plate, which must be constructed in advance, and can so far identify only transparent objects. First, a laser beam is sent through the object of interest, which modifies the beam with a characteristic pattern. Beyond the object, the beam is made to interfere with a second "reference" laser beam coming from a different direction, and the resulting interference pattern is recorded onto a holographic plate.

That process is repeated for all the objects that the viewer is interested in identifying, each time using a reference beam coming from a different direction. A single holographic plate can store up to 10,000 such images, Boyd says.

Then the holographic plate is incorporated into the "ghost imaging" setup. This time, one of the split beams is directed onto the holographic plate rather than the second photon detector.

There's some doubt over whether the identical photon pairs used in ghost imaging are entangled at a quantum level or not, but those in the new system certainly seem to be. That's because if the behaviour of one is modified, the behaviour of the other changes in an identical way regardless of the distance between them.

When one member of an entangled photon pair is modified by passing through the object to be identified, its pair passing through the holograph is also modified in the same way. Those modifications cause the photon to be diffracted in a direction specified by the reference beam that was used to create the holographic pattern.

A series of detectors behind the holographic plate – each aligned with one of the expected diffraction directions – makes it possible to identify an object of interest.

Less is more

It takes only one detected photon pair to establish the object's identity, says Boyd – although in the real world the detectors won't register a hit with every incoming photon, so several might be needed to get a positive ID.

The system does have some drawbacks – for instance, it can only identify objects if they've already been encoded into the holographic plate. But there are situations, for instance in military contexts, where that could still be useful. "We might simply want to know if it's our airplane or theirs," Boyd says.

But before the technique can be used in such settings it must be adapted to work with opaque rather than transparent objects. In 2008 a team based at the University of Maryland, Baltimore County, became the first to demonstrate a ghost imaging technique that uses the photons scattered off an object (Physical Review A, DOI:10.1103/PhysRevA.77.041801) – like standard photography – rather than those transmitted through it. Boyd says it should be possible in principle to adapt the new technique to work with such scattered photons.

But Yanhua Shih, a member of the Maryland team, thinks that even if that is possible, the results will be no match for the clearer picture of an object that his camera produces by using thousands of photons. "A few photons can only provide very limited information, but the research team may be happy with this," he says.

Journal reference: *Physical Review Letters*, in press

http://www.newscientist.com/article/dn18936-quantum-snooper-could-make-positive-id-from-one-photon.html

New deep-sea cables needed to protect global economy

- 18 May 2010 by **Paul Marks**

Magazine issue 2760.

Laying down the line (Image: Luis Marden/Getty)

URGENT action is needed to diversify the global deep-sea cable networks on which the internet depends, to secure them against attacks and accidents that could lead to economic turmoil.

So says a report that highlights the vulnerability of businesses worldwide to the targeting of "choke points" in subsea communications networks by saboteurs, pirates and thieves.

International internet and telephone links are almost entirely dependent on bundles of fibre-optic cables that span the oceans. "More than 99 per cent of intercontinental data traffic goes via submarine cable rather than satellite," says Alan Mauldin, an analyst at Telegeography Research, a New York-based market research firm. "People don't realise the vast role cables play."

It's time they did, says Karl Rauscher, the former Bell Labs engineer who compiled the Institute of Electrical and Electronics Engineers' (IEEE) report presented at the Worldwide Cybersecurity Summit in Dallas, Texas, last week.

The large number of cables passing through choke points, such as the Strait of Malacca near Singapore, the Luzon Strait between Taiwan and the Philippines, and the Suez Canal, are especially vulnerable, the report says. Damage to the cables at these points could lead to phone networks becoming jammed and internet traffic slowing to a crawl.

Accidents are the commonest cause of disruption, with cables becoming tangled in fishing nets or in ships' anchors. Theft of cables for the valuable metal they contain is a growing problem, and has been a major cause of communications outages in south-east Asia over the past decade. The recent increase in the activity of pirates off the Somali coast led to the planned route of a new cable between Kenya and the United Arab Emirates being moved 200 kilometres to the east.

It is not just key connections in the cable network that are vulnerable, says the report. Specialised cable-repair ships could also be targeted by pirates.

The IEEE report calls for new cables to be laid on different routes to provide back-up to vulnerable points in the network. This is already happening in the eastern Mediterranean, where later this year five new cables will provide rerouteing options (see diagram). These are being laid following repeated breaks in the link between Europe and the Middle East temporarily cutting communications, the most recent happening last month.

The report proposes the establishment of a global body to govern the undersea cable industry. However, competition between commercial operators might be an obstacle, says Mauldin. "They don't like to share much information," he says.

Paolo Rosa at the International Telecommunications Union in Geneva, Switzerland, backed the creation of a new global body. It would be of particular help to developing nations, he says.

http://www.newscientist.com/article/mg20627605.500-new-deepsea-cables-needed-to-protect-global-economy.html

History of social network use reveals your identity

- 14:17 18 May 2010 by **Jim Giles**

When you sign up to a membership group on a social networking site you may be revealing more than you bargained for.

An experimental website has managed to identify the names of people who visit it, by harvesting information about the groups they belong to. It's a trick marketing teams and scammers would love to copy.

The snooping site exploits the fact that your web browser keeps track of which web addresses you have visited. Website owners can glean this information by hiding a list of web addresses in the code for their web page. When someone accesses this page, their browser will tell the website owner which of the hidden addresses they have already visited.

Membership groups within social networks have distinct web addresses: the *New Scientist* group on Facebook, for example, is accessed via www.facebook.com/newscientist. What's more, the names of group members are publicly available.

Gilbert Wondracek at the Vienna University of Technology in Austria and his colleagues collected data on 6500 groups, containing 1.8 million users, on Xing, a business-oriented social network based in Hamburg, Germany. After analysing the overlap between membership lists they estimated that 42 per cent of users could be uniquely identified by the groups they visit.

Unique interests

The researchers then built a website that read visitors' history of browsing Xing addresses. When they asked 26 friends and colleagues who use Xing to try it, they were able to identify 15 of them. Wondracek's paper showing how this was done was presented at the IEEE Symposium on Security and Privacy in Oakland, California, this week.

Since Wondracek's experiment, Xing has started adding random numbers to the addresses used to access its membership groups. The Xing server ignores the extra numbers, but they confuse attacks by a site like Wondracek's.

Arvind Narayanan, a computer scientist at Stanford University in California, fears that this may not be enough to fend off similar attacks, especially if they use multiple social networks and other websites that host membership groups. It is unlikely that all such sites will use random characters to mask addresses, he points out.

More complete protection may come in the next round of browser updates. The developers of Firefox, Chrome and Safari are working on fixes that will prevent browsing history being relayed back to website owners. Microsoft declined to say whether it is working on a something similar for Internet Explorer, the web's most popular browser.

Jim Giles tweets at twitter.com/jimgiles

http://www.newscientist.com/article/dn18924-history-of-social-network-use-reveals-your-identity.html

cellphones don't cause tumours (probably)

- 16:43 17 May 2010 by **Nic Fleming**

Magazine issue 2761.

Still getting a mixed signal (Image: Vesa Moilanen/Rex Features)

Do cellphones cause brain tumours? The World Health Organization hoped a $30 million study, involving 50 scientists in 13 countries, would provide an answer. But its "Interphone" study reported its final results this week and, sadly, we remain none the wiser.

"An increased risk of brain cancer is not established, but it's important to note that we can't establish absence of risk either," says study leader Elisabeth Cardis of the Centre for Research in Environmental Epidemiology in Barcelona, Spain.

So why can't Cardis be more conclusive? In a retrospective study, between 2000 and 2006 her team enlisted 6400 people with brain tumours and a similar number of healthy people. They were then quizzed on how much they used a cellphone.

Problem sample

The idea was that if the phones boost the risk of tumours, there would be more phone use in the tumour group compared with the general population, and less phone use in the healthy group. In fact, the team found the opposite.

Good news for cellphone addicts? Not so fast. When the team got back in touch with healthy people who had declined to take part in the study, they discovered that these people were less likely to be regular phone users (defined as making more than one call a week for more than six months) than the healthy people who took part.

This means that the benefit that cellphones seemed to offer could simply be down to an over-representation of people who were both healthy and regular users. It also means that any detrimental effects might have been masked.

Despite this bias towards positive results, when the researchers compared the 10 per cent of cellphone users who spent the most time on their phones with non-users and infrequent users (defined as less than one call per week), this level of use did appear to increase the risk of gliomas by 40 per cent and meningiomas by 15 per cent.

Recall bias

These increases became even more pronounced when only tumours on the same side of the head to which sufferers said they held their cellphones were counted. Frustratingly, the extent to which even these findings can be trusted is unclear, due to another problem.

Because the study was retrospective, the researchers relied on participants' memories – going back up to 10 years – of how much they had used their handsets before being enrolled, and on which side of the head. Yet people who are ill have a tendency – known as "recall bias" – to exaggerate memories of potential risk factors than healthy controls.

What should we make of all this? Cardis advises caution: "It may not be an unreasonable course of action to limit exposure through the use of text messages, hands-free devices and speaker phones."

But Mike Repacholi, who helped set up the study while at the WHO, is more positive: "The study says use of cellphones isn't associated with tumours."

Further studies are underway, but don't hold the line: the prospective Cosmos study hasn't begun yet, and aims to follow users for 20 to 30 years.

Journal reference: *International Journal of Epidemiology*, DOI: 10.1093/ije/dyq079

http://www.newscientist.com/article/dn18920-dont-hang-up-cellphones-dont-cause-tumours-probably.html

What the climate bill means for the US way of life

- Updated 16:08 18 May 2010 by **Jim Giles**

Can they keep burning? (Image: WestEnd61/Rex Features)

The refusal of successive US governments to limit greenhouse gas emissions infuriates environmentalists – but things may be about to change. Last week, Democratic senator John Kerry and Joe Lieberman, an independent, unveiled the American Power Act – a climate bill that has President Barack Obama's backing. The text's 1000-odd pages contain proposals that would shake up the US economy and reinvigorate global climate-change negotiations. Here's what the bill means for US citizens and the rest of the world.

Will the bill really rein in US greenhouse gas emissions?

The headline figures – a 4.5 per cut in emissions by 2013 and 17 per cent by 2020 – sound impressive. But the senators have pegged those cuts to a 2005 baseline. Many other countries use 1990 and, compared with that reference point, the 2020 target amounts to no more than a 3 per cent cut. The European Union has committed to a 20 per cent reduction over the same period – and some climate scientists have called that "inadequate".

But the bill is still hugely important. It tells US businesses to prepare for a future in which emissions will fall, and that will spur investment in energy efficiency and renewable energy. The emissions targets could also be tightened up at a future date.

Will the bill hit US lifestyles?

That's what critics of the proposals would like voters to believe. The bill makes businesses pay for emissions, which will drive up the price of electricity from fossil-fuel sources. Costlier electricity, say critics, will make many products more expensive and put people out of work.

Yet economic analyses paint a different picture. A similar bill was passed by the House of Representatives last year and has since been studied by the US Environmental Protection Agency (EPA). The new Senate version of the bill is similar enough to the House bill to assume that the EPA's assessment holds: it predicts that enacting the bill would cause household consumption to drop by a few hundredths of one per cent by 2015, and by around 0.1 per cent by 2020.

This fall is negligible because consumers will react to higher electricity prices by adopting energy-conservation measures, such as buying more efficient appliances, says Richard Goettle at Northeastern University in Boston, who worked on the EPA analysis. Electricity costs more, but consumers adapt to use less of it and maintain their lifestyles at the same time.

Won't gasoline prices go up?

Yes: Goettle's study predicts that the bill will add about 20¢ to gasoline prices by 2020. But the US economy has been hit by larger increases without suffering too much. Gasoline prices have approximately doubled over the past decade, for example.

The downside is that a bigger price increase would encourage drivers to buy energy-efficient cars and drive less. Christopher Knittel, an economist at the University of California, Davis, has found that every $1 increase in gasoline price causes sales of the biggest SUVs to drop by 25 per cent and purchases of hybrids to increase by 17 per cent.

Will the bill pass? What happens if it doesn't?

Kerry and Lieberman face an enormous challenge. The bill probably needs Republican support, because Democratic senators from coal-rich states may vote against it. It was co-written by Lindsey Graham, a Republican, but he pulled out after Obama decided to address immigration legislation before the climate bill. Graham has offered lukewarm support since, but no other Republican has yet backed it.

The bill may need to be passed soon. If the Democrats lose seats in November's mid-term elections they may not have the political clout to pass the bill for several years. Other nations, such as China, will then be under less pressure to take action. International climate change talks are barely crawling along after the impasse at Copenhagen last December. They may completely stall if Kerry and Lieberman do not get their bill through.

Jim Giles tweets at twitter.com/jimgiles

http://www.newscientist.com/article/dn18917-what-the-climate-bill-means-for-the-us-way-of-life.html

Oil spills: what to do when all else fails

- 13:19 17 May 2010 by **Phil McKenna**

Desperate times call for desperate measures. In the case of the Deepwater Horizon oil spill in the Gulf of Mexico, that means hair bombs and junk shots.

San Francisco-based non-profit organisation Matter of Trust has led an effort to stuff pet fur and human hair clippings into nylon stockings to help mop up the mess.

Meanwhile, BP – the company ultimately responsible for the mess – is injecting scraps of rubber tyres, golf balls and other debris into valves on the sea floor that have thus far failed to cap the gusher. Though company officials claim otherwise, the plan smacks of a last-ditch act of desperation by oilmen who failed to prepare for the worst-case scenario.

Last ditch? Not quite. There have been far more extreme responses to human-made and natural disasters in the past.

1. Nuke it

To cap oil well blowouts, the Soviet Union several times resorted to using nuclear weapons. The USSR carried out at least five controlled nuclear blasts between 1966 and 1981 to extinguish well fires and bury the leaks in a gigantic pile of rubble. The first blast, a 30-kiloton bomb detonated 6 kilometres underground in southern Uzbekistan, was roughly one-and-a-half times the size of the atomic bomb exploded over Hiroshima, Japan, in world war 2. Of the five known blasts, all but one succeeded in capping the uncontrolled well.

2. Burn, bomb, napalm

When one of the first supertankers, the Torrey Canyon, ran aground off Cornwall, UK, in 1967, government officials set the ship ablaze as a method of containment. The Royal Navy then dropped 42 bombs on the ship. When that failed to sink it, the Royal Air Force dropped cans of aviation fuel on the wreck. High tides soon put out the blaze, so the armed forces followed up with a napalm attack before the ship eventually sank.

3. Plug it

Indonesia's National Mudflow Mitigation Team dropped thousands of concrete balls into a mud volcano's steaming vent near Sidoarjo on the island of Java in early 2007 in an attempt to stop mud flows that had displaced thousands of people. There is an ongoing debate over whether the mud flows were triggered by an earthquake or by drilling for a gas exploration well. The concrete balls failed to stop the flow and the approach was abandoned after several months.

4. Re-route it

When lava threatens to take out a town, governments have tried all sorts of diversionary tactics. Hawaii, Italy, Iceland and Japan have built barriers, dug dykes and poured cold water on the pyroclastic flows. In most cases the diversions offer only a brief reprieve before the lava continues on its original path. A notable success was achieved, however, when Italian authorities blasted mount Etna's flow with TNT in the early 1990s. The explosion destroyed a hardened lava tube and redirected the flow, saving the town of Zafferana.

5. Move it

Lanzhou, a Chinese industrial city in a valley surrounded by mountains, routinely ranks as one of the world's most polluted cities. Government officials recently tried to clear the air by removing a mountain on the east side of the town. It wasn't until they had already carted away the top half of the mountain that the group realised their efforts would have little effect on the city's air quality.

http://www.newscientist.com/article/dn18915-oil-spills-what-to-do-when-all-else-fails.html

Infrared cameras could stop road tunnel fires

- 15 May 2010

Magazine issue 2760.

Abnormal hotspots spell danger (Image: Siemens)

SOME of the most lethal fires in road tunnels could be prevented by an experimental system that picks out cars and trucks at risk of catching fire, before they enter a tunnel.

Many tunnel fires start when defects in a vehicle's brakes or engine cause them to run dangerously hot. So in tests to be carried out in the Aubinger road tunnel near Munich this month, engineers at Siemens in Germany will look for hotspots on each vehicle by pointing infrared cameras at them 1 kilometre before the tunnel's entrance.

Fires can start when defects in a truck's brakes or engine cause them to run dangerously hot

The resulting images will be automatically compared with reference images for each vehicle type to identify signs of overheating in the brakes, tyres, engine or other components. Warned by an audible alarm, staff closer to the tunnel will then be able to pull over suspect vehicles for inspection.

Some of the loads carried by commercial vehicles can feed a fire once it starts. A truck fire in the Mont Blanc road tunnel in the French Alps that killed 39 people in 1999 was made worse by the vehicle's cargo of margarine also catching fire.

To help combat this, Siemens is developing long-range battery-powered radio-frequency identification (RFID) tags that transmit details of what trucks are carrying to readers at the tunnel entrance. If a blaze does then break out, firefighters will know precisely what hazards they are faced with.

http://www.newscientist.com/article/mg20627605.100-infrared-cameras-could-stop-road-tunnel-fires.html

Hurricanes cleaned up lead-laden New Orleans

- 12:20 19 May 2010 by **Celeste Biever**

Washing up an unexpected benefit (Image: Rex Features)

Could the devastation caused by hurricanes Katrina and Rita have had a silver lining? The sediment washed into New Orleans by the floods accompanying the storms may have blanketed over heavily polluted, lead-laden soil in the city, leading to a decrease in lead levels in the bloodstreams of children across the city.

So says Howard Mielke, who researches urban geochemistry at Tulane University in New Orleans, Louisiana. Mielke and his colleagues sampled soil in 46 neighbourhoods of New Orleans in 2000 and then again in 2006.

Before the hurricanes, which both occurred in autumn 2005, soil lead levels in 15 neighbourhoods exceeded the US Environmental Protection Agency's limit of 400 milligrams per kilogram, and that this dropped to just six neighbourhoods in 2006. Lead levels declined in 29 neighbourhoods between 2000 and 2006 by an average of 45 per cent.

As soil lead levels had remained fairly constant between 1990 and 2000, and as there were no efforts to remove lead from soil during this period that could have accounted for this reduction, the researchers conclude that this drop was due to the hurricanes, which likely brought unpolluted sediment in from Lake Pontchartrain and the coastal wetlands. "This material is generally much cleaner than what you see in the city," says Mielke.

Child benefits

This drop in lead also seems to have caused a drop in lead in the bloodstream of children. When Mielke's team examined data on thousands of children aged 6 years old and under living in these areas, they found that average bloodstream levels of lead decreased by around 30 per cent between 2000 and 2006 – and that the largest declines were in the neighbourhoods with a drop in soil lead greater than 50 per cent.

Lead can be transferred into the children's bloodstream if they play outside and then lick their hands or put their fingers in their mouths, says Mielke. Higher levels of lead in the bloodstream have been linked to cognitive and behavioural problems, particularly in people who were exposed as young children.

Mielke says the natural effects of the hurricanes could be mimicked by soil-remediation efforts – and that his results indicate that this is a good way to reduce the amount of lead absorbed by children. "It demonstrates the possibility of improving the environment for children and protecting them against lead poisoning."

Wash worry

"An important next step would be to look at materials contaminated with hurricane Katrina and Rita floodwaters to understand the extent and significance of any potential redistribution of lead-contaminated silt," says Trey Brown, an environmental toxicologist at Texas Tech University in Lubbock.

"The paper is a fascinating one and critically important for the health and well-being of children currently residing in New Orleans," he adds.

Gina Solomon of the University of California, San Francisco, has measured arsenic levels before and after hurricane Katrina and found that they increased as a result of the hurricane. "It looks like the silt layer may have been lower in lead, but higher in arsenic," she says. "Maybe you could call it a 'wash', but I'm not sure it's reassuring."

Journal reference: *Environmental Science and Technology*, DOI: 10.1021/es100572s

http://www.newscientist.com/article/dn18934-hurricanes-cleaned-up-leadladen-new-orleans.html

Malaria in retreat despite warmer climate

- 19 May 2010 by **Michael Marshall**
- Magazine issue 2761.

IN A rare instance of humans beating one of the impacts of climate change, measures to combat malaria appear to be neutralising the expected global increase of the disease driven by rising temperatures.

Peter Gething of the University of Oxford compared a map of the range of malaria in 2007 with one from 1900, when the world was 0.7 °C cooler. He found the proportion of Earth's landmass where malaria is endemic has fallen from 58 per cent to 30 per cent (*Nature*, vol 465, p 342). Malaria's rate of transmission has also fallen almost everywhere.

This indicates that the incidence of malaria may not rise as a result of climate change. "The things acting to reduce malaria spread, like improved healthcare and disease control, are much more powerful than the weak effect of warming," Gething says.

That doesn't mean health authorities can rest on their laurels. Kevin Lafferty, an ecologist at the US Geological Survey, says the positive global picture hides shifting regional ones. Malaria is expected to move to different areas, even as its overall range decreases, he says.

http://www.newscientist.com/article/mg20627615.800-malaria-in-retreat-despite-warmer-climate.html

Mysterious ball lightning may be a hallucination

- 17:48 17 May 2010 by **Kate McAlpine**

The fluctuating magnetic fields in lightning strikes may induce hallucinations of glowing orbs called ball lightning (Image: Scott Stulberg/Corbis)

Seen something pale and round floating in the midst of a thunderstorm? If it lasted for a few seconds or less, it might be all in your head. Fluctuating magnetic fields, created by a nearby lightning bolt, could trick the brain into "seeing" round glowing objects, explaining at least some observations of mysterious 'ball lightning'.

The phenomenon is often described as a hovering orb of light – smaller than a beach ball – that lasts for a few seconds or minutes. It is thought to occur when lightning strikes the ground, but its exact cause is not clear.

Now it seems the glowing blobs may be a hallucination. Moving charges, in lightning strikes or in wire coiled around a patient's head, generate magnetic fields. A fluctuating magnetic field induces an electric field that, if powerful enough, can make neurons fire in the visual cortex. Pale ovals, bubbles, lines, or patches are sometimes observed by patients who undergo transcranial magnetic stimulation (TMS).

During a lightning storm, the initial stroke towards Earth is so short that we wouldn't have time to react to it – two to three millionths of a second. After it hits the ground, a return stroke, which carries some of the charge back into the sky with a thunder-causing shockwave, lasts around 0.2 milliseconds – very near the shortest duration of the clinical stimulation.

A single flash generates an average of two to five return strokes. But some strikes can create more than 20 – a protracted stream of events that could produce hallucinations lasting for multiple seconds, according to calculations by Josef Peer and Alexander Kendl, both of Innsbruck University in Austria.

Drifting through walls

In order to feel the effects of the magnetic field – but not be injured – a person would need to be 20 to 200 metres from the strike location, the researchers say. They estimate that in one per cent of close-lightning experiences, the fluctuating magnetic field could produce a hallucination in an observer.

"To our surprise, the results from long, repetitive pulses matched TMS fields astonishingly well," says Kendl.

They estimate that such apparitions account for about half of all ball lightning sightings. Hallucinations would explain how a fireball could apparently drift through a wall or window and leave it unharmed.

"The general notion that the electromagnetic fields of lightning might [affect] neural tissue is an interesting issue," says Thomas Kammer of Germany's University of Ulm, who advised the team on the neurobiological aspects of the work.

Eye of the beholder

Kammer notes that the strong electromagnetic field is likely to cause neurons in the eye's retina to fire before those in the visual cortex, since retinal neurons are sensitive to weaker electric fields. But it's not clear whether this would make observers even more likely to hallucinate ball lightning, since the visual effects that retinal neurons produce are not well understood.

However, he doubts that sightings of ball lightning lasting longer than a few seconds can be explained by TMS hallucinations, since even repetitive return strokes don't last very long.

What's more, the serious burns and deaths attributed to ball lightning need a material explanation.

Plasma research suggests that dust-gas fireballs may be produced in a strike that hits sand or water.

And "ball lightning" that doesn't drift may be Saint Elmo's fire – a glowing plasma of excited electrons generated around the tops of pointed objects, such as a steeple or a ship's mast.

Journal reference: *Physics Letters A* (in press)

http://www.newscientist.com/article/dn18918-mysterious-ball-lightning-may-be-a-hallucination.html

Lost lizards validate grim extinction predictions

- 19:00 13 May 2010 by **Michael Le Page**

It's getting hot out here (Image: Steve Byland/iStock)

Predictions that climate change alone could lead to the extinction of more than one-fifth of plant and animal species before the end of the century have often come under fire, and not just from climate-change deniers. Some biologists are sceptical because the predictions are largely based on theoretical models. Now, the most detailed study yet of one group of species – lizards – suggests extinction levels could indeed be as bad as predicted.

Crucially, the new forecast is based on actual data on what is driving lizards to extinction today on four continents.

The international team of researchers led by Barry Sinervo of the University of California, Santa Cruz, found that even though their habitats remained intact, the population of one group of lizards in Mexico has shrunk by 12 per cent since 1975 due to climate change. They found that the reptiles are disappearing because they need to spend more time in the shade to avoid overheating, leaving them less time to find food.

Silent spring

While lizards need to bask in the morning sun to warm up, they have to retreat into the shade later in the day to avoid heat stress. The hotter it gets, the less time they have to forage for food. Surprisingly, though, warmer springs rather than warmer summers are the killer, because this is the time when lizards reproduce and so need lots of extra food.

The team used its data from Mexico to predict where else lizards might be disappearing. They then compared their predictions with field studies of more than 1000 lizard populations on four different continents. They found that their predictions were accurate. Based on this, they predict that 20 per cent of lizard species will be extinct by 2080.

"This is surprising and very disturbing. None of us expected it," says Raymond Huey of the University of Washington in Seattle, who wrote an accompanying commentary on the study. "I would have predicted that lizards were less vulnerable to warming."

Models questioned

Sinervo's forecast is significant because it is based on real-world studies of populations declining as the climate warms. Until now, most estimates of how many species are threatened by climate change have been based on theoretical studies that look at the climatic and environmental conditions that species need to survive, and overlay this with estimates of how much suitable habitat will remain as the world warms.

"This study is really important because it shows that widespread extinctions associated with climate change are not simply a theoretical construct," says Chris Thomas at the University of York in the UK.

In a widely cited paper in 2004, Thomas and colleagues estimated that 15 to 37 per cent of terrestrial plant and animal species will be "committed to extinction" by 2050 (*Nature*, vol 427, p 145). Subsequent studies have reached similar conclusions. There is a lot of uncertainty about such predictions, he says, but it goes both ways: fewer species may die out than predicted, but then again, even more may go extinct.

Fine details

Not all biologists have been convinced, though. One criticism has been that most models are "coarse" in that they do not take into account local details, like mountains and valleys, which might provide climatic refuges for organisms. Then again, studies that do take the finer detail in account do not always predict fewer extinctions, Thomas says.

For instance, coarse models assume it always gets colder higher up but in Europe north-facing slopes and frost hollows can be colder than higher parts of mountains.

Unpublished work by Thomas's team shows that when this is taken into account for one species of beetle, it disappears even faster than in cruder models.

Butterfly effects

Another criticism is that although there have been periods of extremely rapid regional warming at the end of recent ice ages, they don't appear to have been marked by major extinctions, although this could be because the fossil record is incomplete or poorly studied.

A few studies show some direct evidence of climate change causing extinctions. Butterfly populations are disappearing at the "hot edge" of their distributions in Europe, for instance, while some small mammals are disappearing from low-lying areas in Yosemite National Park in California.

However, these findings have not been used to make forecasts in the same way Sinervo's team has done, based on the comprehensive lizard study. "The possibility that climate change will drive a new spate of extinctions across the world is rapidly turning from speculation into fact," says Thomas.

Journal reference: *Science*, vol 328, p 894, and vol 328, p 823

http://www.newscientist.com/article/dn18899-lost-lizards-validate-grim-extinction-predictions.html

Designing leaves for a warmer, crowded world

- 05 May 2010 by **Linda Geddes**

Magazine issue 2759.

Time to tinker with nature (Image: Raul Touzon/National Geographic Stock)

FROM blades of grass to the cup-like fly-catcher of the pitcher plant, the diversity of leaf shapes, sizes and structures is stunning. It is also incredibly useful, allowing plants to live nearly everywhere on Earth, from the deserts of the western US to the lush shores of the Amazon. Now the precise molecular switches that control the process are being unpicked.

"We are at the stage of putting together a blueprint of the genetic program controlling leaf shape," says Andrew Fleming, a leaf researcher at the University of Sheffield, UK. "This opens the door to experiments whereby we can change leaf form in a targeted fashion." And it's not just about creating weird and wonderful leaf shapes at will. The findings could be the first step in the next green revolution, leading to a new generation of crops with dramatically increased yields. They could also be better adapted to surviving in a warmer world.

Because leaves are the main site of photosynthesis, they are ultimately the source of almost all food on the planet. By controlling the molecular basis of leaf shape, plant biologists may be able to enhance plants' ability to adapt to a changing environment without the protracted guesswork involved in selective breeding. "The question is: what does an optimal leaf look like and can we design one?" says Fleming.

Leaves are the main site of photosynthesis, and so are the source of almost all food on the planet

Over the past year, several landmark papers have been published that shed light on how different leaf patterns are generated. They reveal that the genes and molecules that guide leaf patterns are very similar across a wide variety of plants.

"More and more we're seeing that it's a combination of promoting and suppressing outgrowth," says Neelima Sinha at the University of California, Davis.

Sinha's group has discovered that a growth hormone called auxin - previously known to boost the growth of leaf veins - plays a key role in controlling leaf shape. They applied auxin to one edge of a tomato leaf

and found that it lost its serrated pattern and grew indiscriminately. The auxin-free side of the leaf developed normally (*Development*, DOI: 10.1242/dev.033811).

Miltos Tsiantis of the University of Oxford and his colleagues have also shown that the shape of complex leaflets in *Cardamine hirsuta*, a relative of mustard, is dependent on the action of auxin at distinct points at the edges of developing leaves, and that inhibiting its action prevents leaflet formation (*Nature Genetics*, DOI: 10.1038/ng.189).

Meanwhile, Patrick Laufs at the French National Institute for Agricultural Research in Versailles has discovered "boundary" genes that are expressed in the small nook separating leaflets in pea, columbine, tomato and lamb's cress. The genes seem to inhibit the growth of leaf cells (*Science*, DOI: 10.1126/science.1166168). "If you remove them then the two outgrowths just flow into each other and become one," says Sinha. "By doing this kind of punctuated 'grow' 'don't grow' 'grow' signalling program, you can start to change its shape."

Other genes involved in different aspects of shape are also emerging. Fleming has identified one that seems to make flat leaves goblet-shaped by suppressing cell division in certain areas of the leaf. And Michael Lenhard of the University of Potsdam in Germany and his colleagues recently identified a key gene involved in controlling the size of leaves, petals and seeds (*Current Biology*, DOI: 10.1016/j.cub.2010.01.039). Overexpressing the gene in *Arabidopsis* creates larger leaves, flowers and seeds. Preliminary studies also suggest that it might increase grain size in oil seed rape.

This last point is key. Plants are adapted to the environments they grow in naturally, but these can be very different from farmed settings. Understanding how plants optimise light capture is important, says Sinha. Many of our crops are grown in dense conditions where shading can be an issue, for instance. The emerging research might lead to crops with bigger leaves, or help work out whether certain leaf shapes are better suited to capture light in shadier conditions.

Modifying shape and size can go a long way to increasing a plant's productivity, but it doesn't end there. Stomata are the small pores on leaves that regulate how much carbon dioxide and water moves in and out of leaves. Leaves convert CO_2 into sugars through photosynthesis (see "Tweak photosynthesis") and water is key to both the plant's temperature and ultimately its survival. Controlling whether stomata are open or shut and how many there are can therefore have a major impact on how well the leaf works.

Ikuko Hara-Nishimura at Kyoto University in Japan and her colleagues have found a gene called *stomagen* that increases the density of the pores. When they purified the protein it produces and applied it to *Arabidopsis* seedlings the leaves produced more stomata (*Nature*, DOI: 10.1038/nature08682).

As well as boosting yields by optimising the amount of CO_2 that plants can capture and therefore boosting the amount of sugars they produce, artificially manipulating stomata numbers may help create crops that are more resistent to drought or heat. Plants open their stomata to cool themselves down through transpiration, and close them to retain water. This suggests they may be able to adapt to climate change to some degree, but in extreme situations they may need a helping hand.

"One of the things people have been worrying about for some time now is if we take a global warming scenario, where CO_2 goes up and temperature goes up," says Dominique Bergmann of Stanford University in California. Plants naturally reduce stomata numbers in response to high CO_2 concentrations. But in doing so they might lose their ability to cool themselves, and overheat and die. "If stomata number is sensitive to a number of different environmental factors, they might not be able to uncouple those things in the time that they need to," says Bergmann.

Plant biologists believe that by artificially manipulating the number of stomata, it might be possible to boost plants' natural ability to adapt and create more resilient plants as a result.

Fleming points out that a modified wheat that had shorter stems was in many ways the basis of the green revolution of the 20th century. Shorter stems meant the plant put more resources into producing grain that was easier to harvest. He thinks a similar revolution is overdue. "If we're going to support the growing global population, we need some sort of step change in the amount of food that we produce," he says.

Tweak photosynthesis to turbocharge rice

Rice is a staple food for much of the world, and will be an essential part of solving the looming global food crisis. One way of boosting yields may be to fundamentally change the way it photosynthesises - and that could involve tinkering with the cells that shuttle CO_2 around the leaves.

Photosynthesis comes in two flavours: C3, and the more efficient C4. Rice, like most plants, is a C3 plant so researchers are seeking to make it C4. Early attempts to do this have focused on modifying photosynthetic enzymes - particularly rubisco, which fixes CO_2 and makes it available to chloroplasts. "It now appears clear that you need to adapt aspects of leaf form and anatomy as well," says Andrew Fleming at the University of Sheffield, UK.

In C3 leaves the CO_2 diffuses into each leaf cell separately, where it is captured by rubisco to be turned into sugars. The catch is that rubisco occasionally binds to oxygen instead of CO_2. In C4 leaves, on the other hand, concentric rings of cells "pump" CO_2 into specialised, rubisco-containing cells. By increasing the concentration of CO_2 around the enzyme, this system reduces rubisco's error rate, says Julian Hibberd of the University of Cambridge and a member of an international C4 rice project, funded by the Bill and Melinda Gates Foundation.

Hibberd and his colleagues are screening thousands of different rice mutants for subtle changes in leaf structure that could help them identify the genes responsible for this cellular organisation. The hope is that once they can find the genetic switches that create the cellular CO_2 pump they will be able to implant it into C3 rice and turn them into C4 super-producers.

http://www.newscientist.com/article/mg20627593.400-designing-leaves-for-a-warmer-crowded-world.html

FDA eyes up personal genome scans

- 19 May 2010
- Magazine issue 2761

WHEN does a personal genome scan count as a medical device? That's the question hanging over firms that offer assessments of health risks based on people's DNA.

On 10 May, the US Food and Drug Administration sent a letter to the latest entrant to the market, Pathway Genomics of San Diego, California, suggesting that its genome scans are medical devices and so need the agency's approval.

Pathway seems to have come to the FDA's attention as a result of a plan to sell its test over the counter at pharmacies, which is now on hold. But the agency's move will affect other companies too. "This policy does apply to companies selling similar tests, whether online or in physical stores," says FDA spokesman Dick Thompson.

It is still unclear whether the FDA has the legal authority to demand that genome scans are submitted for its approval.

23andMe of Mountain View, California, has long maintained that its scan is an "informational service", not a medical test. Navigenics, based in nearby Foster City, is already talking to the FDA about its scans.

23andMe says its genome scan is an information service, not a medical test
http://www.newscientist.com/article/mg20627613.600-fda-eyes-up-personal-genome-scans.html

Sleeping newborns are data sponges

- 11:27 19 May 2010 by **Shanta Barley**

Don't let a dozing baby's serenity fool you. As they sleep, newborns soak up information, speeding their adjustment to life *ex utero*. "They're better at sponging up data than we thought," says Dana Byrd at the University of Florida in Gainesville.

Together with William Fifer at the Department of Psychiatry at Columbia University in New York, and colleagues, Byrd played beeps to 26 sleeping babies aged between 10 and 73 hours old. Each beep was followed by an unpleasant puff of air to the eyelid, which prompted babies to scrunch up their eyes.

After 20 minutes, the sleeping infants were four times as likely to flinch after a beep delivered without an air puff as when they began, indicating that they had learned to associate the two in their sleep. Scalp electrodes recorded activity in the prefrontal cortex, which is involved in memory.

Glimmer of consciousness

"Now we know that babies can learn even while they sleep," says Byrd. As babies spend 16 to 18 hours a day dozing, this could have its perks.

Tristan Bekinschtein at the Medical Research Council's Cognition and Brain Sciences Unit in Cambridge, UK, says he has tried to do the same experiment on adults, but failed, as they woke up.

Unlike adults, who are unconscious when they sleep, he suggests that sleeping babies may be in a semi-conscious state, allowing them to learn. "We do not know much about sleep in babies but it does not look like sleep in adults," he says.

A glimmer of consciousness may be enough to learn new associations. Last year, Bekinschtein's team carried out the same experiment on brain-damaged people. The researchers found that those in a "minimally conscious" state were still able to learn to associate the beep with the puff of air.

Journal reference: *Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.1005061107

http://www.newscientist.com/article/dn18933-sleeping-newborns-are-data-sponges.html

Awaken 'sleeping' eggs to boost fertility

- 20:00 17 May 2010 by **Linda Geddes**
- For similar stories, visit the **Genetics** Topic Guide

Let sleeping dogs lie, but not sleeping eggs. Dormant eggs in mouse ovaries have been awoken and used to create healthy pups.

If the approach works in women it could be used to boost fertility or help those who froze ovarian tissue prior to chemotherapy.

Female mammals are born with millions of dormant eggs, but only a small fraction ever mature into cells with reproductive potential. One factor keeping cells in this immature state is the *PTEN* gene, which suppresses a signalling pathway involved in cell growth.

Aaron Hsueh at Stanford University Medical School in California and his colleagues exposed mouse ovaries to a *PTEN* inhibitor and a molecule that stimulates the signalling pathway that *PTEN* inhibits.

Control ovaries remained untreated. The ovaries were then transplanted back into the mice, and they received a hormone to stimulate egg development.

Healthy pups

Two weeks later, the treated ovaries contained two to six times as many mature follicles – which have the potential to release mature eggs – as the untreated ones.

Twenty healthy mouse pups were born after fertilised eggs from the treated ovaries were implanted into surrogate mothers.

Hsueh's team has used a similar approach to stimulate fragments of human ovarian tissue. When these were implanted into mice, four times as many mature follicles were produced as in controls. But for ethical reasons, the eggs could not be fertilised.

It's an important proof of principle, says Evelyn Telfer of the University of Edinburgh, UK.

However, she cautions that maturing the human eggs in mice makes it difficult to assess just how successful the approach would be in humans. Her team is currently using a similar approach to mature human follicles to the point where they release a mature egg – all outside the body.

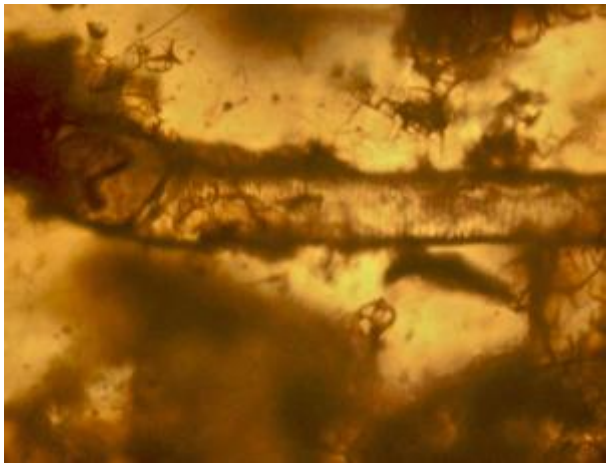
"We can stimulate follicle development, isolate and grow the eggs to quite an advanced stage, but we haven't been able to fertilise them," she says – also for ethical reasons. Telfer's team hasn't yet published its results.

Journal Reference: *Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.1001198107

http://www.newscientist.com/article/dn18921-awaken-sleeping-eggs-to-boost-fertility.html

CSI 100 million years BC: oldest mammalian hair found

- 14:56 19 May 2010 by **Shanta Barley**



Hairs in amber, just like ours (Image: V. Girard (Senckenberg Museum) & R. Vullo (Géosciences Rennes))

The oldest sample of mammalian hair ever found has been retrieved from a 100-million-year-old lump of amber. The scales on the hair – which provide its protective waterproof cover – are identical to those found on the hairs of mammals walking the Earth today.

This may mean that the structure of mammalian hair has remained unchanged for much of our evolution, says Romain Vullo at the University of Rennes I in France, who discovered the hair. "Perhaps mammalian hair does its job so well that it does not need to evolve."

Imprints of fur have been seen in two 160-million-year-old fossils in China, but this is the oldest example of actual hair, and therefore the first time researchers have been able to study the pattern of scales on their surface.

It turns out that the pattern is identical to that found on modern mammalian hair: rows of overlapping scales stacked on top of each other in an orderly fashion, with each row roughly 2 to 8 micrometres high.

This discovery is "wonderful progress", says Zhe-Xi Luo, Curator of Vertebrate Paleontology at the Carnegie Museum of Natural History in Pittsburgh, Pennsylvania. "It shows the microstructure of hairs of mammals have always been the same."

Crime scene

Vullo discovered the amber-encased hair in the Font-de-Benon quarry in Charente-Maritime, south-western France. Around 100 million years ago, the site of what is now the quarry was a lush tropical forest.

Interpreting the ancient "crime scene" where the hair's owner died is fraught with difficulties.

First, how to identify the victim? The hair may have belonged to a small opossum-like animal. Four teeth discovered in the same quarry suggest a possible candidate: *Arcantiodelphys marchandi*, one of the oldest known marsupials.

What was the cause of death? The casing of the pupa of a carrion-eating blowfly discovered near the fur prompted George Poinar of the Department of Zoology at Oregon State University in Corvallis to speculate on how the creature met its end.

"A mammal that was running up and down a pine tree maybe got stuck in a pool of sap and perished," he says. "This was in the tropics, so the body decayed quickly, attracting carrion flies that laid their eggs in the carcass before the resin could solidify."

Alternatively, the hair may have been plucked off the creature as it brushed past some resin on a bough. "The puparium may be a red herring," says Poinar.

Journal reference: *Naturwissenschaften*, DOI 10.1007/s00114-010-0677-8

http://www.newscientist.com/article/dn18937-csi-100-million-years-bc-oldest-mammalian-hair-found.html

Living in denial: Why sensible people reject the truth

- 19 May 2010 by **Debora MacKenzie**

Magazine issue 2760.

Good story, shame about the evidence (Image: Chris Casciano)

HEARD the latest? The swine flu pandemic was a hoax: scientists, governments and the World Health Organization cooked it up in a vast conspiracy so that vaccine companies could make money.

Never mind that the flu fulfilled every scientific condition for a pandemic, that thousands died, or that declaring a pandemic didn't provide huge scope for profiteering. A group of obscure European politicians concocted this conspiracy theory, and it is now doing the rounds even in educated circles.

This depressing tale is the latest incarnation of denialism, the systematic rejection of a body of science in favour of make-believe. There's a lot of it about, attacking evolution, global warming, tobacco research, HIV, vaccines - and now, it seems, flu. But why does it happen? What motivates people to retreat from the real world into denial?

Here's a hypothesis: denial is largely a product of the way normal people think. Most denialists are simply ordinary people doing what they believe is right. If this seems discouraging, take heart. There are good reasons for thinking that denialism can be tackled by condemning it a little less and understanding it a little more.

Whatever they are denying, denial movements have much in common with one another, not least the use of similar tactics (see "How to be a denialist"). All set themselves up as courageous underdogs fighting a corrupt elite engaged in a conspiracy to suppress the truth or foist a malicious lie on ordinary people. This conspiracy is usually claimed to be promoting a sinister agenda: the nanny state, takeover of the world economy, government power over individuals, financial gain, atheism.

All denialists see themselves as underdogs fighting a corrupt elite

This common ground tells us a great deal about the underlying causes of denialism. The first thing to note is that denial finds its most fertile ground in areas where the science must be taken on trust. There is no denial of antibiotics, which visibly work. But there is denial of vaccines, which we are merely told will prevent diseases - diseases, moreover, which most of us have never seen, ironically because the vaccines work.

Similarly, global warming, evolution and the link between tobacco and cancer must be taken on trust, usually on the word of scientists, doctors and other technical experts who many non-scientists see as arrogant and alien.

Many people see this as a threat to important aspects of their lives. In Texas last year, a member of a state committee who was trying to get creationism added to school science standards almost said as much when he proclaimed "somebody's got to stand up to experts".

It is this sense of loss of control that really matters. In such situations, many people prefer to reject expert evidence in favour of alternative explanations that promise to hand control back to them, even if those explanations are not supported by evidence (see "Giving life to a lie").

All denialisms appear to be attempts like this to regain a sense of agency over uncaring nature: blaming autism on vaccines rather than an unknown natural cause, insisting that humans were made by divine plan, rejecting the idea that actions we thought were okay, such as smoking and burning coal, have turned out to be dangerous.

This is not necessarily malicious, or even explicitly anti-science. Indeed, the alternative explanations are usually portrayed as scientific. Nor is it willfully dishonest. It only requires people to think the way most people do: in terms of anecdote, emotion and cognitive short cuts. Denialist explanations may be couched in sciency language, but they rest on anecdotal evidence and the emotional appeal of regaining control.

Anecdote and emotion

Greg Poland, head of vaccines at the Mayo Clinic in Minnesota and editor in chief of the journal *Vaccine*, often speaks out against vaccine denial. He calls his opponents "the innumerate" because they are unable to grasp concepts like probability. Instead, they reason based on anecdote and emotion. "People use mental short cuts - 'My kid got autism after he got his shots, so the vaccine must have caused it,'" he says. One emotive story about a vaccine's alleged harm trumps endless safety statistics.

Seth Kalichman, a social psychologist at the University of Connecticut at Storrs, understands this better than most: he spent a year infiltrating HIV denialist groups. Many of the people he met were ordinary and sincere. "Denialism fills some need," he says. "For people with HIV, it is a coping strategy," albeit a maladaptive one.

Kalichman, however, feels that everyday reasoning alone is not enough to make someone a denialist. "There is some fragility in their thinking that draws them to believe people who are easily exposed as frauds," he says. "Most of us don't believe what they say, even if we want to. Understanding why some do may help us find solutions."

He believes the instigators of denialist movements have more serious psychological problems than most of their followers. "They display all the features of paranoid personality disorder", he says, including anger, intolerance of criticism, and what psychiatrists call a grandiose sense of their own importance. "Ultimately, their denialism is a mental health problem. That is why these movements all have the same features, especially the underlying conspiracy theory."

Neither the ringleaders nor rank-and-file denialists are lying in the conventional sense, Kalichman says: they are trapped in what classic studies of neurosis call "suspicious thinking". "The cognitive style of the denialist represents a warped sense of reality, which is why arguing with them gets you nowhere," he says. "All people fit the world into their own sense of reality, but the suspicious person distorts reality with uncommon rigidity."

It is not only similar tactics and psychology that unite denial in its many guises: there are also formal connections between the various movements.

Many denialist movements originate as cynical efforts by corporations to cast doubt on findings that threaten their bottom line. Big Tobacco started it in the 1970s, recruiting scientists willing to produce favourable data and bankrolling ostensibly independent think tanks and bogus grass-roots movements (see "Manufacturing doubt"). One such think tank was The Advancement of Sound Science Coalition (TASSC), set up in 1993 by tobacco company Philip Morris (*American Journal of Public Health*, vol 91, p 1749). TASSC didn't confine itself to tobacco for long. After getting funds from Exxon, it started casting doubt on climate science.

Such links between denial movements are not unusual. A number of think tanks in the US and elsewhere have been funded by both the oil and tobacco industries and have taken denialist positions on smoking and warming.

TASSC folded when its true identity became widely known, but its successor, JunkScience, still rubbishes tobacco and climate research and warns people not to believe any scientist who says something "might be" true or uses statistics - which pretty much covers all scientists.

Perhaps it is no surprise that some industries are prepared to distort reality to protect their markets. But the tentacles of organised denial reach beyond narrow financial interests. For example, some prominent backers of climate denial also deny evolution. Prominent creationists return the favour both in the US and elsewhere. Recent legislative efforts to get creationism taught in US schools have been joined by calls to "teach the controversy" on warming as well.

These positions align neatly with the concerns of the US political and religious right, and denial is often driven by an overtly political agenda. Some creationists have explicitly argued that the science of both climate and evolution involve "a left-wing ideology that promotes statism, nanny-state moralism and... materialism".

People who buy into one denialism may support others for this reason. Dan Kahan at Yale Law School has found that people's views on social issues such as abortion and same-sex marriage predict their position on climate science too. This, he argues, is because social conservatives tend to be pro-business and resist the idea that it is damaging the planet (*Nature*, vol 436, p 296).

But other denialisms suggest psychology, not just ideology, is crucial. There is no obvious connection between conservatism and vaccine or AIDS denial, and flu denial was promulgated by a left-leaning group suspicious of the vaccine industry.

Common ground

Nevertheless, some connections exist that hint at a wider agenda. For example, there is considerable overlap in membership between the vaccine and HIV deniers, says John Moore, an AIDS researcher at Weill Cornell Medical College in New York. Both movements have massive but mysterious funding.

Consider, too, the journal of the Association of American Physicians and Surgeons, a lobbying group for private medicine. It showcases nearly all denialist causes. In the past two years it has published articles claiming that HIV tests do not detect HIV, second-hand smoke does little harm, smoking bans do not reduce heart attacks, global warming presents little health threat and proposals for a US vaccination registry are "not really about vaccines but about establishing a computer infrastructure... that can be used for other purposes later". It repeatedly published discredited assertions that vaccines cause autism.

It is tempting to wonder if activists sympathetic to climate and evolution denial might be grasping opportunities to discredit science in general by spreading vaccine and HIV denialism.

The conservative character of much denial may also explain its success at winning hearts and minds.

George Lakoff, a cognitive psychologist at the University of California, Berkeley, argues that conservatives have been better than progressives at exploiting anecdote and emotion to win arguments. Progressives tend to think that giving people the facts and figures will inevitably lead them to the right conclusions. They see anecdotes as inadmissible evidence, and appeals to emotion as wrong.

The same is true of scientists. But against emotion and anecdote, dry statements of evidence have little power. To make matters worse, scientists usually react to denial with anger and disdain, which makes them seem even more arrogant.

Poland has reached a similar conclusion. He has experimented a few times with using anecdote and appeals to emotion when speaking to lay audiences. "I get very positive responses - except from numerates, who see it as emotionally manipulative," he says.

There are lessons here for other scientists who engage with denial. They can only win by learning to speak to the "innumerates", who are otherwise likely prey for denialists.

The stakes are high - and sometimes even personal. Like many vaccine developers, Poland has received death threats. "I get phone messages saying 'I hope your kids are safe'," he says. So has Faye Flam, a *Philadelphia Inquirer* reporter who has written in support of climate science.

I get phone messages saying 'I hope your kids are safe'

Denialism has already killed. AIDS denial has killed an estimated 330,000 South Africans. Tobacco denial delayed action to prevent smoking-related deaths. Vaccine denial has given a new lease of life to killer diseases like measles and polio. Meanwhile, climate change denial delays action to prevent warming. The backlash against efforts to fight the flu pandemic could discourage preparations for the next, potentially a more deadly one.

If science is the best way to understand the world and its dangers, and acting on that understanding requires popular support, then denial movements threaten us all.

Read more: *Special report: Living in denial*

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How to be a denialist

Martin McKee, an epidemiologist at the London School of Hygiene and Tropical Medicine who also studies denial, has identified six tactics that all denialist movements use. "I'm not suggesting there is a manual somewhere, but one can see these elements, to varying degrees, in many settings," he says (*The European Journal of Public Health*, vol 19, p 2).

- **1.** Allege that there's a conspiracy. Claim that scientific consensus has arisen through collusion rather than the accumulation of evidence.
- **2.** Use fake experts to support your story. "Denial always starts with a cadre of pseudo-experts with some credentials that create a facade of credibility," says Seth Kalichman of the University of Connecticut.

- **3.** Cherry-pick the evidence: trumpet whatever appears to support your case and ignore or rubbish the rest. Carry on trotting out supportive evidence even after it has been discredited.
- **4.** Create impossible standards for your opponents. Claim that the existing evidence is not good enough and demand more. If your opponent comes up with evidence you have demanded, move the goalposts.
- **5.** Use logical fallacies. Hitler opposed smoking, so anti-smoking measures are Nazi. Deliberately misrepresent the scientific consensus and then knock down your straw man.
- **6.** Manufacture doubt. Falsely portray scientists as so divided that basing policy on their advice would be premature. Insist "both sides" must be heard and cry censorship when "dissenting" arguments or experts are rejected.

Debora MacKenzie is New Scientist's correspondent in Brussels, Belgium

http://www.newscientist.com/article/mg20627606.100-living-in-denial-why-sensible-people-reject-the-truth.html

Proof at last for Boltzmann's 140-year-old gas equation

- 18:52 18 May 2010 by **Jacob Aron**

It has taken 140 years, but only now do we have mathematical proof that a seminal equation describing the behaviour of gases is correct. Robert Strain and Philip Gressman at the University of Pennsylvania employed modern mathematical tools to find solutions for the Boltzmann equation, which predicts the motion of gas molecules.

The existence of molecules was still being disputed when Ludwig Boltzmann formulated his equation in 1872, but its ability to accurately predict gaseous behaviour won out over any philosophical objections. Physicists today use the equation to model gases in everything from nuclear power stations to galaxies, yet until now there was no guarantee that it would work correctly in every possible situation.

A formal proof has eluded mathematicians for so long because Boltzmann's work was ahead of his time. "All the pieces have only been in place for about five years," says Strain. The difficulty was due to a concept known as fractional derivatives.

Most of the fundamental equations in physics are differential equations, which means they describe how the rate at which one variable changes is related to another variable.

Real-world meaning

The rates of change are called derivatives. The first derivative of distance with respect to time is speed, for example, while the second derivative is acceleration. But what if you tried to identify the half or two-thirds derivative?

They exist mathematically, but don't make any sense in the real world, so Strain was surprised to see them while working with the Boltzmann equation. "It's very rare to find fractional derivatives appearing in a physical model," he says.

What's more, the mathematical theories behind them were developed many years after the equation.

Strain and Gressman show that Boltzmann's equation will always produce the right answer for gases that are close to equilibrium, such as the air in a building close to room temperature. However, they still can't say whether the equation holds in more complex situations, such as a storm.

Journal reference: *Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.1001185107

http://www.newscientist.com/article/dn18931-proof-at-last-for-boltzmanns-140yearold-gas-equation.html

Pyramids are the best shape for packing

- 12 May 2010 by **Rachel Courtland**
- Magazine issue 2760.

Tetrahedra pack tightly, even when jumbled together (Image: A. Jaoshvili/P. Chaikin/M. Porrati/A. Esakia)

If physicists ran candy stores, gumball machines might be filled with pyramids instead of spheres. It seems that tetrahedra, with their four triangular faces, are the most efficient shape for filling a container randomly, as opposed to carefully stacking objects within it.

Graduate student Alexander Jaoshvili of New York University and his colleagues filled and shook containers of tetrahedral game dice. They found that the tetrahedra were packed tightly enough to occupy 76 per cent of their containers. In comparison, randomly packed spheres fill up to 64 per cent of space, while the figure for squashed spheres, or ellipsoids, can be as high as 74 per cent.

The work is sure to rock the confectionery world, but it has implications for developing stronger materials as well. That's because MRI studies by the team show that a tetrahedral die can be locked into place by its immediate neighbours alone, making it harder to nudge out of place. Jumbled collections of spheres, by contrast, are less rigid because any sphere can be moved by objects as far away as six diameters.

Tough dinnerware

The insight could lead to the creation of nearly unbreakable plates. "If, for instance, you wanted to make a very dense, rigid, hard ceramic, you would probably be better off making the powder from tetrahedra," says Jaoshvili's adviser, Paul Chaikin.

And tetrahedra may be able to pack together randomly even more efficiently, says Salvatore Torquato of Princeton University.

In a recent simulation, Torquato and student Yang Jiao found a way to pack tetrahedra that took up more than 82 per cent of space. But this configuration may be more ordered than the one in Jaoshvili's study.

Ordered or random

The question is important because it's still not clear what kind of packing – random or ordered – is most efficient for tetrahedra.

Ordered, crystalline arrangements of tetrahedra can fill more than 85 per cent of available space, according to recent simulations, but randomly assembled objects might be able to pack more tightly. "Nobody knows whether the densest packing is ordered or random," Chaikin told *New Scientist*.

"People tend to think that the densest packings are always ordered, but there's no fundamental reason why that has to be true," agrees Torquato. "We can't rule out the possibility that the densest packings of tetrahedra will be disordered."

Future simulations may help settle the matter. And shapes more complex than spheres, ellipsoids and tetrahedra are only beginning to be explored, so we may not yet have discovered the optimal candy shape.

Journal reference: *Physical Review Letters* (DOI:10.1103/PhysRevLett.104.185501)

http://www.newscientist.com/article/mg20627604.100-pyramids-are-the-best-shape-for-packing.html

Birds and Mammals Share a Common Brain Circuit for Learning

New research identifies specific classes of neurons within the brains of songbirds and matching them to their mammalian counterparts. (Credit: Image courtesy Aaron Andalman/MIT)

ScienceDaily (May 18, 2010) — Bird song learning is a model system for studying the general principles of learning, but attempts to draw parallels between learning in birds and mammals have been difficult because of anatomical brain differences between the two species.

A new study from researchers at MIT and Hebrew University helps solve this problem, by identifying specific classes of neurons within the brains of songbirds and matching them to their mammalian counterparts.

The study focuses on the basal ganglia, brain structures that play a key role in skill learning and habit formation and are also linked to many disorders, including Parkinson's disease, obsessive-compulsive disorder, and drug addiction. Mammalian basal ganglia consist of several structures, including the striatum and the globus pallidus, both of which are centrally involved in Parkinson's disease.

There is growing evidence that similar brain circuits are also present in birds, in which these circuits appear to underlie song learning. In birds, however, there are no anatomical divisions, and the different basal ganglia cell types are intermixed within a tiny (~1mm) structure known as 'area X.' Jesse Goldberg and Michale Fee at MIT's McGovern Institute for Brain Research recorded electrical activity from individual neurons in the brains of young zebra finches, using a motorized microdrive to position the electrodes precisely within area X.

Based on their patterns of electrical activity while the birds were singing, the researchers identified two distinct classes of neurons that show different firing patterns. The researchers compared their recordings with the activity patterns recorded from the two known anatomical pathways in the monkey globus pallidus. Although firing rates are much faster in birds (up to 700 spikes per second, among the fastest of any neurons), the patterns are otherwise highly similar between the two species. Additionally, the researchers confirmed that one of the two classes in birds forms the same types of connections as their primate counterparts.

The new findings appear in the May 26 issue of Journal of Neuroscience. In a separate study, recently published in Journal of Neurophysiology, Goldberg and Fee reported that other neurons in area X exhibit activity similar to four known classes of neurons within the mammalian striatum.

"Our results strongly suggest that the same brain circuits underlie learning in birds and mammals, despite the superficial differences of anatomy," says Goldberg. "This circuit must have evolved at least 300 million years ago, before birds and mammals diverged."

Bird song learning is a very stereotyped form of learning and is an ideal model system in which to understand general principles that are involved with the learning of complex actions. The new findings support the idea that such lessons are likely to be relevant to human biology and to the treatment of human disorders such as Parkinson's disease.

Avital Adler and Hagain Bergman of Hebrew University-Hadassah Medical School in Jerusalem also contributed to the study, which was funded by the National Institutes of Health, Damon Runyon Research Foundation, Charles King Trust, FP7, ICNC, and the McGovern Institute for Brain Research at MIT.

Story Source:

Adapted from materials provided by Massachusetts Institute of Technology. Original article written by Julie Pryor, McGovern Institute.

Journal Reference:

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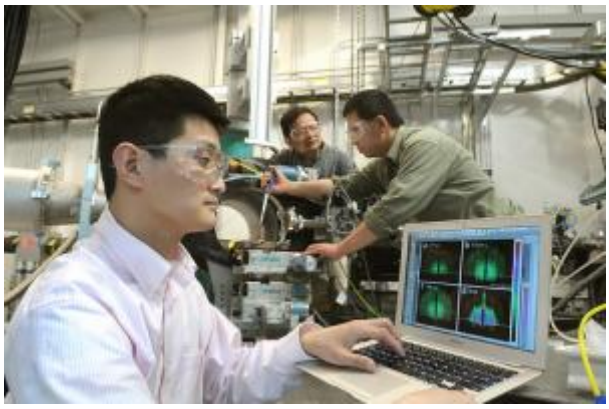
Scientists Reveal Secret of Nanoparticle Crystallization in Real Time



Assistant physicist Zhang Jiang (from left) examines a X-ray diffraction as physicist Jin Wang and nanoscientist Xiao-Min Lin prepare a sample at one of the Advanced Photon Source's beamlines. The Argonne scientists have examined nanoparticle crystallization in unprecedented detail using the high powered X-rays of the APS. (Credit: Image courtesy of DOE/Argonne National Laboratory)

ScienceDaily (May 19, 2010) — A collaboration between the Advanced Photon Source and Center for Nanoscale Materials at U.S. Department of Energy's (DOE) Argonne National Laboratory has enabled researchers to "see" the crystallization of nanoparticles in unprecedented detail.

"Nanoscience is a hot issue right now, and people are trying to create self-assembled nanoparticle arrays for data and memory storage," Argonne assistant physicist Zhang Jiang said. "In these devices, the degree of ordering is an important factor."

In order to call up a specific bit of data, it is ideal to store information on a two-dimensional crystal lattice with well-defined graphical coordinates. For example, every bit of information of a song saved on a hard drive must be stored at specific locations, so it can be retrieved later. However, in most cases, defects are inherent in nanoparticle crystal lattices.

"Defects in a lattice are like potholes on a road," Argonne physicist Jin Wang said. "When you're driving on the highway, you would like to know whether it is going to be a smooth ride or if you will have to zigzag in order to avoid a flat tire. Also, you want to know how the potholes form in the first place, so we can eliminate them."

Controlling the degree of ordering in nanoparticle arrays has been elusive. The number of nanoparticles a chemist can make in a small volume is astonishingly large.

"We can routinely produce 10^{14} particles in a few droplets of solution. That is more than the number of stars in the Milky Way Galaxy," Argonne nanoscientist Xiao-Min Lin. "To find conditions under which nanoparticles can self-assemble into a crystal lattice with a low number of defects is quite challenging."

Because nanoparticles are so small, it is not easy to see how ordered the lattice is during the self-assembly process. Electron microscopy can see individual nanoparticles, but the field of view is too small for scientists to get a "big picture" of what the ordering is like in macroscopic length scale. It also doesn't work for wet solutions.

"With local ordering, one cannot assume the same order exists throughout the whole structure; it's like seeing a section of road and assuming it is straight and well constructed all the way to the end," Wang said.

The same group of researchers at Argonne, together with their collaborators at the University of Chicago, discovered that under the right conditions, nanoparticles can float at a liquid-air interface of a drying liquid droplet and become self-organized.

This allows the two-dimensional crystallization process to occur over a much longer time scale. "You typically don't expect metallic particles to float. It is like throwing stones into a pond and expecting them to float on the surface," Lin said. "But in the nanoworld, things behave differently."

Using high-resolution X-ray scattering at the Advanced Photon Source (APS), Jiang and the others examined the crystallization process in unprecedented detail as it forms in real time. They discovered that the nanoparticle arrays formed at the liquid-air interface can enter a regime of a highly crystalline phase defined in the classical two-dimensional crystal theory. Only when the solvent starts to dewet from the surface, do defects and disorder begin to appear.

"We can probe the entire macroscopic sample and monitor what's happening in real time," Jiang said. "This allows us to understand what parameters are important to control the self-assembly process."

With this level of understanding, the scientists hope that one day devices such as the iPod Nano can be made from nanoparticles.

A paper on this research was published in *Nano Letters.*

Story Source:

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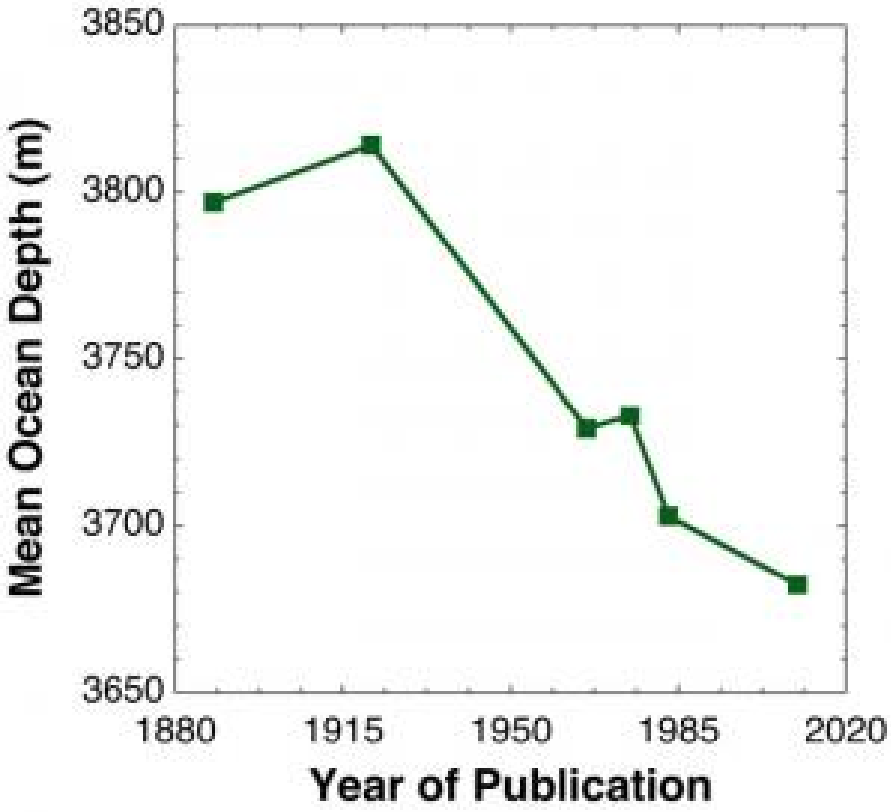
Volume and Depth of the World's Oceans Calculated



The measured decrease in Mean Ocean Depth over the years does not mean there is less water in the oceans. Rather it reflects more precise detection and measurement of undersea mountain ranges and other formations that take up the space previosuly attributed to water. (Credit: Graph by Matthew A. Charette, WHOI, and Walter H.F. Smith, NOAA)

ScienceDaily (May 19, 2010) — How high is the sky? Scientists have a pretty good handle on that one, what with their knowledge of the troposphere, stratosphere an the other "o-spheres." Now, thanks to new work headed by the Woods Hole Oceanographic Institution (WHOI), they are closing in on the other half of that age-old query: How deep is the ocean?

They're also tackling an even more intriguing -- if less romantic -- question: What is the volume of the Earth's oceans? It's hard to imagine Irving Berlin putting those words into the mouth of a serenading lover -- as he did in his classic song, "How Deep is the Ocean?" -- let alone the answer: 1.332 billion cubic kilometers.

But that figure is pure music to the ears of Matthew Charette, an associate scientist in WHOI's Department of Marine Chemistry and Geochemistry who is part of a research effort to audit all the water on the planet. "A lot of water values are taken for granted," he says. "If you want to know the water volume on the planet, you Google it and you get five different numbers, most of them 30- or 40-year-old values."

Until now.

Using satellite measurements, Charette and co-investigator Walter H.F. Smith, a geophysicist at the National Environmental Satellite, Data and Information Service of the National Oceanic and Atmospheric

Administration, have come with up the new ocean volume figure. Their work, funded in part by the EarthWater Institute, is published in the current issue of the journal *Oceanography*.

The researchers report that the world's total ocean volume is less than the most recent estimates by a volume equivalent to about five times the Gulf of Mexico, or 500 times the Great Lakes. While that might seem a lot at first glance, it is only about 0.3% lower than the estimates of 30 years ago.

What may be more interesting, he says, is how accurate scientists were in the past, using cruder techniques to measure ocean depth. As long ago as 1888, for example, John Murray dangled lead weights from a rope off a ship to calculate an ocean volume -- the product of ocean area and mean ocean depth -- just 1.2% greater than the figure Charette and Smith now report.

Starting in the 1920s, researchers using echosounders improved depth estimates significantly, according to the researchers. Most recently, Smith and others have pioneered the use of satellites to calculate ocean volume.

The trend toward a progressive lowering of volume estimates is not because the world's oceans are losing water. Rather, it reflects a greater ability to locate undersea mountain ranges and other formations, which take up space that would otherwise be occupied by water.

Satellite measurements reveal that ocean bottoms "are bumpier and more mountainous than had been imagined," said Smith. As measurements improve, ocean-volume values are lowering, he notes, emphasizing that this does not reflect an actual lessening of water but a more accurate accounting of undersea formations.

Satellite-based radar cannot "see" the ocean bottom, he explains. Rather, it measures the ocean surface, which reflects what lies beneath. For instance, if a mountain range lurks under a certain part of the ocean, the surface above it will bulge outward. "I take the data set and estimate the location and height of the mountains," Smith says.

The satellite project has covered virtually all the world's oceans, except for some areas of the Arctic that are covered with ice, he says. The result is a "new world map" of the oceans, Smith adds. "Matt and I are seeing a better picture of the shape and volume of oceans."

But satellite measurements have their shortcomings. "There is a problem of spatial resolution, like an out-of-focus camera," says Smith. "We're measuring the sea surface that is affected by mountains," he says, "but we're seeing only really big mountains, and in a blurry way. The resolution is 15 times worse than our maps of Mars and the moon."

Consequently, the researchers say, more ship-based measurements are needed to augment and "fine tune" the satellite data. And so far, ship-based sonar and other instrumentation have mapped only 10% of the Earth's seafloor. "We have gaps in echosounding measurements as wide as New Jersey," says Smith.

It would take a single ship 200 years (or 10 ships 20 years) to measure all the ocean-floor depths with an echsounder, according to published U.S. Navy estimates. "That would come to about $2 billion," Smith says. "NASA is spending more than that on a probe to [the Jupiter moon] Europa."

Charette and Smith are not sure why so little ship-based ocean mapping has been done throughout history. It may be because ocean depth and volume seem to have few direct, practical implications.

However, Charette notes, accurate estimates of ocean depth and volume could tie in with the growing field of ocean observation and exploration as well as, perhaps, climate change models and estimates of salt in the oceans.

And for those of you wondering -- as Berlin put it so eloquently in his music -- if you ever lost your love, how much would you cry? Apparently not as much as you might have 30 years ago. The study's calculation of the ocean's mean depth is 3,682.2 meters -- that's 21-to-51 meters less than previous estimates.

Story Source:

Adapted from materials provided by Woods Hole Oceanographic Institution.

Journal Reference:

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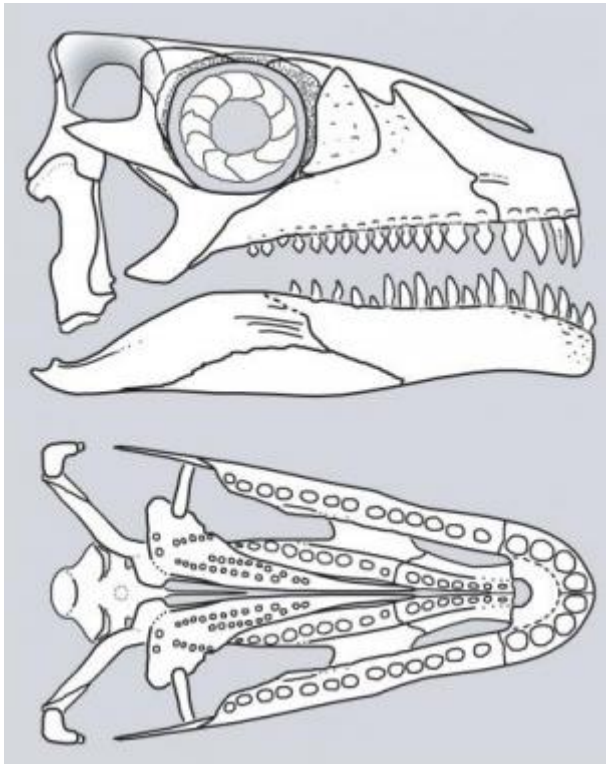
http://www.sciencedaily.com/releases/2010/05/100518170040.htm

Demoting a Dinosaur: New Fossil Material Redefines Azendohsaurus as a Peculiar Early Reptile



This is a reconstruction of the skull of the new species of Azendohsaurus. On top is a lateral or side view, and on the bottom, a palatal or roof of the mouth view. Note the teeth covering the palate, a highly unusual feature among reptiles, and the downturned front end of the lower jaw, a feature found independently in many herbivorous archosauromorphs. (Credit: S. Nesbitt)

ScienceDaily (May 18, 2010) — *Azendohsaurus* just shed its dinosaur affiliation. A careful new analysis of *A. madagaskarensis* -- this time based on the entire skull rather than on just teeth and jaws -- aligns this 230-million-year-old animal with a different and very early branch on the reptile evolutionary tree. Many aspects of *Azendohsaurus* are far more primitive than previously assumed, which in turn means that its plant-eating adaptations, similar to those found some early dinosaurs, were developed independently.

The new analysis is published in the journal *Palaeontology*.

"Even though this extraordinary ancient reptile looks similar to some plant-eating dinosaurs in some features of the skull and dentition, it is in fact only distantly related to dinosaurs," says John J. Flynn, curator in the Division of Paleontology at the American Museum of Natural History. "With more complete material, we re-assessed features like the down-turned jaw and leaf-shaped teeth found in *A. madagaskarensis* as convergent with some herbivorous dinosaurs."

The fossil is a member of Archosauromorpha, a group that includes birds and crocodilians but not lizards, snakes, or turtles. The type specimen of the genus *Azendohsaurus* was a fragmentary set of teeth and jaws found in 1972 near (and named for) a village in Morocco's Atlas Mountains. The fossils on which the current research paper is based was discovered in the late 1990s in southwestern Madagascar. Named *A. madagaskarensis*, this specimen was uncovered by a team of U.S. and Malagasy paleontologists in a "red bed" that includes multiple individuals that probably perished together. This species was initially published as an early dinosaur in *Science* over a decade ago, but the completeness of the more recently unearthed and studied fossils has provided the first complete glimpse of what this animal looked like and was related to. *A. madagaskarensis* was not a dinosaur.

A. madagaskarensis lived during the period of time that dinosaurs, crocodile relatives, mammals, pterosaurs, turtles, frogs, and lizards were getting their start, and all of the continents were connected as the supercontinent Pangaea. *A. madagaskarensis* was 2 to 4 meters long and weighed between 20 and 50 kilos (about 44 to110 pounds). *A. madagaskarensis* was an efficient herbivore -- "a veritable four-legged weed-whacker," according to Flynn -- with teeth modified for slicing vegetation covering not only its jaws, but also the roof of its mouth. Even though early archosaurs were commonly thought to be primarily carnivorous, *A. madagaskarensis* shows that traits associated with herbivory were much more widespread across archosaur reptiles.

"Now there are many more cases of herbivorous archosaurs," says André Wyss, professor at the University of California, Santa Barbara. "We are rethinking the evolution of diet and feeding strategies, as well as the broader evolution of the group."

"This is the way science works," says Flynn, commenting on the reinterpretation of the fossils. "As we found and analyzed more material, it made us realize that this was a much more primitive animal and the dinosaur-like features were really the product of convergent evolution."

Wyss adds, "In many ways *Azendohsaurus* ends up being a much more fantastic animal than if it simply represented a generic early dinosaur."

In addition to Flynn and Wyss, authors include Sterling Nesbitt, a former graduated student affiliated with the Museum and Columbia University; J. Michael Parrish, San Jose State University in California; and Lovasoa Ranivoharimanana, Université d'Antananarivo in Madagascar. This research was funded by the National Geographic Society, The Field Museum, American Museum of Natural History, the University of California Santa Barbara, and Worldwide Fund for Nature, Madagascar.

Story Source:

Adapted from materials provided by American Museum of Natural History, via EurekAlert!, a service of AAAS.

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Egyptian Blue Found in Romanesque Altarpiece

The altarpiece of the Church of Sant Pere contains Egyptian blue, archaeologists have found. (Credit: Patrimoni-UB.)

ScienceDaily (May 18, 2010) — A team of researchers from the University of Barcelona (UB) has discovered remains of Egyptian blue in a Romanesque altarpiece in the church of Sant Pere de Terrassa (Barcelona). This blue pigment was used from the days of ancient Egypt until the end of the Roman Empire, but was not made after this time. So how could it turn up in a 12th Century church?

Egyptian blue or Pompeian blue was a pigment frequently used by the ancient Egyptians and Romans to decorate objects and murals. Following the fall of the Western Roman Empire (476 AD), this pigment fell out of use and was no longer made. But a team of Catalan scientists has now found it in the altarpiece of the 12th Century Romanesque church of Sant Pere de Terrassa (Barcelona). The results of this research have just been published in the journal *Archaeometry*.

"We carried out a systematic study of the pigments used in the altarpiece during restoration work on the church, and we could show that most of them were fairly local and 'poor' -- earth, whites from lime, blacks from smoke -- and we were completely unprepared for Egyptian blue to turn up," Mario Vendrell, co-author of the study and a geologist from the UB's Grup Patrimoni research group, said.

The researcher says the preliminary chemical and microscopic study made them suspect that the samples taken were of Egyptian blue. To confirm their suspicions, they analysed them at the Daresbury SRS Laboratory in the United Kingdom, where they used X-ray diffraction techniques with synchrotron radiation. It will be possible to carry out these tests in Spain once the ALBA Synchrotron Light Facility at Cerdanyola del Vallés (Barcelona) comes into operation.

"The results show without any shadow of a doubt that the pigment is Egyptian blue," says Vendrell, who says it could not be any other kind of blue pigment used in Romanesque murals, such as azurite, lapis lazuli or aerinite, "which in any case came from far-off lands and were difficult to get hold of for a frontier economy, as the Kingdom Aragon was between the 11th and 15th Centuries."

A possible solution to the mystery

The geologist also says there is no evidence that people in Medieval times had knowledge of how to manufacture this pigment, which is made of copper silicate and calcium: "In fact it has never been found in any mural from the era."

"The most likely hypothesis is that the builders of the church happened upon a 'ball' of Egyptian blue from the Roman period and decided to use it in the paintings on the stone altarpiece," Vendrell explains.

The set of monuments made up by the churches of Sant Pere, Sant Miquel and Santa María de Terrassa are built upon ancient Iberian and Roman settlements, and the much-prized blue pigment could have remained hidden underground for many centuries. "But only a little of it, because this substance couldn't be replaced -- once the ball was all used up the blue was gone," concludes Vendrell.

Story Source:

Adapted from materials provided by FECYT - Spanish Foundation for Science and Technology, via EurekAlert!, a service of AAAS.

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http://www.sciencedaily.com/releases/2010/05/100505102557.htm

Happy Ending' Gives Recyclable Products Higher Status

Shayne Beaver. (Credit: Image courtesy of Queensland University of Technology)

ScienceDaily (May 18, 2010) — For a "throw away" society, Queenslanders have a "lot of guilt" about disposing of products that are not recycled, a Queensland University of Technology (QUT) industrial design study has found.

PhD researcher in industrial design at QUT's School of Design Shayne Beaver looked at people's emotional attachments to every day materials such as timber, metal, glass and plastic and found we valued more highly the ones that could be maintained or recycled.

In an almost counterintuitive finding for a society that has mountainous landfill sites, she said people wanted their relationships with products to "end well" and that meant knowing the products would be recycled or reused.

"There is a lot of guilt about the way things are disposed of and that translates to a higher status for materials that can be renewed and reused," Ms Beaver said.

"The highest status was given to wood because people felt it could be rejuvenated -- sanded and repainted or oiled, it lasts and it can be recycled."

Ms Beaver studied the reactions of 15 pairs of people of all ages -- one male and one female -- when asked to describe their thoughts on wood, glass, metal, plastic, textile, and ceramic, in terms of durability, disposal, maintenance, origin, texture, appearance and other qualities.

"The study had a range of aims included to underpin research into new material so that positive feelings towards products can be enhanced with the materials used," Ms Beaver said.

"For example, people really dislike plastic. The say it discolours, its texture is unpleasant, it makes your hands sweat and people don't know if it will be recycled.

"They also said they didn't like it because it imitates other material, such as metal in mobile phones, and then it lets people down.

"Many participants mentioned the plastic toys they had and how they had learnt to expect plastic things to break. So whereas they would hold onto a stainless steel mixing bowl they wouldn't keep a plastic one."

She said it was important for designers to know about human reactions to materials so they could make products people liked to use and valued.

"Also we need to understand how to choose materials that fit the purpose of the product," said Ms Beaver.

" For example, if something is going to be only used for four months then it should be made from material that is recyclable.

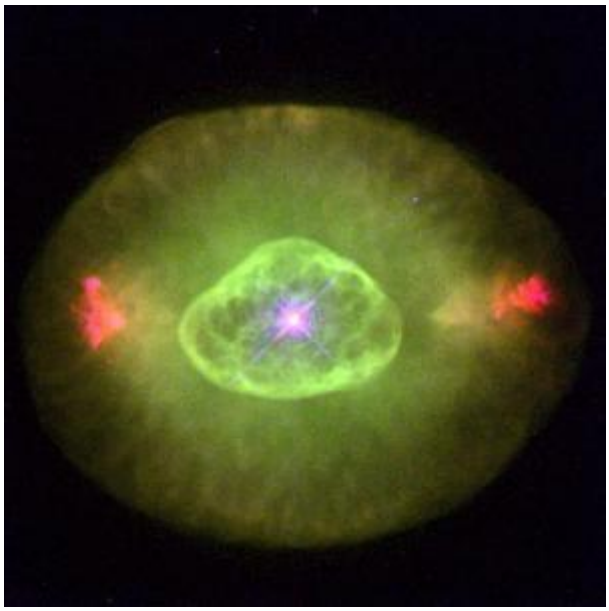
"Study participants also showed that they would blacklist a brand if they were not satisfied with the life of the product in relation to the material. For example, one participant tried to buy cartridges for a printer that was less than a year old and was told that they no longer made the cartridges. She was advised to buy a new printer.

"Instead, she bought refilled cartridges and vowed never to purchase that brand again because she was angered by the waste of having to throw out the printer even though it was cheap to replace."

Adapted from materials provided by Queensland University of Technology.

http://www.sciencedaily.com/releases/2010/05/100510092101.htm

Whole Earth Telescope Watching 'Dancing' Stars



This star is on its way to becoming a white dwarf. (Credit: Image courtesy of NASA Hubble Telescope)

ScienceDaily (May 18, 2010) — After billions of years of twinkling and shining, some stars in the heavens appear to "dance" as they wind down. Maybe not like Elvis or Michael Jackson, but they definitely have a rhythmic beat, and some may even spin like a top.

For the next two weeks, the Whole Earth Telescope, an international network of cooperating astronomical observatories led by the University of Delaware, will be continuously monitoring three of these stars to try to figure out what's going on inside their luminous masses of cooling plasma.

The primary target is a white dwarf star known as GD358 in the constellation Hercules. It's made of helium and has a surface temperature estimated at around 19,000 Kelvin.

"We recently discovered that this star is pulsating a little strangely, and we are looking for signs that it is spinning like a top," says Judi Provencal, assistant professor of physics and astronomy at the University of Delaware and director of the Delaware Asteroseismic Research Center.

A primary mission of the center, which is sponsored by Mt. Cuba Observatory in Greenville, Del., and UD, is to coordinate the activities of the Whole Earth Telescope.

A white dwarf is a "dead" star that doesn't generate its own energy like the sun does, Provencal says.

"The sun will one day become a white dwarf star, which is why we're interested in knowing more about them and what happens to any planets the original star might have had," Provencal notes.

The Whole Earth Telescope's second target star is the rapidly pulsating PG1325+101 in the constellation Virgo, which is suspected of having one or more planets in orbit around it. The international team will be working to confirm that suspicion, observing the star in collaboration with colleague Roberto Silvotti, leader of the observing group in Italy.

The third target star, WD1524, in the constellation Serpens, was observed during the Whole Earth Telescope's 2009 international campaign. The star was a high-amplitude pulsator until right before the observing run started, when it mysteriously became a small-amplitude pulsator.

"How stars pulsate depends on their structure and composition," says Provencal. "Last year, WD1524 completely changed how it was pulsating. Imagine ringing the Liberty Bell and having it sound like a hand bell. That would be hard to do. We don't understand how this happens with our pulsating stars. We now know that this star has changed yet again, so we are trying to understand how that can happen. Our current theoretical models of white dwarfs don't predict this sort of behavior."

There are thousands of white dwarfs in our galaxy; however, only about 30 percent are bright enough for scientists to study using the science of stellar seismology or asteroseismics, which can determine the age, temperature, and composition of a star from its oscillations and brightness.

A white dwarf star pulsates or quakes as waves of energy travel through it. The star's outer surface sloshes from side to side, like waves on the ocean, Provencal says.

From the shape of these pulses, scientists can measure how the atmosphere is moving around in these pulsating stars and figure out what's going on inside them, and determine whether an external object like a planet is influencing the star.

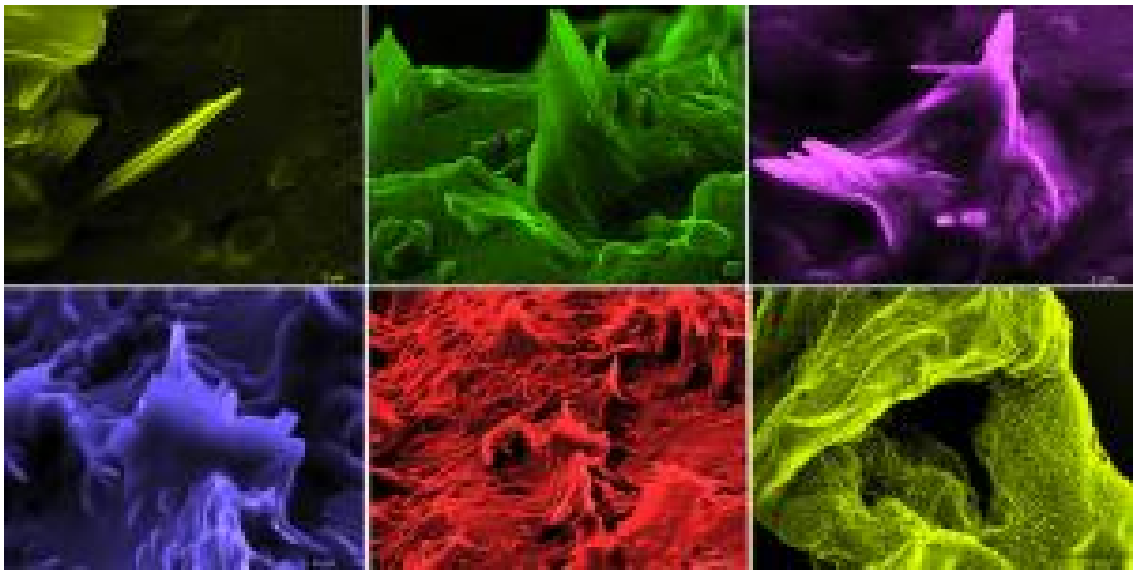
The scientific goal of the Whole Earth Telescope is to obtain uninterrupted time-series measurements of "variable stars" -- stars whose brightness changes over time -- and then construct theoretical models from which their fundamental astrophysics can be derived. The approach, which has been extremely successful, according to Provencal, has placed the fledgling science of "star quakes" at the forefront of stellar astrophysics.

Story Source:

Adapted from materials provided by University of Delaware.

http://www.sciencedaily.com/releases/2010/05/100518124843.htm

Cholesterol Crystals Incite Inflammation in Coronary Arteries, Research Finds



The protruding elements seen in the different slides are cholesterol crystals. Those elements are arising from within the artery wall, causing tearing and damage to the artery. The colors have been added for enhancement and imagery. (Credit: Image courtesy of Michigan State University)

ScienceDaily (May 18, 2010) — Cholesterol crystals, known to be a catalyst for heart attacks and strokes, also cause cells to send out danger signals that can lead to the inflammation and hardening of arteries, according to a Michigan State University cardiologist.

The discovery by George Abela, chief of the cardiology division in MSU's College of Human Medicine, and a team of researchers provides new insights into how arteries harden -- a process called atherosclerosis -- and gives hope for new and early treatments of cardiovascular disease.

The findings are published in the most recent edition of the journal *Nature*.

Past research has shown that as cholesterol builds up along the wall of an artery, it crystallizes from a liquid to a solid state and expands, said Abela, who has been studying cholesterol crystals for nearly a decade. As the crystals expand, they can disrupt plaque and cause clotting, leading to cardiac attacks. That research also was recently highlighted recently in the *Journal of Clinical Lipidology*.

In a new discovery, Abela and the team -- while looking at causes of inflammation during atherosclerosis in mice -- found that the once cholesterol crystals form in the arterial wall, they activate a biomarker called NLRP3 that induces inflammation.

"What we have found now, at the cellular level, is that the crystals are an early cause rather than a late consequence of inflammation," Abela said.

The discovery could lead to new treatments for heart disease.

"Since cholesterol crystals form very early in the process of heart disease, with great potential to aggravate atherosclerosis, we can target them early on," Abela said. "We can target new therapies by reducing cholesterol crystal deposits early on or use an inhibitor to block the inflammatory biomarker."

Abela added that the biomarker activated by the crystals could be a better indicator of potential cardiovascular disease than others, such as serum cholesterol, or the amount of cholesterol found in the bloodstream.

"Now we treat atherosclerosis on the systematic level; with this discovery we can also treat it the cellular level," he said.

Story Source:

Adapted from materials provided by Michigan State University.

Journal References:

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http://www.sciencedaily.com/releases/2010/05/100518170034.htm

Invasive Kudzu Is Major Factor in Surface Ozone Pollution, Study Shows

Kudzu, sometimes called the vine that ate the Southeastern USA, growing over an abandoned car and truck in Chattanooga, Tennessee. This invasive vine when left unchecked will cover anything that isn't moving. (Credit: iStockphoto/Roel Smart)

ScienceDaily (May 18, 2010) — Kudzu, an invasive vine that is spreading across the southeastern United States and northward, is a major contributor to large-scale increases of the pollutant surface ozone, according to a study published the week of May 17 in the journal *Proceedings of the National Academy of Sciences*.

Kudzu, a leafy vine native to Japan and southeastern China, produces the chemicals isoprene and nitric oxide, which, when combined with nitrogen in the air, form ozone, an air pollutant that causes significant health problems for humans. Ozone also hinders the growth of many kinds of plants, including crop vegetation.

"We found that this chemical reaction caused by kudzu leads to about a 50 percent increase in the number of days each year in which ozone levels exceed what the Environmental Protection Agency deems as unhealthy," said study co-author Manuel Lerdau, a University of Virginia professor of environmental sciences and biology. "This increase in ozone completely overcomes the reductions in ozone realized from automobile pollution control legislation."

Lerdau and his former graduate student, lead author Jonathan Hickman -- now a postdoctoral fellow at Columbia University -- used field studies at three sites in Georgia to determine the gas production of kudzu. They then worked with Shiliang Wu and Loretta Mickley, atmospheric scientists at Harvard University, who used atmospheric chemistry computer models to evaluate the potential 50-year effect of kudzu invasion on regional air quality.

"Essentially what we found is that this biological invasion has the capacity to degrade air quality, and in all likelihood over time lead to increases in air pollution, increases in health problems caused by that air pollution, and decreases in agricultural productivity," Lerdau said.

"This is yet another compelling reason to begin seriously combating this biological invasion. What was once considered a nuisance, and primarily of concern to ecologists and farmers, is now proving to be a potentially serious health threat."

Ozone acts as an irritant to the eyes, nose and throat, and can damage the lungs, sometimes causing asthma or worsening asthma symptoms. It also is a mutagen and can cause lung cancer.

Ozone, while essential to the health of the Earth in the upper atmosphere where it shields the surface from excess ultraviolet radiation, is hazardous to human health when it forms at the earth's surface. This occurs most often in the summertime as plants grow and produce chemicals that react with the air.

Introduced to the United States in the late 19th century, kudzu, with its unique nitrogen-fixing physiology, allows a rapid, nearly uninhibited rate of growth, about three times the rate of trees and other vegetation. The vine was cultivated more extensively in the 1920s and 1930s as a control for soil erosion and rapidly became known as "the vine that ate the South."

In recent, milder winters, Kudzu has expanded its range northward into Pennsylvania and New York.

"What was once a Southern problem is now becoming an East Coast issue," Lerdau said.

Various strategies are used for controlling and eradicating kudzu, including livestock grazing, burning, mowing and herbicides.

Story Source:

Adapted from materials provided by University of Virginia, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Jonathan E. Hickman, Shiliang Wu, Loretta J. Mickley, and Manuel T. Lerdau. **Kudzu (Pueraria montana) invasion doubles emissions of nitric oxide and increases ozone pollution**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.0912279107

http://www.sciencedaily.com/releases/2010/05/100517172302.htm

Physicists' Findings About Helium Could Lead to More Accurate Temperature

Vial of glowing ultrapure helium. (Credit: Image by Jurii -- see: http://images-of-elements.com/helium.php)

ScienceDaily (May 18, 2010) — In the May 7 edition of *Physical Review Letters*, a journal of the American Physical Society, an international team led by University of Delaware researchers reports new findings about helium that may lead to more accurate standards for how temperature and pressure are measured.

In the article, highlighted as an "Editor's Suggestion" by the journal, the scientists provide a new theoretical computation of the force acting between a pair of helium atoms, referred to as "pair potential," that is more accurate than any published to date.

Krzysztof Szalewicz, professor in the UD Department of Physics and Astronomy, led the study, which involved Wojciech Cencek, a postdoctoral researcher at UD, and colleagues from the University of Warsaw and Adam Mickiewicz University in Poland, and the University of Oslo in Norway.

Most of us know helium as a gas for filling party balloons or for making your voice temporarily sound like a cartoon character's. But this element named for the sun is used in lasers for eye surgery, to cooling agents in nuclear reactors.

Helium has a number of characteristics that make it special, Szalewicz says. It is the most stable of all the elements and has the lowest boiling point. It becomes a fluid at temperatures close to absolute zero while most other materials are a solid. In fact, helium is a liquid even at absolute zero and becomes a solid only at high pressure.

Helium is the only substance that exhibits superfluidity, and it will not burn or react with other elements, which is one reason why it is used as a pressurizing agent for liquid fuel rockets in space exploration, among many other applications.

"Of all the elements, helium is closest to the ideal gas," Szalewicz says. "Two helium atoms form the weakest bound diatomic molecule. All the properties of temperature, for example, which is a measure of the kinetic energy of particles in matter, can be modeled if the force acting between a pair of helium atoms is known.

"This has been the subject of extensive activity," Szalewicz notes, "as accurate knowledge of the pair potential of helium is of importance in several branches of science, including low-temperature condensed matter physics, spectroscopy, and metrology, which is the science of measurement."

The research team used complex numerical techniques to compute several physical effects in the helium pair potential which are rarely considered in molecular physics. These effects include couplings of the electronic and nuclear motions, contributions due to Einstein's special relativity, and the so-called quantum electrodynamics contributions due to the interaction of the electrons with the electromagnetic field.

The scientists predict that the binding energy of two molecules of helium, chemically referred to as a "dimer," is 6,790 times smaller than the potential depth, and the average separation between the atoms is 47 angstroms compared to the typical chemical bond length of about 1 angstrom. The estimated uncertainties of the theoretical results are an order of magnitude smaller than the best experimental ones, they report.

The thermophysical properties of gaseous helium computed from this potential now will be used to calibrate the apparatus for measuring properties such as viscosities or the speed of sound.

"These calculations should lead to new, better standards for quantities such as temperature or pressure," Szalewicz says. "Continuous improvement of metrology standards is important for progress in experimental science, as well as in many industrial applications."

The research was supported in part by grants from the National Institute of Standards and Technology and the National Science Foundation.

Story Source:

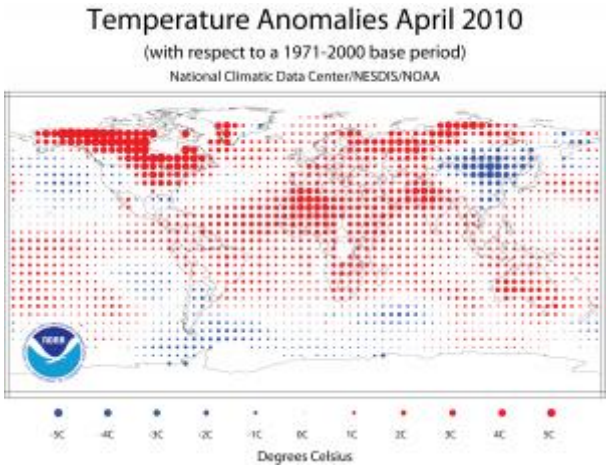
Adapted from materials provided by University of Delaware. Original article written by Tracey Bryant.

Journal Reference:

1. M. Przybytek, W. Cencek, J. Komasa, G. %u0141ach, B. Jeziorski, K. Szalewicz. **Relativistic and Quantum Electrodynamics Effects in the Helium Pair Potential**. *Physical Review Letters*, 2010; 104 (18): 183003 DOI: 10.1103/PhysRevLett.104.183003

http://www.sciencedaily.com/releases/2010/05/100517152526.htm

Warmest April Global Temperature on Record, NOAA Says



Temperature Anomalies April 2010. (Credit: NOAA)

ScienceDaily (May 18, 2010) — The combined global land and ocean surface temperature was the warmest on record for both April and for the period from January-April, according to NOAA. Additionally, last month's average ocean surface temperature was the warmest on record for any April, and the global land surface temperature was the third warmest on record.

The monthly analysis from NOAA's National Climatic Data Center, which is based on records going back to 1880, is part of the suite of climate services that NOAA provides government, business and community leaders so they can make informed decisions.

Global Temperature Highlights -- April 2010

- The combined April global land and ocean average surface temperature was the warmest on record at 58.1°F (14.5°C), which is 1.37°F (0.76°C) above the 20th century average of 56.7°F (13.7°C).
- The combined global land and ocean average surface temperature was the warmest on record for January-April at 56.0°F (13.3°C), which is 1.24°F (0.69°C) above the 20th century average.
- Separately, the global ocean surface temperature was 1.03°F (0.57°C) above the 20th century average of 60.9°F (16.0°C) and the warmest on record for April. The warmth was most pronounced in the equatorial portions of the major oceans, especially the Atlantic.
- The global land surface temperature was 2.32°F (1.29°C) above the 20th century average of 46.5 °F (8.1°C) -- the third warmest on record for April. Warmer-than-normal conditions dominated the globe, with the most prominent warmth in Canada, Alaska, the eastern United States, Australia, South Asia, northern Africa and northern Russia. Cooler-than-normal places included Mongolia, Argentina, far eastern Russia, the western contiguous United States and most of China.
- El Niño Southern Oscillation (ENSO) weakened in April, as sea-surface temperature anomalies decreased across the equatorial Pacific Ocean. The weakening contributed significantly to the warmth observed in the tropical belt and the warmth of the overall ocean temperature for April. According to NOAA's Climate Prediction Center, El Niño is expected to continue through June.

Other Highlights

- Arctic sea ice was below normal for the 11th consecutive April, covering an average of 5.7 million square miles (14.7 million square kilometers). This is 2.1 percent below the 1979-2000

average extent and the 15th smallest April extent since records began in 1979. It was, however, the largest April Arctic sea ice extent since 2001.

- Antarctic sea ice extent in April was near average, just 0.3 percent below the 1979-2000 average.
- Based on NOAA satellite observations, snow cover extent was the fourth-lowest on record (since 1967), and below the 1967-2010 average for the Northern Hemisphere for the seventh consecutive April. Warmer-than-normal conditions over North America, Europe and parts of Russia contributed to the small snow footprint.
- The North American snow cover extent for the month was the smallest on record for April. It also was the largest negative anomaly, meaning difference below the long-term average, on record for *any* month.
- According to Australia's Bureau of Meteorology, Victoria and Tasmania had their warmest 12-month period since national records began.
- According to the Beijing Climate Center, China experienced its coolest April since 1961. Liaoning, Jilin and Shandong had their coolest April on record. Hebei, Anhui and Jiangsu had their second coolest April since records began in 1951.
- China had its wettest April since 1974 and Tibet had its wettest April since records began in 1951. Meanwhile, Germany had its second-driest April on record since 1901, behind 2007, according to the German Meteorological Service (Deutscher Wetterdienst).

Scientists, researchers, and leaders in government and industry use NOAA's monthly reports to help track trends and other changes in the world's climate. This climate service has a wide range of practical uses, from helping farmers know what and when to plant, to guiding resource managers with critical decisions about water, energy and other vital assets.

Story Source:

Adapted from materials provided by National Oceanic and Atmospheric Administration.

http://www.sciencedaily.com/releases/2010/05/100517233818.htm

Caffeine May Slow Alzheimer's Disease and Other Dementias, Restore Cognitive Function, According to New Evidence

Coffee with caffeine. Caffeine may be protective against the cognitive decline seen in dementia and Alzheimer's disease. (Credit: iStockphoto)

ScienceDaily (May 18, 2010) — Although caffeine is the most widely consumed psychoactive drug worldwide, its potential beneficial effect for maintenance of proper brain functioning has only recently begun to be adequately appreciated. Substantial evidence from epidemiological studies and fundamental research in animal models suggests that caffeine may be protective against the cognitive decline seen in dementia and Alzheimer's disease (AD).

A special supplement to the *Journal of Alzheimer's Disease*, "Therapeutic Opportunities for Caffeine in Alzheimer's Disease and Other Neurodegenerative Diseases," sheds new light on this topic and presents key findings.

Guest editors Alexandre de Mendonça, Institute of Molecular Medicine and Faculty of Medicine, University of Lisbon, Portugal, and Rodrigo A. Cunha, Center for Neuroscience and Cell Biology of Coimbra and Faculty of Medicine, University of Coimbra, Portugal, have assembled a group of international experts to explore the effects of caffeine on the brain. The resulting collection of original studies conveys multiple perspectives on topics ranging from molecular targets of caffeine, neurophysiological modifications and adaptations, to the potential mechanisms underlying the behavioral and neuroprotective actions of caffeine in distinct brain pathologies.

"Epidemiological studies first revealed an inverse association between the chronic consumption of caffeine and the incidence of Parkinson's disease," according to Mendonça and Cunha. "This was paralleled by animal studies of Parkinson's disease showing that caffeine prevented motor deficits as well as neurodegeneration "Later a few epidemiological studies showed that the consumption of moderate amounts of caffeine was inversely associated with the cognitive decline associated with aging as well as the incidence of Alzheimer's disease. Again, this was paralleled by animal studies showing that chronic caffeine administration prevented memory deterioration and neurodegeneration in animal models of aging and of Alzheimer's disease."

Key findings presented in "Therapeutic Opportunities for Caffeine in Alzheimer's Disease and Other Neurodegenerative Diseases":

- Multiple beneficial effects of caffeine to normalize brain function and prevent its degeneration
- Caffeine's neuroprotective profile and its ability to reduce amyloid-beta production
- Caffeine as a candidate disease-modifying agent for Alzheimer's disease
- Positive impact of caffeine on cognition and memory performance
- Identification of adenosine A2A receptors as the main target for neuroprotection afforded by caffeine consumption

- Confirmation of data through valuable meta-analyses presented
- Epidemiological studies corroborated by meta-analysis suggesting that caffeine may be protective against Parkinson's disease
- Several methodological issues must be solved before advancing to decisive clinical trials

Mendonça and Cunha also observe that "the daily follow-up of patients with AD has taught us that improvement of daily living may be a more significant indicator of amelioration than slight improvements in objective measures of memory performance. One of the most prevalent complications of AD is depression of mood, and the recent observations that caffeine might be a mood normalizer are of particular interest."

The supplement was funded by the Associação Industrial e Comercial do Café, while leaving full scientific independence to all contributors. The entire issue has been made available on a no-fee basis at http://iospress.metapress.com/content/t13614762731/.

Story Source:

Adapted from materials provided by IOS Press, via EurekAlert!, a service of AAAS.

http://www.sciencedaily.com/releases/2010/05/100517111937.htm