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Why the Haiti quake killed so many

- 13:18 19 January 2010 by **Kate Ravilious**

Better buildings could have saved lives (Image: Thony Belizaire/AFP/Getty Images)

Last week's earthquake in Haiti has been described by the United Nations as the worst humanitarian crisis in decades, with estimates of the number of dead ranging from 50,000 to 200,000. The UN blames the fact that the quake hit a densely populated capital city, knocking out many of the agencies that would have dealt with disaster relief.

Geologists speaking to *New Scientist* explained some of the other reasons why the quake was so bad, and warned that more quakes may come, because not all the pent-up seismic energy was released in the tragedy.

First, the quake was "shallow source" and so allowed less warning time to get out of buildings than deep quakes. And Port au Prince is built not on solid rock but on soil, which collapses when shaken. Finally, building standards were not adequate for major earthquakes.

If a similar quake occurred in California, the death toll would almost certainly have been much lower. "Better buildings would have saved lives," says Chuck DeMets, a tectonic geologist from the University of Wisconsin-Madison.

Tale of two quakes

A comparison with two very similar earthquakes backs up this assertion. Both occurred in densely populated regions, but they had very different outcomes. In 1988, the Spitak magnitude-6.9 earthquake in Armenia took more than 25,000 lives. By contrast the magnitude-7.1 Loma Prieta earthquake in

California in 1989 caused only 63 deaths. "The difference in the numbers of fatalities illustrates the huge effect that high building standards can have in saving people's lives," says DeMets.

The multi-storey concrete buildings that made up much of Port-au-Prince proved to be death traps when the earthquake struck. "The buildings were brittle and had no flexibility, breaking catastrophically when the earthquake struck," says Ian Main, a seismologist at the University of Edinburgh, UK.

And the disaster was compounded by the earthquake's shallow source. "With deep earthquakes the primary waves arrive first, giving you a bit of warning before the shear waves [responsible for shaking the ground from side to side] arrive," says Uri ten Brink, an expert on earthquakes in the Caribbean from the US Geological Survey in Woods Hole, Massachusetts. In Haiti the epicentre was so close to the surface that the primary and shear waves arrived almost at the same time.

Design and survive

So what kind of buildings can withstand this kind of shake? "Engineers use more flexible materials with a built-in capacity to absorb damage, much as car bonnets are now designed to crumple, leaving the interior intact," explains Main. "This might include base-isolation shock absorbers on the first floor, to help resist or minimise dynamic shear and twisting motions."

Retrofitting conventional buildings to make them earthquake-proof is expensive, but constructing new buildings to be shake-proof is not.

"Seismic-resistant buildings cost a few per cent more in building materials and need a little extra designer time, but they are not a great deal more expensive than ordinary buildings," says Main.

http://www.newscientist.com/article/dn18406-why-the-haiti-quake-killed-so-many.html?DCMP=NLC-nletter&nsref=dn18406

Alive and Well

December 28, 2009
By Mary B. Marcy

The liberal arts are higher education's answer to Broadway, that "fabulous invalid" whose demise is predicted with both certainty and regularity. Claims that the liberal arts are in jeopardy have taken on increased urgency in the current economic climate. As students swell the ranks of community colleges, the presumption is that readily identifiable and employable skills rather than broad and deep learning are the primary focus of their educational ambitions.

But in the case of the liberal arts, conventional wisdom is at odds with what experience and current data suggest. For example, the benchmark freshmen surveys conducted each year by UCLA's Higher Education Research Institute show an increasing appetite for the kind of educational experience typically associated with the liberal arts. In 2008, for the first time since 1982, more than 50 percent of first year students identified "developing a meaningful philosophy of life" as an important or very important goal of their college experience.

Similarly, the venerable pollster John Zogby has found that a growing segment -- including but not limited to the traditional college age population -- of United States citizens believes living a "meaningful life" is central to the realization of the American dream. And despite dire predictions, enrollment at most liberal arts colleges, including my own, has risen during this difficult economic year.

There are likely two reasons for this gap between conventional wisdom and student decision making. The first is that the separation of liberal arts education from employment is simply unfounded. Employers consistently say that they want to hire graduates who can write and speak clearly, who are innovative and critical thinkers, and who are sophisticated and comfortable with diversity. While not exclusively the domain of liberal education, these traits are certainly cultivated in a liberal arts environment.

The second probable reason for the persistence of the liberal arts is the focus of students themselves. Today's traditional college age population is more globally-minded, less interested in work as a means only to material success, more willing to find middle ground on issues that typically lead to bi-modal responses (such as abortion), and entirely comfortable with differences in race, gender, and sexual orientation.

In short, today's young people are balm to the liberal educator's soul. Ideally, liberal education should literally do just that – it should be education that liberates, that frees the mind from the vagaries and prejudices of received opinion and limited life experiences.

Of course, a reinvigorated focus on liberal education in this light suggests that some of the country club amenities of recent college life may not be particularly essential. Yet material gain is not eschewed in recent findings; it is simply not sufficient. Student expectations for material comfort and the search for meaning are not incompatible, but they may not be attainable in institutions whose resources are strained.

When in doubt, we should follow the example of Bobby Kennedy during the Cuban missile crisis: ignore unreasonable demands and respond to the best of their aspirations. In this case, the liberal arts should provide a model of education that offers both a path to employment and faith in learning for its own sake; a set of useful skills along with the ability to reflect and find value in something beyond oneself. And a campus with older residence halls housing two and three students to a room is not only defensible, it is quite probably a sign of an institution focused on -- well, on education.

To add to the economic anxiety, there is also frequent hand wringing over the fate of the liberal arts due to the growth and proliferation of technology. It was not so long ago that technology was seen as a threat to educational engagement, whether it was through online learning or in society at large as we all "bowled

alone." Yet much of this anxiety evolved from a false dichotomy -- the notion that high tech and high touch are incompatible.

Students see no contradiction between technological sophistication and a personally connected learning community, and they expect both to be a part of their education. The reflection and personal engagement implied by the search for a meaningful life is fully compatible with the Internet age. Students are increasingly sophisticated in online work, while simultaneously they thrive, as much as ever, from strong relationships with faculty. Students expect fully contemporary technological resources, even as they seek the depth and meaning promised by a liberal arts education. The practical and financial challenge is to secure the necessary technological resources and fully integrate them into a sophisticated liberal arts education.

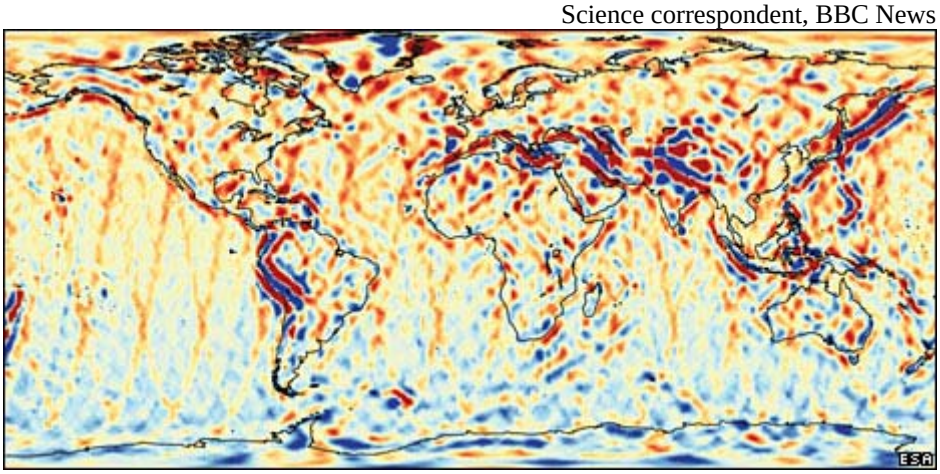
The threat to the liberal arts, if there is one, is not from the recession -- although our resources in higher education are limited. And it is not from a failure to offer marketable skills, for liberal education prepares students for both life and employment. The threat is the enduring challenge of education: to engage eternal truths even as we respond to contemporary issues. It is to ensure that liberal education evolves, that meaningful reflection can employ contemporary technological tools, that cultural exchange should extend beyond the boundaries of western democracies, that understanding identity does not inevitably lead to a chasm of difference. It is to create a liberal education that is both contemporary and enduring, evolving and profound. This is, simply and as always, the promise and the challenge of liberal education.

Mary B. Marcy is provost and vice president of Bard College at Simon's Rock.

http://www.insidehighered.com/views/2009/12/28/marcy

ESA satellite senses Earth's pull

By Jonathan Amos
Science correspondent, BBC News



Europe's Goce satellite is returning remarkable new data on the way the pull of gravity varies across the Earth. Scientists say its first maps clearly show details not seen in previous space and ground measurements.

Goce was launched by the European Space Agency (Esa) in March from the Plesetsk Cosmodrome in north-west Russia.

Its information is expected to bring new insights into how the oceans move, and to frame a universal system to measure height anywhere on the planet.

Researchers who study geological processes, such as earthquakes and volcanoes, will also make use of the data.

The first maps built from Goce observations were presented at the American Geophysical Union's (AGU) recent Fall Meeting, the world's largest annual gathering of Earth scientists.

More or less

Although they represent just 47 days of operation following the start of the satellite's science campaign on 30 September, the maps prove Goce is attaining an exceptional level of performance.

GRAVITY - A MOVING TARGET
The 'standard' acceleration due to gravity at the Earth's surface is 9.8m per second squared
In reality the figure varies from 9.78 (minimum) at the equator to 9.83 (maximum) at the poles

"There is a tremendous amount of geophysics in these plots," explained Rune Floberghagen, Esa's Goce mission manager.

"You see where there are big variations, for example in the mountain range of the Andes, or the Mariana Trench, or the Indonesian Arc, or the Himalayas. In fact, on most of the continents, you see a lot of variation," he told BBC News.

The maps reproduced on this page illustrate "gravity gradients".

The red colours indicate a positive variation in gravity moving from one place to another - i.e. places where Earth's tug becomes greater.

The blue colours indicate a negative variation in gravity - places where Earth's tug is a little less.

Simply put, if you were to take some bathroom scales to these locations you would weigh fractionally more in red places and weigh less in blue ones.

Most people are taught at school that the acceleration due to gravity at the Earth's surface - known as *g* - is about 9.8m per second squared. But, in truth, this figure varies around the planet depending on the nature of the material underfoot.

The planet is far from a smooth sphere; the radius of the globe at the equator is about 20km longer than at the poles.

This ellipsoid is then marked by tall mountain ranges and cut by deep ocean trenches.

The Earth's interior layers are also not composed of perfect shells of homogenous rock - some regions are thicker or denser.

Such factors will cause *g* to deviate from place to place by very small but significant amounts.

The Gravity Field and Steady-State Ocean Circulation Explorer (Goce) maps these differences with a state-of-the-art gradiometer produced by the French Onera company. The instrument is sensitive to accelerations of about one-tenth of a millionth of a millionth of *g* .

And the gradiometer measures these accelerations across all three axes of the spacecraft to obtain a multi-dimensional view of the Earth's gravity field. "These are by far the smallest accelerations ever measured from orbit," said Dr Floberghagen.

Ocean shape

The first maps not only record the three components but also compare their signals to the best available gravity field models assembled from existing space- and ground-acquired data-sets.

Again, in this challenge to the existing models the Goce gradients appear most pronounced in high latitude and continental regions. The gradients seem less marked over the oceans where a lot of gravity field information has already been determined by spacecraft that measure sea-surface topography.

The Goce team stresses that its data is not yet fully homogenous; some areas of the Earth are currently covered better than others. This is evident in the diagonal stripes that can be seen in a number of the maps. The scientists say that some work also remains to be done in understanding how best to process the data.

Nonetheless, it is hoped that sufficient high-quality information will have been gathered in the opening months of the science campaign to construct what geophysicists call a geoid. This is a special type of Earth model which traces its idealised "horizontal" surface - the plane on which, at any point, the pull of gravity is perpendicular to it. If you could put a ball on this hypothetical surface, it would not roll - even though it appears to have slopes.

The geoid is of paramount interest to oceanographers who study the causes of the "hills" and "valleys" on the sea surface. If local gravity differences are not pulling water about to create these features, then other factors such as currents, winds and tides must be responsible.

Extended mission

The mission team also announced at the AGU meeting that Goce is likely to keep flying far longer than anyone had envisaged at launch.

This increase in lifetime is a result of the unusually quiet behaviour of the Sun at the moment. In periods of reduced solar activity, the Earth's atmosphere is less extensive and this means satellites do not experience quite so much drag.

Even at its ultra-low altitude of just 254.9km, Goce requires little effort from its propulsion system to maintain a steady orbit and keep itself from falling out of the sky.

Esa had been expecting the satellite to stay aloft for about two years. Current solar conditions suggest Goce will still be orbiting and gathering science data in five years' time.

"The air drag that we have experienced on orbit after launching has been very different from what any model was able to predict pre-launch," said Dr Floberghagen. "And that in turn means there is a lot of new science not only in the gravity field measurements but also in the measurements of the surface forces acting on the spacecraft.

"So we plan to generate another product from this mission which will serve modellers of the thermosphere, people who model the air density in the upper layers of the atmosphere."

GRAVITY FIELD AND STEADY-STATE OCEAN CIRCULATION EXPLORER

1. Goce senses tiny variations in the pull of gravity over Earth
2. The data is used to construct an idealised surface, or geoid
3. It traces gravity of equal 'potential'; balls won't roll on its 'slopes'
4. It is the shape the oceans would take without winds and currents
5. So, comparing sea level and geoid data reveals ocean behaviour
6. Gravity changes can betray magma movements under volcanoes
7. A precise geoid underpins a universal height system for the world
8. Gravity data can also reveal how much mass is lost by ice sheets

1. The 1,100kg Goce is built from rigid materials and carries fixed solar wings. The gravity data must be clear of spacecraft 'noise'

2. Solar cells produce 1,300W and cover the Sun-facing side of Goce; the near side (as shown) radiates heat to keep it cool

3. The 5m-by-1m frame incorporates fins to stabilise the spacecraft as it flies through the residual air in the thermosphere

4. Goce's accelerometers measure accelerations that are as small as 1 part in 10,000,000,000,000 of the gravity experienced on Earth

5. The UK-built engine ejects xenon ions at velocities exceeding 40,000m/s; the engine throttles up and down to keep Goce at a steady altitude

6. S Band antenna: Data downloads to the Kiruna (Sweden) ground station. Processing, archiving is done at Esa's centre in Frascati, Italy

7. GPS antennas: Precise positioning of Goce is required, but GPS data in itself can also provide some gravity field information

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Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8408957.stm

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Natural Variability Led to Extra-Cold 2008, Research Finds

New research finds that anthropogenic forcing in 2008 did contribute to temperatures warmer than would otherwise have occurred but that those human-induced effects were overwhelmed by a particularly strong bout of natural cooling. (Credit: iStockphoto/Todd Lammers)

ScienceDaily (Dec. 31, 2009) — An especially cold year in North America in 2008 led some members of the public and the media to question the scientific consensus on human-induced global warming. In addition, the cool global temperatures during the past decade may appear to contrast with the warming expected due to human influence.

To clarify the roles of human influence and natural climate variability, Perlwitz et al. used observed temperature data and a suite of climate model simulations to analyze factors contributing to the 2008 North American temperature conditions.

The researchers found that the anthropogenic forcing in 2008 did contribute to temperatures warmer than would otherwise have occurred but that those human-induced effects were overwhelmed by a particularly strong bout of natural cooling. The authors determined that the North American cooling likely resulted from a widespread natural coolness in the tropical and northeastern Pacific Ocean.The study implies that the abnormally cool 2008 is not likely part of a prolonged cooling trend and that general warming trends are likely to continue.The research is published in *Geophysical Research Letters.* Authors include Judith Perlwitz, Jon Eischeid, and Taiyi Xu: Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, Colorado, USA, and Earth System Research Laboratory, NOAA, Boulder, Colorado, USA; Martin Hoerling: Earth System Research Laboratory, NOAA, Boulder, Colorado, USA; and Arun Kumar: Climate Prediction Center, NOAA, Camp Springs, Maryland, USA

Story Source:

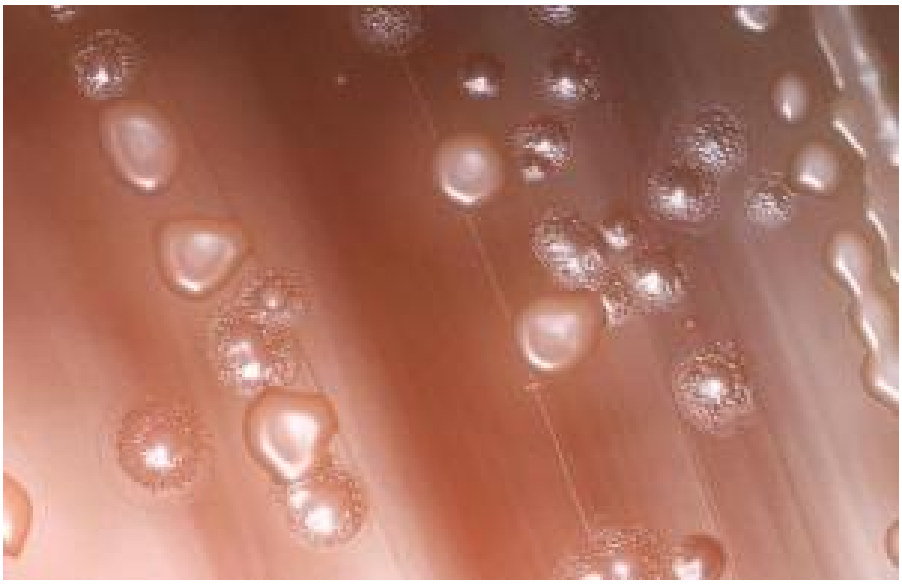
Adapted from materials provided by American Geophysical Union, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Perlwitz et al. **A strong bout of natural cooling in 2008**. *Geophysical Research Letters*, 2009; 36 (23): L23706 DOI: 10.1029/2009GL041188

http://www.sciencedaily.com/releases/2009/12/091230183204.htm

Severity of H1N1 Influenza Linked to Presence of Streptococcus Pneumoniae



Streptococcus pneumoniae bacterial colonies. (Credit: CDC/Dr. Richard Facklam)

ScienceDaily (Dec. 31, 2009) — The presence of the *Streptococcus pneumoniae* in samples that can be easily obtained in clinics and emergency rooms may predict risk of severe disease in H1N1 pandemic influenza.

Reports that H1N1 pandemic influenza in Argentina was associated with higher morbidity and mortality than in other countries led investigators in the Center for Infection and Immunity (CII) at the Mailman School of Public Health of Columbia University, their colleagues at Argentina's National Institute of Infectious Diseases (INEI), and Roche 454 Life Sciences to look for viral mutations indicative of increased virulence and for co-infections that could contribute to disease.

Complete genome sequencing of nasopharyngeal samples representing severe or mild disease revealed no evidence of evolution toward a more virulent phenotype or development of antiviral resistance. However, MassTag PCR, a method for sensitive, simultaneous surveillance and differential diagnosis of infectious diseases, found a strong correlation between the presence of *Streptococcus pneumoniae* and increased risk for severe disease. The findings, which suggest a new strategy for identifying and treating these patients, are currently online in the publication Plos One.

The scientists examined nasopharyngeal samples representing 199 cases of H1N1 pandemic (H1N1pdm) influenza virus infections from Argentina. The sample set included 39 cases classified as severe and 160 cases categorized as mild.

"We used a combination of 454 pyrosequencing and classical Sanger sequencing methods to test for viral evolution toward increased virulence. Comparison of viral sequences from Argentina with those obtained from other parts of the world provided no clues to the increase in severity of disease," said Gustavo Palacios, PhD, assistant professor of epidemiology at CII, and a lead and corresponding author. "However, MassTag PCR allowed us to find a new risk factor, independent of obesity, asthma, diabetes or chronic illness. *S. pneumoniae* was present in the majority of severe cases."

Specimens were tested for the presence of 33 viral and bacterial respiratory pathogens. "The presence of *Streptococcus pneumoniae* in individuals between the age of 6 and 55, those most affected by the current pandemic, was associated with a 125-fold increased risk of severe disease," said Mady Hornig, MD, associate professor of epidemiology and a co-first author of the paper.

"Whereas the association of *S. pneumoniae* with morbidity and mortality had been established in current and previous influenza pandemics, this study is the first to demonstrate that the diagnosis of *S. pneumoniae*, when it is still actionable, might have an impact on clinical management."

"Three practical implications emerge from our study," said CII Director W. Ian Lipkin, MD, John Snow Professor of Epidemiology, and professor of Neurology and Pathology at Columbia University. "First, *S. pneumoniae* is important in the pathogenesis and prognosis of H1N1pdm-associated disease. Whether this effect is associated with all *S. pneumoniae* or only with specific serotypes remains to be determined. Second, easily accessible samples such as nasopharyngeal swab samples may be used as an index to risk of severe disease. Third, multiplex diagnostic methods like MassTag PCR can enable rapid detection of a broad spectrum of viral and bacterial agents and inform clinical care."

Story Source:

Adapted from materials provided by Columbia University's Mailman School of Public Health, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Palacios et al. **Streptococcus pneumoniae Coinfection Is Correlated with the Severity of H1N1 Pandemic Influenza**. *PLoS ONE*, 2009; 4 (12): e8540 DOI: 10.1371/journal.pone.0008540

http://www.sciencedaily.com/releases/2009/12/091230201419.htm

Handful of Iron Beads Offer Clues to Solve Mystery of Ancient Iron Forges

Some forge beads from the forges. (Credit: Photo by Tove Eivindsen/NTNU Museum)

ScienceDaily (Dec. 31, 2009) — When archaeologist Ruth Iren Øien noticed a cluster of tiny iron beads in the ground, she knew she was onto something. She did not know, however, that her team had stumbled upon Scandinavia's oldest and most complex group of iron forges.

And not only that, it would be months before Øien, with the Norwegian University of Science and Technology's Museum of Natural History and Archaeology, would discover the actual significance of her find.

The iron beads were first found in November 2008, right at the very end of a highly weather-dependent field season in Norway. With frost about to set in, further investigation had to wait until the summer of 2009. But in July, Øien's team returned to the site.

The iron beads that had piqued Øien's interest were only 1 to1.5 millimetres in diameter. But they were sufficient to make her realize they might be residue from a smithy. It turned out she was right, but the number of forges on the small field surprised everyone.

"We found three different types of forges," Øien says. "Some were small and circular, some were indoors, and a third type was in the shape of a figure eight. Findings suggest the smiths used one half of the figure-eight shaped forges for the rough work before refining the iron in the other forges."

The excavations uncovered more than 200 construction-related artefacts, including post holes, forges, fireplaces and wall ditches. "Even though we have only uncovered half of the area, we have already found seven forges," says Preben Rønne, the museum's project manager for the site. "This cluster suggest some kind of early industrial activity, in the sense that clearly they had large scale production."

"These are rare and exciting results, and unique in a Scandinavian context," he adds.

The forges were found at Forsetmoen, a rural area about 1.5 hours south of Trondheim, Norway. The scientists believe the location is anything but coincidental.

"The iron was produced in the smaller side valleys, and transported to Forsetmoen for refining. From there iron artefacts have been transported to the larger farms further out. Maybe they've been sold even further," Rønne says.

The forges have been dated to 0-500 AD. and the various building artefacts to 400-500 AD.

The team also found post holes from a large house that was at least 30 metres long. One end seems to have been used for working the iron, with remains of elevated forges, an airing canal and a possible foundation for an ambolt. The large quantities of burnt bark that they found could be from a roof, and suggest the forge might have burnt down.

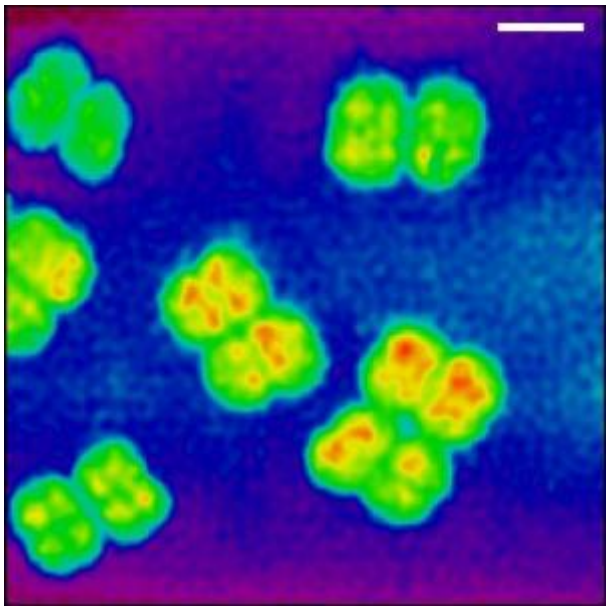
The finds are the first tantalizing clues that give an answer to the archaeological mystery of where and how Iron Age Scandinavians refined their iron.

Story Source:

Adapted from materials provided by The Norwegian University of Science and Technology (NTNU), via AlphaGalileo.

http://www.sciencedaily.com/releases/2009/12/091228124733.htm

Researchers Demonstrate Nanoscale X-Ray Imaging of Bacterial Cells



Deinococcus radiodurans in x-ray-light. Blue colors indicate areas with low density, red areas mark highest density. These are the regions carrying the compressed DNA-molecules. (Credit: Image courtesy of Tim Salditt, University of Goettingen)

ScienceDaily (Dec. 30, 2009) — An ultra-high-resolution imaging technique using X-ray diffraction is a step closer to fulfilling its promise as a window on nanometer-scale structures in biological samples. In the *Proceedings of the National Academy of Sciences*, researchers report progress in applying an approach to "lensless" X-ray microscopy that they introduced one year ago.

They have produced the first images, using this technique, of biological cells -- specifically the intriguing polyextremophile *Deinococcus radiodurans*.

Better ability to see nanoscale structures in cells could yield important insights for evolutionary biology and biotechnology. In the case of *D. radiodurans*, for example, it could help to settle questions about whether -- or how -- the structure of this organism's DNA-bearing nucleoid region accounts for its hardiness against ionizing radiation. Having demonstrated the resolution, reliability, and reproducibility of their technique, the researchers are now working to extend it to three-dimensional imaging of biological cells.

X-ray imaging is best known for its medical applications, such as traditional radiographs and CT scans. Yet the use of X-rays goes far beyond routine imaging. In particular, the very short wavelength of X-ray radiation allows various modes of microscopy that can reach the nanometer resolution. One of the main hurdles to high-resolution X-ray microscopy is the difficulty of producing high-quality X-ray lenses. To overcome these difficulties, so-called "lensless" microscopy methods have emerged in the last decade. A technique developed by researchers now in the biomedical physics group at Technische Universitaet Muenchen (TUM) has shown great promise for ultra-high resolution imaging of materials and life science samples.

This imaging technique, called ptychography, was first introduced in the 1970s for electron diffraction. It consists in measuring full far-field diffraction patterns as a small illumination is scanned on a sample. While its use in electron microscopy is still limited, ptychography has gained tremendous popularity in the X-ray imaging community in the last few years, thanks to the development by Franz Pfeiffer, now chair of the biomedical physics group at TUM, and his team. A critical step in the development of

ptychography was published by the team one year ago in Science. The super-resolution capability of the imaging method was successfully demonstrated with a gold test structure.

Now a collaboration of the Pfeiffer group, together with researchers at University of Goettingen and at the Swiss Light Source (Villigen, Switzerland), has gone a step further and produced the first images of biological cells with the same technique.

These results, published in the *Proceedings of the National Academy of Sciences*, show that lensless X-ray imaging, in particular ptychography, can be used to obtain accurate maps of the electron density forming a biological sample. This type of quantitative measurement is extremely difficult with most other high-resolution techniques currently available. Moreover, biological samples are very fragile and nearly transparent to X-rays, making this type of accurate measurement even more challenging.

The Pfeiffer group is now moving beyond this success and looking into ways of improving the technique further. In particular, the team is aiming at the next milestone: three-dimensional imaging of biological samples.

This research is supported by the German Research Foundation (DFG), the Helmholtz Society, and the German Ministry of Education and Research.

Story Source:

Adapted from materials provided by Technische Universitaet Muenchen, via EurekAlert!, a service of AAAS.

Journal References:

1. K. Giewekemeyer, P. Thibault, S. Kalbfleisch, A. Beerlink, C. M. Kewish, M. Dierolf, F. Pfeiffer, T. Salditt. **Quantitative biological imaging by ptychographic x-ray diffraction microscopy**. *Proceedings of the National Academy of Sciences*, 2009; DOI: 10.1073/pnas.0905846107
2. P. Thibault, M. Dierolf, A. Menzel, O. Bunk, C. David, F. Pfeiffer. **High-resolution scanning x-ray diffraction microscopy**. *Science*, 2008; 321 (5887): 379-381 DOI: 10.1126/science.1158573

http://www.sciencedaily.com/releases/2009/12/091207151234.htm

New Acoustic Tools May Reduce Ship Strikes on Whales

Large commercial ships routinely pass through feeding grounds for endangered North Atlantic right whales and other marine mammals. (Credit: Stellwagen Bank National Marine Sanctuary, NOAA)

ScienceDaily (Dec. 30, 2009) — Over the past decade, researchers have developed a variety of reliable real-time and archival instruments to study sounds made or heard by marine mammals and fish. These new sensors are now being used in research, management, and conservation projects around the world, with some very important practical results. Among them is improved monitoring of endangered North Atlantic right whales in an effort to reduce ship strikes, a leading cause of their deaths.

"The tools available to both acquire and analyze passive acoustic data have undergone a revolutionary change over the last ten years, and have substantially increased our ability to collect acoustic information and use it as a functional management tool," said Sofie Van Parijs, lead author and a bioacoustician at NOAA's Northeast Fisheries Science Center laboratory in Woods Hole, Mass. "These tools have significantly improved monitoring of North Atlantic right whales and enhanced the efficacy of managing ship traffic to reduce ship strikes of whales through much of the western North Atlantic off the U.S. East Coast."

Van Parijs is one of many researcher whose work is decribed this month in the journal *Marine Ecology Progress Series*. Her paper is one of about a dozen in a special theme issue focused on acoustics in marine ecology. Van Parijs, who currently heads the NEFSC's Protected Species Branch, is also a co-author of a related paper on acoustic interference or masking, in which marine animals alter their use of sound as a result of changing background noise.

Van Parijs and her colleagues focus on two types of acoustic sensors, real-time and archival. Real-time sensors are mounted on surface buoys, usually anchored or cabled to the ocean bottom, or deployed as arrays towed from a surface vessel. Archival sensors are affixed on bottom-moored buoys equipped with hydrophones to continuously record ocean sounds for long periods of time, often up to three months, before the sensors are temporarily recovered and their batteries refreshed. Some archiving sensors can be mounted of individual animals.

"Marine animals live their lives and communicate acoustically across different time and space scales and use sound for different reasons," said Van Parijs. "We need to use the right tool in the right place for the right need. There is no 'one size fits all' when it comes to using technology in the ocean."

Large whales move and communicate over great distances, while smaller whales and dolphins tend to communicate over smaller areas. Pinnipeds, the group of marine mammals that includes seals, walrus and sea lions, can breed on land, on ice or in the water, and move and communicate from small to medium distances. Human-produced sounds complicate the sensing problem by adding sounds to what can be a very noisy environment.

The use of passive acoustic monitoring is increasing as improved reliability and lower hardware and software costs provide researchers with a set of tools that can answer a broad range of scientific questions. This information can, in turn, be used in conservation management and mitigation efforts. While most of the new technologies have been applied in studies of whales and dolphins, the researchers say the sensors can also be used in studying pinnipeds, sirenians (manatees and dugongs), and fish.

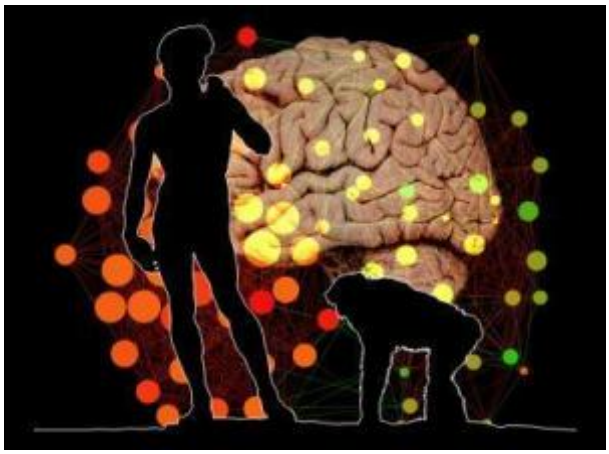
In addition to Van Parijs and colleagues at NOAA's Northeast and Southwest Fisheries Science Centers, co-authors on the article include researchers from Cornell University's Bioacoustics Research Program, Instituto Baleta Jubarta in Brazil, Pennsylvania State University, Integrated Statistics, and the Alfred Wegener Institute for Polar and Marine Research in Germany.

Story Source:

Adapted from materials provided by NOAA Fisheries Northeast Fisheries Science Center.

http://www.sciencedaily.com/releases/2009/12/091229124930.htm

Transcription Factors Guide Differences in Human and Chimp Brain Function



Gene regulatory networks differ between human and chimp brains, the researchers found. (Credit: Image: Edwin Hadley, University of Illinois.)

ScienceDaily (Dec. 30, 2009) — Humans share at least 97 percent of their genes with chimpanzees, but, as a new study of transcription factors makes clear, what you have in your genome may be less important than how you use it.

The study, in *Proceedings of the National Academy of Sciences,* found that broad differences in the gene activity of humans and of chimpanzees, affecting nearly 1,000 genes, appear to be linked to the action of about 90 transcription factors.

Transcription factors are proteins that bind to specific regions of the DNA to promote or repress the activity of many genes. A single transcription factor can spur the transcription of dozens of genes into messenger RNA (mRNA), which is then translated into proteins that do the work of the cell. This allows specific organs or tissues to quickly ramp up a response to an environmental change or internal need.

Previous studies have found differences in gene expression between humans and chimps, particularly in the brain. Genes involved in metabolism or protein transport, for example, are translated into mRNAs at a much higher level in human brains than in the smaller brains of chimpanzees.

This makes sense, said University of Illinois cell and developmental biology professor Lisa Stubbs, who led the new analysis with postdoctoral researcher Katja Nowick.

"These differences fit what we know because the human brain is so much larger and proteins need to be shuttled a long way out to the synapses," Stubbs said. "A higher requirement for metabolic energy has also been demonstrated independently for human brains."

What wasn't clear from previous studies was how this upsurge in gene activity was coordinated, she said.

Stubbs has had a longtime interest in the evolutionary role of transcription factors and other regulatory agents in the genome. She is particularly interested in the largest family of transcription factors in mammals, the KRAB zinc finger (KRAB-ZNF) genes, which on average have accumulated more differences in sequence between humans and chimps than other genes.

"There are a lot of unique new transcription factors that arise in this family," Stubbs said. "And they arise by duplication of older genes. So the genes make a new copy of themselves and then that new copy takes on a slightly different or even dramatically different function."

"Our very strong bias is to believe that these transcription factors are involved in speciation and traits that make species unique," she said.

Nowick, who studies human and primate evolution, was part of a team (at the Max Planck Institute for Evolutionary Anthropology, in Leipzig, Germany) that analyzed differences in gene expression between humans and chimps.

In the new study, Nowick and computer scientist Tim Gernat, a co-author, took a new look at data from that study, which tracked gene expression -- including genes coding for transcription factors -- in tissues from six humans and five chimpanzees.

"Katja and Tim came up with a strategy for cleaning up the data and looking at these genes more uniquely," Stubbs said. "It hadn't been done before."

The analysis revealed a broad pattern of activity in 90 transcription factors that paralleled the activity of about 1,000 genes in humans and chimps.

The KRAB-ZNF genes were the most common members of this group, but many other transcription factors were also involved. Some were activators and some were repressors, but their activity coincided with a general upsurge of these genes in human brains.

Eivind Almaas, a researcher at the Norwegian University of Science and Technology and a co-author on the study, developed a gene regulatory network diagram of the transcription factors in relation to the genes that rise or fall with them. The proximity of one transcription factor to another in the network depended on the degree of overlap of the lists of genes that correlate with each. Almaas created one network diagram for humans and another for chimps, and uncovered some interesting differences.

"The chimp network looks very much like the human one except there are a few transcription factors in different positions and with different connectivity," Stubbs said. "Those are of interest from the point of view that they signal a major gene regulatory shift between species, and this shift may help us explain some of the biological differences."

The new findings indicate that certain transcription factors are working together in a coordinated way to regulate the changes in seen in gene expression between humans and chimps, the researchers said.

"Once this network of transcription factors is established, changes in the network can be amplified because transcription factors control other genes," Nowick said. "Even a small change in transcription factor expression can therefore produce a large effect on overall gene expression differences between chimpanzees and humans."

Story Source:

Adapted from materials provided by University of Illinois at Urbana-Champaign.

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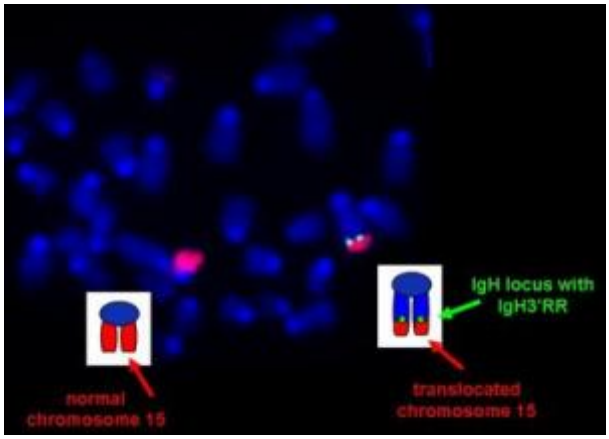
New Target for Lymphoma Therapy



This image shows how the movement of genes, or translocation, is responsible for cancers that arise from mature B-cells, such as Burkitt's lymphoma. Chromosome 15 (in red) contains c-myc, a known oncogene. If a part of chromosome 15 becomes connected to the IgH region of the DNA, the gene regulator IgH3'RR (green) can over-activate c-myc, leading to tumors. (Credit: Courtesy of Monica Gostissa, PhD, PCMM/IDI)

ScienceDaily (Dec. 30, 2009) — Researchers at the Program in Cellular and Molecular Medicine and the Immune Disease Institute at Children's Hospital Boston (PCMM/IDI) have found a link between a common mutation that can lead to cancer and a distant gene regulator that enhances its activity. Discovery of this relationship could lead to drugs targeting B-cell lymphomas, including Burkitt's lymphoma, an aggressive cancer in children, as well as multiple myelomas and other blood-related cancers.

Lymphomas often originate in B cells, the same cells that produce antibodies to help fight infections. A B cell can become cancerous if a gene known as c-myc leaps to another section of DNA (the IgH region, responsible for building antibodies), fuses with it, and somehow becomes over-activated. Scientists have wondered for years how this oncogenic activation occurs, in particular what component in the IgH region activates c-myc. The new study, published in the Dec. 10 issue of *Nature*, identifies this regulatory component, and marks the first time researchers are able to understand how this movement of genes, or "chromosomal translocation," can hijack a B cell's operation badly enough to lead to cancer.

"IgH-to-myc translocation is the classic example of activation of an oncogene in cancer," says Frederick Alt, PhD, scientific director of PCMM/IDI and senior author of the study. "But nobody really understood how it works."

Aberrant DNA translocations can occur during two different stages of a B cell's development: during a process known as VDJ recombination, when a progenitor B cell creates an antibody to fight a specific pathogen, or during class switch recombination, when a mature B cell gives its antibody a different strategy to fight infection (changing from an IgM to an IgG antibody, for example). Based on their past research , Alt and his colleagues decided to focus on one part of the IgH region called IgH 3' regulatory region (IgH3'RR). They had already shown IgH3'RR to be a far-reaching gene regulator that enhances the transcription of neighboring genes in the IgH region during class switch recombination.

To investigate the relationship between IgH3'RR and lymphoma, the team, led by Alt and first author Monica Gostissa, PhD, of PCMM/IDI, deleted the IgH3'RR in a line of mutant mice previously generated in the Alt lab. These mice routinely develop a B-cell lymphoma in which c-myc is translocated to the IgH region of the DNA. However, without IgH3'RR, mature B cells did not become cancerous, suggesting that mature B cells -- from which most human lymphomas originate -- need IgH3'RR in order to develop into lymphoma.

"The study shows that the IgH3'RR is a key element for turning on the cancer-causing activity of c-myc after it is translocated to the IgH locus," says Alt. He noted that the study also shows that the cancer-causing activity of the IgH3'RR on c-myc can extend over surprisingly long chromosomal distances.

The study suggests the IgH3'RR as a new target for arresting lymphomas and other blood-related cancers that arise from mature B cells. Though inactivating IgH3'RR can impair a B cell's versatility in creating different classes of antibodies, it would not leave a patient immune-deficient because the B cells would retain some of their activity, says Gostissa. Furthermore, such a treatment would be reversible.

The next step is for the researchers to see what eliminating IgH3'RR will do to existing tumors, and then to create a cell-based drug screening assay to test for possible IgH3'RR inhibitors.

The study was funded by grants from the National Institutes of Health and the Leukemia and Lymphoma Society of America (including funds from the de Villiers International Achievement Award). Alt is an investigator of the Howard Hughes Medical Institute.

Story Source:

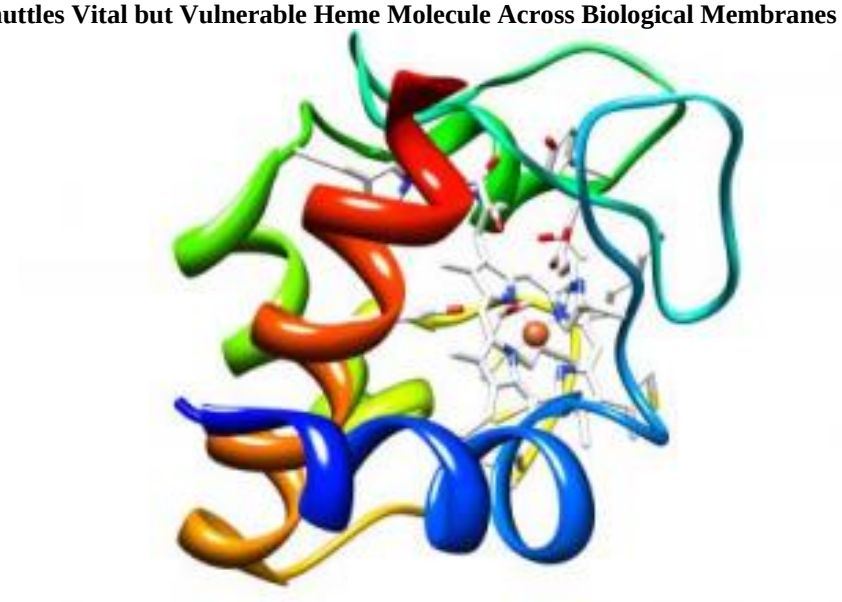
Adapted from materials provided by Children's Hospital Boston.

Journal Reference:

1. Gostissa et al. **Long-range oncogenic activation of IgH/c-myc translocations by the IgH 3' regulatory region**. *Nature*, 2009; 462 (7274): 803 DOI: 10.1038/nature08633

http://www.sciencedaily.com/releases/2009/12/091209134635.htm

Heme Channel Found: Shuttles Vital but Vulnerable Heme Molecule Across Biological Membranes



The cytochrome c protein (colored ribbons), holds in its embrace a heme group (white honeycomb) that in turn clasps an iron atom (orange ball). This molecule is essential to life and any chemical that interferes with its activity is lethal. (Credit: Resource for Biocomputing, Visualization, and Informatics at the University of California, San Francisco.)

ScienceDaily (Dec. 30, 2009) — In some ways a cell in your body or an organelle in that cell is like an ancient walled town. Life inside either depends critically on the intelligence of the gatekeepers.

If too many barbarians sneak into town, the town may be put to the torch. And if the cellular gatekeepers can't control the flow of ions and molecules into and out of the cell, the cell may die.

Because of their importance, cellular gates, channels and transporters, are the targets of intense scientific interest.

One substance that has to cross the cell membrane is a molecule called heme, which plays a crucial role in supplying the cell with the energy needed to carry out the chemical reactions that sustain life.

Although heme is made inside a bacterium or cell organelle, it must be moved outside and plugged into a protein before it becomes functional. What's more, because it is chemically vulnerable, it must be protected as it makes this mini-journey.

Earlier this year scientists at Washington University in St. Louis discovered a channel present in plants and many bacteria that both transfers and protects the heme. The work, done by graduate student Elaine Frawley and biology professor Robert Kranz, was recently published in the Proceedings of the National Academy of Sciences.

What's a heme when it's at home?

Heme is a circlet of atoms that hold an iron atom much as a setting holds the diamond in a ring.

The body needs iron because it easily accepts and donates electrons, which makes it useful for all sorts of cellular chemistry. But, by the same token, free iron would participate in destructive chemical reactions whose byproducts might kill cells. This is one reason iron is usually bound in heme or in other proteins.

Heme is the essential component of two types of molecules. One is the hemoglobin molecules that bind oxygen in the lungs and ferry it around the body.

More than half the heme in the body is in hemoglobin, but some of the rest is in the hemeproteins called cytochromes. These are part of a chain of molecules embedded in the membranes of cell organelles that wring energy out of food.

The molecules in the chain extract electrons from sugar molecules, siphoning off a little of their energy, and passing them on to the next molecule, which also siphons off a little energy, and so on.

Kranz has devoted much of his career to understanding the molecular machinery that makes cytochrome c, one of the most important of these proteins. There are several different versions of this machinery, but the heme group is always assembled in the protected environment inside a cell organelle or bacterium, and then moved outside, where it is locked into a cytochrome c protein sitting on the outside of the cell membrane.

Trapping the heme in the channel protein

To figure out how heme gets across the membrane, Frawley used a benign strain of common gut bacterium Escherichia coli. But this was a special *E. coli* whose own cytochrome-c making machinery had been removed and replaced with machinery taken from *Helicobacter hepaticus*, a recently discovered bacterium that can cause hepatitis.

The Helicobacter system for making cytochrome features a humongous protein called CcsBA that threads repeatedly through the cell membrane, leaving messy loops on either side like the stitches made by a sewing machine whose tension is out of adjustment.

The parts of the molecule that pass through membrane are called transmembrane domains.

By trapping the heme inside the isolated channel protein, Frawley showed that two transmembrane domains come together to form a channel for the heme.

Proteins like CcsBA that are embedded in the cell membrane are difficult to work with, Kranz explains. The membrane is a lipid, or fat, so trying to extract a membrane protein is like trying to wash greasy dishes in cold water. Frawley had to use detergents to separate the protein, he says, and even then it took her a year or two to purify enough protein to work with.

But then there was a eureka moment. "When I got enough pure protein and concentrated it in the test tube, I could see it was tinted red, the color of heme," Frawley says. That told me I had trapped the heme in the channel protein. I was ecstatic!"

Just to make sure her eyes weren't fooling her, she analyzed the sample spectroscopically and confirmed that it was indeed absorbing light at the wavelengths characteristic of heme.

Heme guards

But that isn't the end of the story. The heme is just a building block, a part rather than a whole. Like the parts of a lamp or table that you buy in a cardboard box and have to assemble yourself, it has "projections" that need to be protected until you can stick them into the corresponding "holes" in another part.

The "projections" are available electrons, and the problem with heme is to prevent it from oxidizing, or giving up some of its spare electrons, before it can be plugged into the waiting cytochrome. Only the non-

oxidized form can form the correct bonds with the cytochrome precursor on the outside of the cell. But while it is traversing the channel and before it is bound to the cytochrome, the heme is exposed to a hostile, oxidizing environment.

How is it protected in transit? Frawley and Kranz knew that some parts of the membrane protein CcsBA are highly conserved, meaning that no matter how evolution alters the rest of the protein, it leaves these sections alone. They suspected the conserved bits, four copies of the amino acid histidine, are guard molecules that protect the heme from oxidizing.

When Frawley mutated the histidines on the inside of the membrane, the protein's absorption spectrum told her it had stopped functioning. The heme channel protein couldn't bind the heme and shuttle it through to the outside anymore.

"That's the key point of the paper," says Kranz. "There's a heme channel and the histidines have to be there to both bind heme and protect the heme from the environment."

To prove the mutated histidines were the problem, she added imidazole, a small compounds that is chemically the same as part of the histidine, to her *E. coli* cultures. The imidazole fixed the broken channel and the *E. coli* started making cytochrome again.

The imidazole trick, Kranz says, "is probably the coolest result I've had in 23 years in my lab."

Story Source:

Adapted from materials provided by Washington University in St. Louis, via EurekAlert!, a service of AAAS.

http://www.sciencedaily.com/releases/2009/12/091217183103.htm

Evolution Experiments With Flowers

A flowerbed of petunias. Although the petunia flower structure is similar to that of Arabidopsis thaliana, there are considerable differences in how the flowers of these plants are formed. (Credit: iStockphoto)

ScienceDaily (Dec. 30, 2009) — Evolution uses every chance it gets to try something new. Dutch researcher Anneke Rijpkema investigated how petunia flowers are formed and discovered that nature is even more varied than the naked eye can spot. The genes involved in flower formation can function differently in different species. Evolution has discovered a system that works, but within that system it continues to innovate.Up until now, research into the regulation of flower formation focused mostly on two model species: *Arabidopsis* and *Anthirrhinum.* Yet according to Rijpkema that is not enough to gain a complete picture. She investigated *Petunia hybrida*, related to plants such as the tomato and potato. Although the petunia flower structure is similar to that of *Arabidopsis thaliana*, there are considerable differences in how the flowers of these plants are formed. The result is more or less the same, yet in the process preceding this there are considerable differences. So there is even more variation in the natural world than the naked eye can spot.

Rijpkema analysed which genes are responsible for the flower formation in petunia. She did this, for example, by examining mutants: flowers in which a gene no longer functions, as a result of which they acquire a different appearance. This enabled her to determine the exact function of each gene. The developmental biologist discovered, for example, that gene duplication -- the process in which two or more copies of a gene are made -- plays a major role in the development of variation in flower development.

Petunias, tomatoes and gerberas

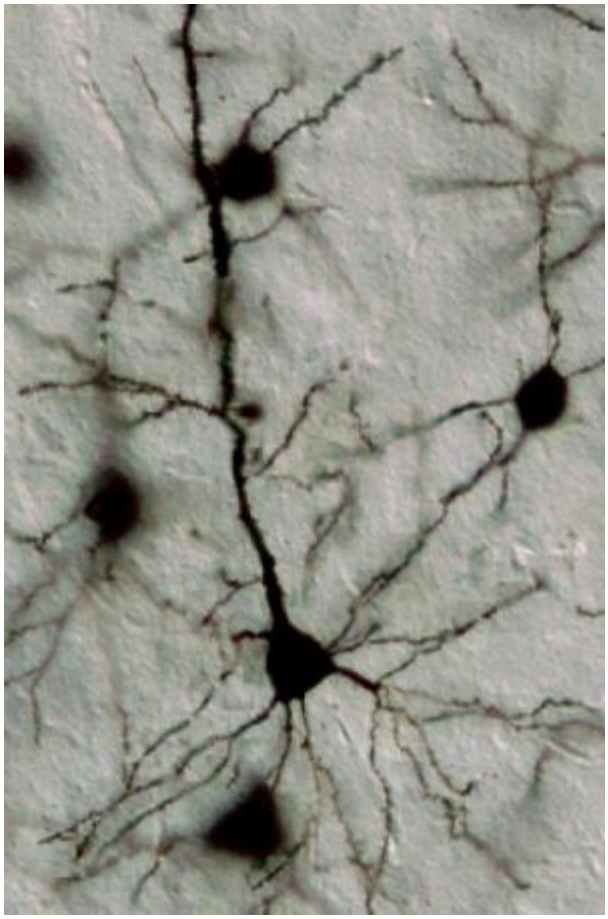
Besides unveiling how evolution works in plants, Rijpkema's research also reveals how plants function now. This is particularly interesting for breeders. Knowledge of flower formation can enable them to change a plant. Furthermore, knowledge about the petunia can also provide insights about related plant species such as the potato and tomato.Rijpkema carried out her research at Radboud University Nijmegen with a grant from NWO. In 2008, she received a Rubicon grant from NWO to carry out research at the University of Helsinki. This time she is working on gerberas.

Story Source:

Adapted from materials provided by NWO (Netherlands Organization for Scientific Research).

http://www.sciencedaily.com/releases/2009/10/091029150610.htm

Scientists Discover a Controller of Brain Circuitry



A pyramidal neuron in the mouse cerebral cortex is labeled using the Golgi technique. (Credit: Image by Tracy Tran, David Ginty and Alex Kolodkin of Johns Hopkins Medicine)

ScienceDaily (Dec. 30, 2009) — By combining a research technique that dates back 136 years with modern molecular genetics, a Johns Hopkins neuroscientist has been able to see how a mammal's brain shrewdly revisits and reuses the same molecular cues to control the complex design of its circuits.

Details of the observation in lab mice, published Dec. 24 in *Nature*, reveal that semaphorin, a protein found in the developing nervous system that guides filament-like processes, called axons, from nerve cells to their appropriate targets during embryonic life, apparently assumes an entirely different role later on, once axons reach their targets. In postnatal development and adulthood, semaphorins appear to be regulating the creation of synapses -- those connections that chemically link nerve cells.

"With this discovery we're able to understand how semaphorins regulate the number of synapses and their distribution in the part of the brain involved in conscious thought," says David Ginty, Ph.D., a professor in the neuroscience department at the Johns Hopkins University School of Medicine and a Howard Hughes Medical Institute investigator. "It's a major step forward, we believe, in our understanding of the assembly of neural circuits that underlie behavior."

Because the brain's activity is determined by how and where these connections form, Ginty says that semaphorin's newly defined role could have an impact on how scientists think about the early origins of autism, schizophrenia, epilepsy and other neurological disorders.

The discovery came as a surprise finding in studies by the Johns Hopkins team to figure out how nerve cells develop axons, which project information from the cells, as well as dendrites, which essentially bring information in. Because earlier work from the Johns Hopkins labs of Ginty and Alex Kolodkin, Ph.D., showed that semaphorins affect axon trajectory and growth, they suspected that perhaps these guidance molecules might have some involvement with dendrites.

Kolodkin, a professor in the neuroscience department at Johns Hopkins and a Howard Hughes Medical Institute investigator, discovered and cloned the first semaphorin gene in the grasshopper when he was a postdoctoral fellow. Over the past 15 years, numerous animal models, including strains of genetically engineered mice, have been created to study this family of molecules.

Using two lines of mice -- one missing semaphorin and another missing neuropilin, its receptor -- postdoctoral fellow Tracy Tran used a classic staining method called the Golgi technique to look at the anatomy of nerve cells from mouse brains. (The Golgi technique involves soaking nerve tissue in silver

chromate to make cells' inner structures visible under the light microscope; it allowed neuroanatomists in 1891 to determine that the nervous system is interconnected by discrete cells called neurons.)

Tran saw unusually pronounced "spines" sprouting willy-nilly in peculiar places and in greater numbers on the dendrites in the neurons of semaphorin-lacking and neuropilin-lacking mice compared to the normal wild-type animals. It's at the tips of these specialized spines that a lot of synapses occur and neuron-to-neuron communication happens, so Tran suspected there might be more synapses and more electrical activity in the neurons of the mutant mice.

The researchers tested this hypothesis by examining even thinner brain slices under an electron microscope.

The spines of both semaphorin-lacking and neuropilin-lacking mice were dramatically enlarged, compared to those of the smaller, spherical-looking spines in the wild-type mice. In wild types, Tran generally noted a single site of connection per spine. In the mutants, the site of connection between two neurons was often split.

Next, the team recorded the electrical output of mutant and wild-type neurons and found that the mutants, with more spines and larger spines, also had about a 2.5-times increase in the frequency of electrical activity, suggesting that this abnormal synaptic transmission is due to an increase in the number of synapses.

What causes synapses to form or not form in appropriate or inappropriate places is an extremely important and poorly understood process in the development of the nervous system, Kolodkin says, explaining that the neurons his team studies can have up to 10,000 synaptic connections with other neurons. If connections between neurons are not being formed how and where they're supposed to, then miscommunication occurs and circuits malfunction; as a result, any number of diseases or disorders might develop. "Seizures can be interpreted as an uncontrolled rapid-firing of certain neural circuits," Kolodkin asserts. "Clearly there's a deficit in these animals that has a human corollary with respect to epilepsy. It's also thought that schizophrenia and autism spectrum disorders have developmental origins of one sort or another. There likely are aspects to the formation of synapses -- if they're not in the correct location and in the correct number -- that lead to certain types of defects. The spine deficits in these mice that are lacking semaphorin or its receptor appear very similar to those that are found in Fragile X, for instance."

This work was supported by the National Institutes of Health, National Science Foundation, and the Howard Hughes Medical Institute.Johns Hopkins authors of this paper are Tracy S. Tran, Alex L. Kolodkin, David D. Ginty, Richard L. Huganir, Roger L. Clem, and Dontais Johnson. Other authors are Maria E. Rubio of the University of Connecticut; and Lauren Case and Marc Tessier-Lavigne, of Stanford University.

Story Source:

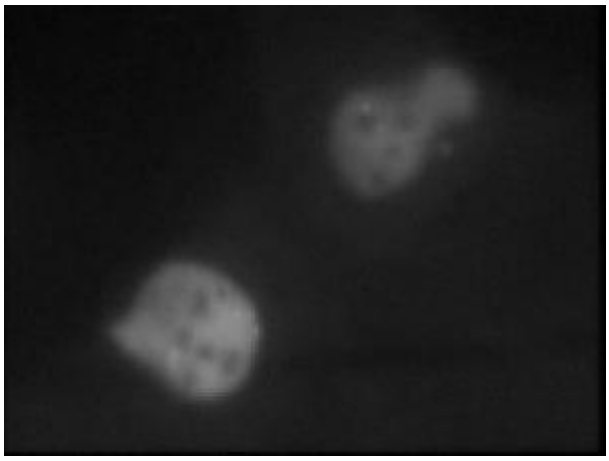
Adapted from materials provided by Johns Hopkins Medical Institutions, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Tracy S. Tran, Maria E. Rubio, Roger L. Clem, Dontais Johnson, Lauren Case, Marc Tessier-Lavigne, Richard L. Huganir, David D. Ginty & Alex L. Kolodkin. **Secreted semaphorins control spine distribution and morphogenesis in the postnatal CNS**. *Nature*, 2009; 462 (7276): 1065 DOI: 10.1038/nature08628

http://www.sciencedaily.com/releases/2009/12/091228163310.htm

Mobilizing the Repair Squad: Critical Protein Helps Mend Damaged DNA



The protein CtIP is recruited to sites of DNA damage in human cells, where it helps convert the initial DNA damage signal into a repair response. (Credit: Courtesy of Dr. Zhongsheng You, Washington University School of Medicine.)

ScienceDaily (Dec. 30, 2009) — In order to preserve our DNA, cells have developed an intricate system for monitoring and repairing DNA damage. Yet precisely how the initial damage signal is converted into a repair response remains unclear. Researchers at the Salk Institute for Biological Studies have now solved a crucial piece of the complex puzzle.

In a forthcoming article in the Dec. 24 issue of *Molecular Cell*, they show that a protein named CtIP plays an essential role in the DNA damage "signal-to-repair" conversion process. "Being able to repair damaged DNA is extremely important; the cell has to know when it has received this type of damage and respond appropriately," explains Tony Hunter, Ph.D., American Cancer Society Professor in the Molecular and Cell Biology Laboratory and director of the Salk Institute Cancer Center, who led the study. "Failure to do so can have disastrous consequences."

The DNA in our cells is under constant attack from reactive chemicals generated as byproducts of cellular metabolism. In addition, it is assaulted by x-rays, ultraviolet radiation from the sun, and environmental carcinogens such as tobacco smoke. As a result of this continuous bombardment, some studies have estimated that the DNA in a single human cell gets damaged over 10,000 times every day.

If not repaired properly, the damage leads to mutations, which over time can cause cancer. "As a result, individuals with an inherited impairment in DNA repair capability are often at increased risk of cancer," notes first author Zhongsheng You, Ph.D., a former postdoctoral researcher at the Salk Institute and now an assistant professor at Washington University School of Medicine in St. Louis.

DNA consists of two intertwined strands so that when the DNA is broken, two ends are revealed, one from each strand. In order to repair the DNA break, one strand is trimmed away -- or resected -- like a loose thread, leaving only the second strand. This exposed strand then searches for a copy of itself (located on its sister chromosome), and "photocopies" past the broken region, repairing the DNA and zipping itself back up.

In yeast, CtIP is required for resection of the broken end, and since it is also recruited to sites of DNA damage in human cells, Hunter's team wanted to know whether CtIP plays a similar role there. To find out, they depleted CtIP from human cells and caused DNA damage. Without the CtIP, they discovered, the cells could no longer trim back the damaged DNA strands, which brought the whole repair process to an abrupt halt.

"It looks like CtIP recruitment is a very important control point in the DNA repair process," You observes. "Once CtIP is recruited, resection and repair begin, so regulating CtIP recruitment is one way to regulate DNA repair itself."

In order to understand the process better, the researchers then asked which regions of the CtIP protein are involved in binding it to the broken DNA ends. By testing small portions of the protein, they found that a region in the central part of CtIP helps recruit the protein. They named this region the "damage recruitment" (DR) domain.

Further studies suggested that the DR domain within CtIP is normally hidden inside the folded protein. Only when the cell sends a DNA damage signal is CtIP's DR domain exposed, and only then can CtIP bind to the broken DNA. In this way, CtIP is like a switchblade that cells open only in the presence of DNA damage.

The authors believe that exposure of CtIP 's DR domain and its recruitment to the site of DNA damage triggers a chain reaction that results in DNA repair, and they now want to understand exactly what CtIP does to start the DNA repair process.

You is also trying to understand the modifications in CtIP that cause the DR domain to be exposed, and is looking into the role of CtIP in cancer. "Mutations in CtIP have not been mapped extensively in human tumors, but from this data, we predict that mutations to the DR domain would lead to cancer," he says.

In the long term, the team hopes that a better understanding of the DNA damage pathway may provide clues for cancer treatment in the future. "CtIP is another important player in the double-strand break response," says Hunter. "We have added another piece to the complex puzzle of DNA repair."

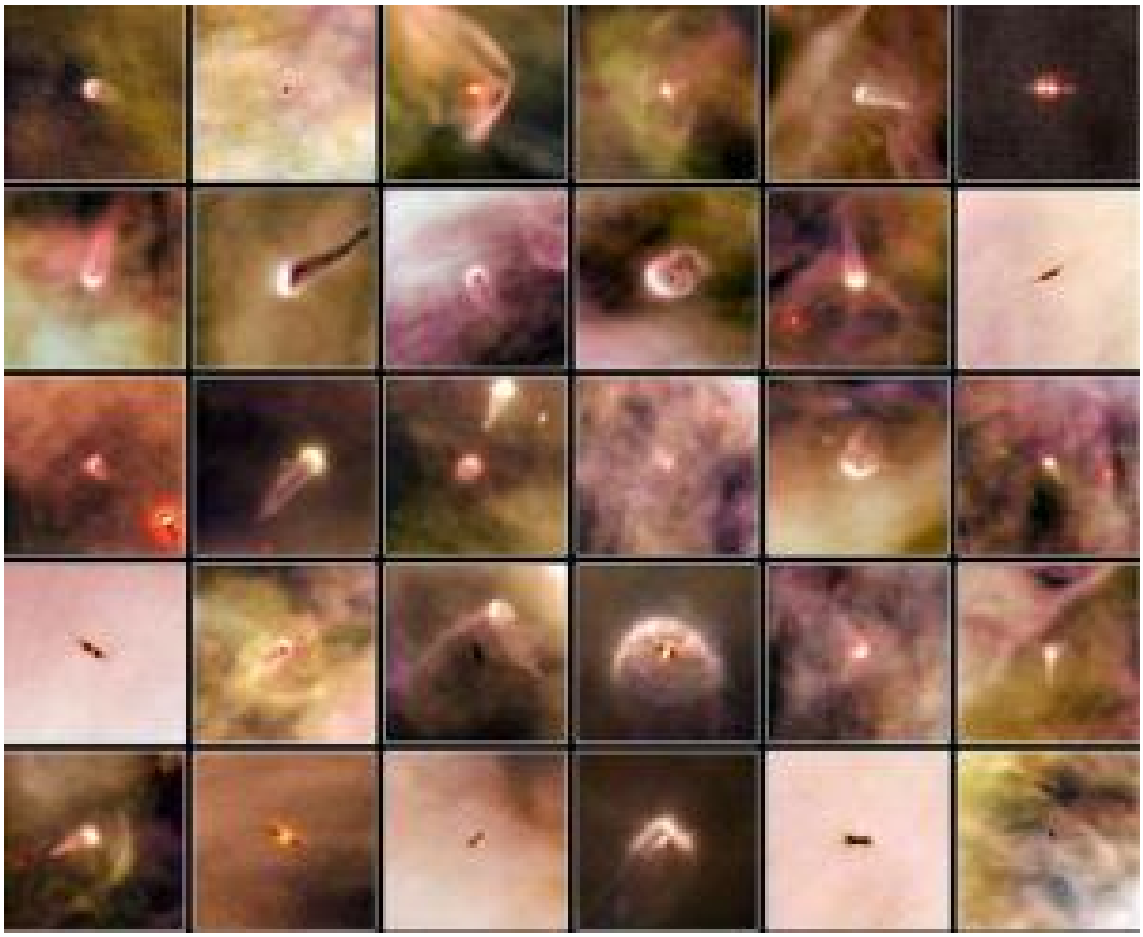
Along with Drs. Hunter and You, researchers who contributed to the work include Linda Shi, Ph.D. , and Andrew Basilio at the University of California, San Diego; Quan Zhu, Ph.D., Nina Tonnu, and Inder Verma, Ph.D. in the Salk Institute's Laboratory of Genetics; Peng Wu, Ph.D., in You's lab at Washington University School of Medicine; You-Wei Zhang, Ph.D. , now at Case Western Reserve University; and Michael W. Berns, Ph.D., at UCSD and University of California, Irvine.

Story Source:

Adapted from materials provided by Salk Institute.

http://www.sciencedaily.com/releases/2009/12/091227212319.htm

Born in Beauty: Proplyds in the Orion Nebula



A collection of 30 never-before-released images of embryonic planetary systems in the Orion Nebula are the highlight of the longest single Hubble Space Telescope project ever dedicated to the topic of star and planet formation. (Credit: NASA, ESA and L. Ricci (ESO))

ScienceDaily (Dec. 30, 2009) — A collection of 30 never-before-released images of embryonic planetary systems in the Orion Nebula are the highlight of the longest single Hubble Space Telescope project ever dedicated to the topic of star and planet formation. Also known as proplyds, or protoplanetary discs, these modest blobs surrounding baby stars are shedding light on the mechanism behind planet formation.

Looking like a graceful watercolour painting, the Orion Nebula is one of the most photogenic objects in space and one of the Hubble Space Telescope's favourite targets. As newborn stars emerge from the nebula's mixture of gas and dust, protoplanetary discs, also known as proplyds, form around them: the centre of the spinning disc heats up and becomes a new star, but remnants around the outskirts of the disc attract other bits of dust and clump together. Proplyds are thought to be young planetary systems in the making. In an ambitious survey of the familiar nebula using Hubble's Advanced Camera for Surveys (ACS), researchers have discovered 42 protoplanetary discs.

Visible to the naked eye, the Orion Nebula has been known since ancient times, but was first described in the early 17th century by the French astronomer Nicolas-Claude Fabri de Peiresc -- who is given credit for discovering it. At 1500 light-years away, the nebula, also known as Messier 42, is the closest star-forming region to Earth with stars massive enough to heat up the surrounding gas, setting it ablaze with colour, and making the region stand out to stargazers.

Within the awe-inspiring, gaseous folds of Orion, researchers have identified two different types of discs around young and forming stars: those that lie close to the brightest star in the cluster (Theta 1 Orionis C) and those farther away from it. This bright star heats up the gas in nearby discs, causing them to shine brightly. Discs that are farther away do not receive enough energetic radiation from the star to heat up the gas and so they can only be detected as dark silhouettes against the background of the bright nebula, as the dust that surrounds these discs absorbs background visible light. By studying these silhouetted discs, astronomers are better able to characterize the properties of the dust grains that are thought to bind together and possibly form planets like our own.

The brighter discs are indicated by a glowing cusp in the excited material and facing the bright star, but which we see at a random orientation within the nebula, so some appear edge on, and others face on, for instance. Other interesting features enhance the look of these captivating objects, such as emerging jets of matter and shock waves. The dramatic shock waves are formed when the stellar wind from the nearby massive star collides with the gas in the nebula, sculpting boomerang shapes or arrows or even, in the case of 181-825, a space jellyfish!

It is relatively rare to see visible images of proplyds, but the high resolution and sensitivity of Hubble and the Orion Nebula's proximity to Earth allow for precise views of these potential planetary systems.

This proplyd atlas is the first scientific outcome from the HST Treasury Program on the Orion Nebula. Treasury Programs are carried out to allow scientists to conduct comprehensive studies over longer periods since time on the in-demand Hubble Space Telescope is strictly allocated. High resolution imaging of protoplanetary discs is an example of a science discovery that has led to better technology and is one of the main science cases for the Atacama Large Millimeter/submillimeter Array (ALMA), one of the largest ground-based astronomy projects of the next decade. ALMA will observe the dust at longer wavelengths, in emission (instead of in absorption as we see it at optical wavelengths) with an angular resolution up to 10 times better than that of Hubble.

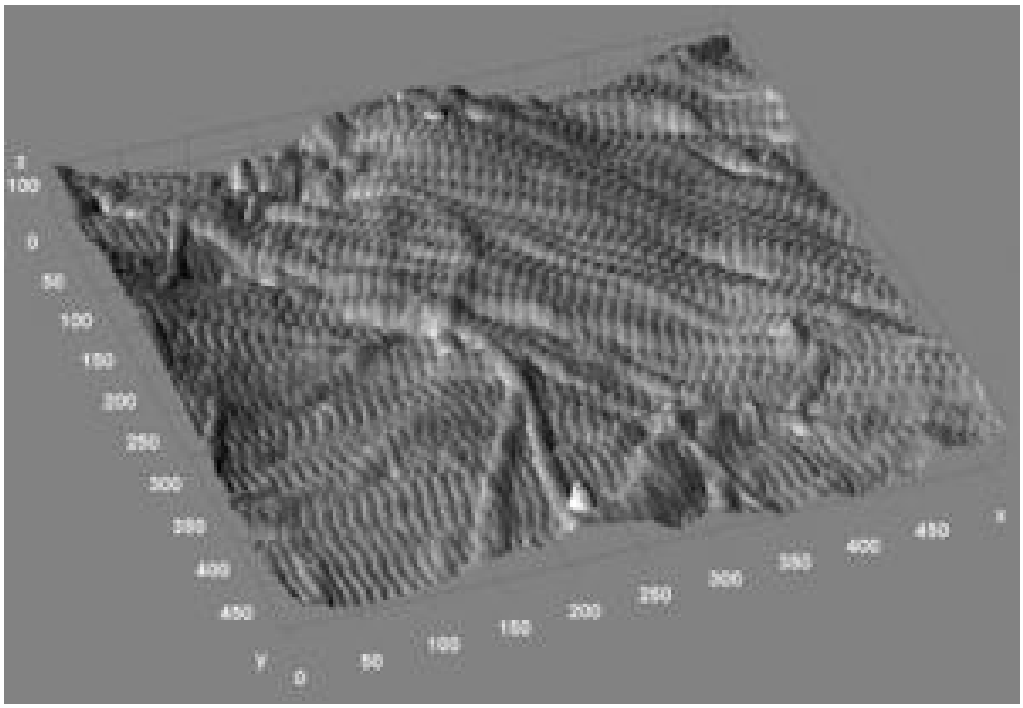
Only the NASA/ESA Hubble Space Telescope, with its high resolution and sensitivity, can take such detailed pictures of circumstellar discs at optical wavelengths.

Story Source:

Adapted from materials provided by ESA/Hubble Information Centre.

http://www.sciencedaily.com/releases/2009/12/091214121453.htm

Nanoscale Changes in Collagen Are a Tipoff to Bone Health



A three-dimensional rendering from the surface of a mouse bone. In this 3.5 x 3.5 micrometer image (100 nanometer height), the rich sample topography characteristic of bone is evident. Type I collagen fibrils are seen running in a bundle from left to right near the top. A second layer of fibrils appears to be running below, almost perpendicular to this bundle, near the bottom corner. (Credit: Image courtesy of University of Michigan)

ScienceDaily (Dec. 30, 2009) — Using a technique that provides detailed images of nanoscale structures, researchers at the University of Michigan and Detroit's Henry Ford Hospital have discovered changes in the collagen component of bone that directly relate to bone health.

Their findings, published online Dec. 16 in the journal *Bone*, could lead to new methods of diagnosing osteoporosis and other diseases affecting collagen-containing tissues.

Bone is a composite material made up of a flexible collagen matrix impregnated with and surrounded by a stiffer, stronger mineral component. Though much is known about the importance of bone health to overall health, there's a critical lack of knowledge about the sub-microscopic structure of bone and how collagen and mineral -- and the interactions between them -- contribute to properties of healthy and diseased bone.

"Our initial question was, could we discover more about the nanoscale structure of the collagen in bone, using the technique of atomic force microscopy," said Mark Banaszak Holl, a U-M professor with joint appointments in chemistry and macromolecular science and engineering.

The atomic force microscope, one of the most valuable tools for imaging, measuring and manipulating matter at the nanoscale level, works something like a phonograph with a motion detector attached to its needle. As the tip systematically moves across a bumpy surface, the motion detector records its every movement. The result is a three-dimensional image of the surface's contours.

Using such an instrument, the researchers were able to see and measure key features of collagen fibrils in mouse bone. Each collagen fibril is made up of many individual collagen molecules packed together in a staggered array that resembles a railroad track.

"For each fibril, we measured the mean spacing of the 'railroad track' cross hatches," said post doctoral associate Joseph Wallace, the paper's lead author. Wallace, Banaszak Holl and coworkers found that not all fibrils had the same mean spacing, a finding that ran counter to conventional wisdom in the field.

"As opposed to a single value, our data indicate that normal bone contains a distribution of collagen fibril spacings," Wallace said.

Next, the team wanted to know if the distribution of fibril spacings differed in bone from healthy and diseased individuals. To address that question, they collaborated with Clifford Les of Henry Ford Hospital, who has been studying how bone changes when estrogen wanes, as it does in menopause. To model the age-related estrogen depletion that occurs in humans, Les uses sheep that have had their ovaries removed. The sheep exhibit some of the same symptoms as menopausal women, and they undergo some bone remodeling, but they don't develop osteoporosis.

When the researchers compared bone from normal and ovariectomized sheep, they found striking differences in fibril spacing distributions, suggesting that estrogen depletion has a significant effect on the spacing.

"This ability to measure fibril spacing and to distinguish between normal and diseased bone not only gives us a powerful method to study the mechanism of disease at the nanoscale, but it also has important implications to the future diagnosis of disease in bone and perhaps other collagenous tissues," said Banaszak Holl. "Collagen is the most common protein in the mammalian body. It's in bones, teeth, tendons, skin, arteries. We basically don't work well when it's not working well, so there are many diseases related to problems with collagen. We're very excited about developing this method as a diagnostic for all kinds of diseases of structural collagen."

The technique could be a powerful complement to the current gold standard for diagnosing osteoporosis: measuring bone mineral density (BMD) with dual energy X-ray absorptiometry (DEXA). Although widely used, DEXA isn't ideal, because people with normal BMD can still get fractures, and abnormalities often don't show up until after a fracture has occurred. Changes in collagen, on the other hand, may be apparent earlier in the disease's progression.To further explore the method's potential, the researchers plan to use it to study collagen fibril spacing in human patients with and without osteoporosis. U-M has filed for patent protection and is seeking a commercialization partner to help bring the technology to market.

"This project is an example of what happens if you put the right group of people together on a problem," said Banaszak Holl. Wallace, a biomedical engineer, had experience working with bone in previous research; Banaszak Holl's lab group brought expertise in surface analysis; Les contributed knowledge about bone biology and understanding of the sheep model; and coauthors Bradford Orr, director of the Applied Physics Program, and Blake Erickson, a biophysics graduate student, are skilled in data analysis.

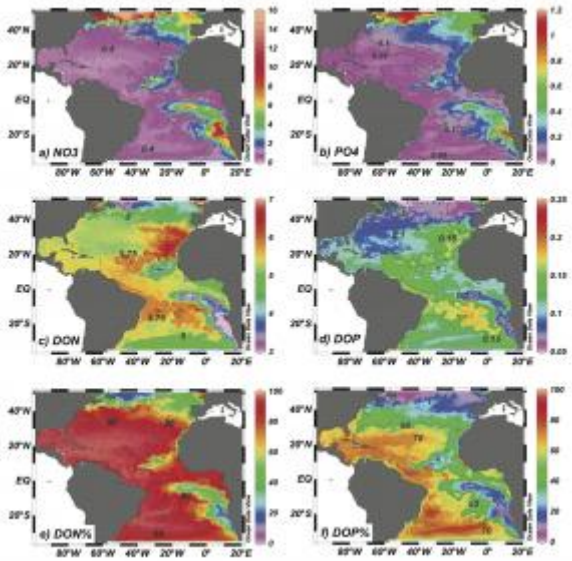
"All these different pieces were necessary to solve the problem," Banaszak Holl said.The research was funded by the National Institutes of Health (National Institute of Dental and Craniofacial Research and National Institute of Arthritis and Musculoskeletal and Skin Diseases).

Story Source:

Adapted from materials provided by University of Michigan.

http://www.sciencedaily.com/releases/2009/12/091222154740.htm

Mapping Nutrient Distributions Over The Atlantic Ocean



Shows in the two upper panels the distribution of the dissolved inorganic nutrients, nitrate (NO3) and phosphate (PO4). Here one can appreciate the vast areas of the Atlantic where inorganic nutrients are very low (most of it looks pinky, and pink colour indicated extremely low concentrations). The middle panels show the distributions of dissolved organic nitrogen and dissolved organic phosphorus, where the regions where these are produced can be appreciated. Also the way the ocean circulation and eddies redistribute these nutrients can be clearly seen. Finally, the lower panels show the contribution (in percent) of dissolved organic nutrients towards the Total nutrient pools in the surface ocean. (Credit: Image courtesy of Dr. Rory Howlett)

ScienceDaily (Dec. 30, 2009) — Large-scale distributions of two important nutrient pools -- dissolved organic nitrogen and dissolved organic phosphorus (DON and DOP) have been systematically mapped for the first time over the Atlantic Ocean in a study led by Dr Sinhue Torres-Valdes of the National Oceanography Centre, Southampton. The findings have important implications for understanding nitrogen and phosphorus biogeochemical cycles and the biological carbon pump in the Atlantic Ocean.

Tiny marine plants called phytoplankton living in the sunlit surface waters of the oceans produce organic matter through the process of photosynthesis, thereby drawing carbon dioxide down from the atmosphere. Much of this organic matter is recycled, but some of it -- the so-called export production -- sinks as 'marine snow' to the deep ocean. This is also known as the biological carbon pump, and it helps to significantly reduce the CO2 released by the burning of fossil fuels (oil, gas and coal), that would otherwise accumulate in the atmosphere.

In addition to light, phytoplankton growth requires nutrients for growth. However, inorganic nutrients are in short supply in vast areas of the oceans known as oligotrophic regions or oligotrophic oceans. This means that phytoplankton must get the nutrients from somewhere else and therefore "understanding the sources and distribution of nutrients is of major interest to oceanographers," says Torres-Valdes. The new study involved scientists based at the National Oceanography Centre, Southampton and the University of Liverpool.

The scientists studied the distributions of dissolved organic nutrients during eight research cruises in the Atlantic between spring 2000 and autumn 2005. Six of these cruises sampled north-south transects between 50 degrees N and 50 degrees S, while the other two sampled east-west transects at 24 and 36 degrees N. In this way, they were able systematically to cover large tracts of the Atlantic Ocean.

"This big effort combines observations and a modelling study in order to understand the role dissolved organic nutrients play in export production" said Torres-Valdes: "The large scale distributions revealed very interesting things: First, nutrient pools in surface waters are dominated by dissolved organic nutrients, making up typically more that 75% of the total nutrient pools in the upper 100 metres of the oligotrophic Atlantic Ocean. Second, patterns emerged showing differences exist between the extensive oligotrophic North and South Atlantic subtropical gyres. DON and DOP concentrations are lower in the North Atlantic. These differences are more striking in the case of DOP, which is very low in the North Atlantic subtropical gyre."

This is important because export production over the nutrient poor, or 'oligotrophic' subtropical gyres is thought to account for up to half of global oceanic carbon export. The patterns observed probably reflect differences in how dissolved organic nutrients are recycled, with DON being mostly refractory. DOP seems more easily taken up by organisms than DON. In the North Atlantic subtropical gyre, DOP may actually provide the extra phosphorus required by microbes that 'fix' nitrogen.

The researchers also used a computer model to study the effect of cycling and transport on export production. The modelling work shows that both DON and DOP are important. While DON contributes up to 40% of the particulate nitrogen export, DOP contributes up to 70% of the modelled particulate phosphorus export. This also shows that DOP is more easily used by microbes than DON.

The observations and model results are consistent with the hypothesis that DON and DOP are important for sustaining export production in surface layers of oligotrophic gyres. Specifically, these dissolved organic nutrients are produced as a result of enhanced primary production over upwelling regions -- the tropical Atlantic more or less along the equator, off the Northwest African Coast and the North Atlantic subpolar gyre. These nutrients are then distributed by the ocean circulation, with a very important eddy component, and are then used and recycled as they are transported.

"It's very likely that this situation also applies to many nutrient-poor marine systems, including other subtropical gyres, the Mediterranean Sea, and summer, stratified shelf seas," said Torres-Valdes.

The study was supported by the UK Natural Environment Research Council.

The researchers are Sinhue Torres-Valdes NOCS), V. Roussenov (University of Liverpool), Richard Sanders (NOCS), S. Reynolds, S. (U. Liverpool; now at the British Oceanographic Data Centre, Liverpool, X. Pan (NOCS; now at the British Oceanographic Data Centre), R. Mather U. (Liverpool), A. Landolfi (NOCS; now at Leibniz-Institut Fur Meereswissenschaften, Marine), G. Wolff (U. Liverpool), Eric Achterberg (NOCS) and R. G. Williams (U. of Liverpool).

Story Source:

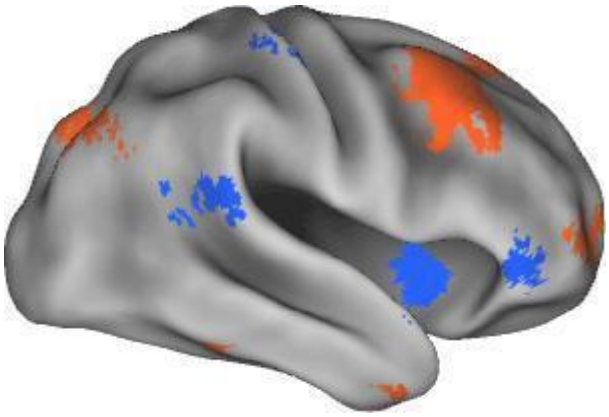
Adapted from materials provided by National Oceanography Centre, Southampton (UK), via EurekAlert!, a service of AAAS.

Journal Reference:

1. Torres-Valdés et al. **Distribution of dissolved organic nutrients and their effect on export production over the Atlantic Ocean**. *Global Biogeochemical Cycles*, 2009; 23 (4): GB4019 DOI: 10.1029/2008GB003389

http://www.sciencedaily.com/releases/2009/11/091103112237.htm

Brain Scans Show Distinctive Patterns in People With Generalized Anxiety Disorder



This image shows, in red, brain regions with stronger connections to the amygdala in patients with GAD, while the blue areas indicate weaker connectivity. The red corresponds to areas important for attention and may reflect the habitual use of cognitive strategies like worry and distraction in the anxiety patients. (Credit: Image courtesy of Stanford University Medical Center)

ScienceDaily (Dec. 30, 2009) — Scrambled connections between the part of the brain that processes fear and emotion and other brain regions could be the hallmark of a common anxiety disorder, according to a new study from the Stanford University School of Medicine. The findings could help researchers identify biological differences between types of anxiety disorders as well as such disorders as depression.

The study, which will be published Dec. 7 in the *Archives of General Psychiatry*, examined the brains of people with generalized anxiety disorder, or GAD, a psychiatric condition in which patients spend their days in a haze of worry over everyday concerns. Researchers have known that the amygdala, a pair of almond-sized bundles of nerve fibers in the middle of the brain that help process emotion, memory and fear, are involved in anxiety disorders like GAD. But the Stanford study is the first to peer close enough to detect neural pathways going to and from subsections of this tiny brain region.

Such small-scale observations are important for understanding the brains of people with psychiatric disorders, said Duke University neuroscientist Kevin LaBar, PhD, who was not involved in the research. "If we want to distinguish GAD from other anxiety disorders, we might have to look at these subregions instead of the general signal from this area," he said. "It's methodologically really impressive."

To get close enough to discern one region of the amygdala from another, Stanford psychiatry resident Amit Etkin, MD, PhD, and his colleagues focused on "regions of interest" defined by detailed anatomical studies of human brains. They recruited 16 people with GAD and 17 psychologically healthy participants and scanned their brains using functional magnetic resonance imaging, which measures blood-flow fluctuations caused by changes in activity in different regions of the brain. Each person spent eight minutes in the fMRI scanner, letting their minds wander.

The researchers analyzed the resulting data to determine which areas were connected -- that is, which regions were likely to activate in tandem. They first looked at one subregion, the basolateral amygdala, which sits at the base of the amygdala. In healthy participants, they found that the subregion was linked to the occipital lobe at the rear of the brain, the temporal lobes beneath the ears and the prefrontal cortex just behind the forehead. These regions are associated with visual and auditory processing, as well as with memory and high-level emotional and cognitive functions.

The other subregion, known as the centromedial amygdala and found at the top of the amygdala, was associated with subcortical, or deeper, areas of the brain. These connections included the thalamus, which controls information flow throughout the brain and helps regulate alertness from its perch in the midbrain; the brain stem, which regulates heart rate, breathing and release of neurotransmitters like serotonin and

dopamine; and the densely wrinkled cerebellum, which sits behind the brain stem and controls motor coordination. The associations corroborated what anatomical studies in animals have found, said Etkin, the lead author of the study. The team also analyzed resting fMRI data from 31 more healthy people and found similar results.

But in people with GAD, the scans revealed another pattern. The two regions still sent emissaries to their separate targets, but the lines of communication were muddled.

"The basolateral amygdala was less connected with all of its targets and more connected with centromedial targets," Etkin said. "And the centromedial was less connected with its normal targets and more connected with the basolateral targets."

The researchers also found that both amygdala regions had less connectivity to the region of the brain responsible for determining the importance of stimuli. This could mean that people with the disorder have a harder time discerning truly worrisome situations from mild annoyances. At the same time, the amygdala was more connected to a cortical executive-control network previously found to exert cognitive control over emotion.

The cognitive control connection might explain why GAD is characterized by obsessive worry, Etkin said. People with the disorder feel overwhelmed by emotion and don't believe they can feel sad or upset without coming completely undone. So, in an attempt to avoid facing their unpleasant feelings, they distract themselves by fretting. Such overthinking may work in the short term but becomes problematic over time.

Researchers can't say for sure whether the connectivity abnormalities came first or whether excessive worrying shaped the brain by reinforcing particular neural pathways. Still, the patterns uncovered by neurological scans could one day help psychiatrists diagnose and treat the disease.

"This is a nice example of neurology and psychiatry joining forces," said Michael Greicius, MD, assistant professor of neurology and neurological sciences at Stanford and senior author of the paper.

The next step, said Etkin, is to study patients with other anxiety disorders and with depression. That will allow researchers to see if patterns of amygdala connectivity differ between disorders. If they do, brain scans could one day become additional diagnostic tools for disorders with symptoms that often overlap.

The research was funded by the National Institutes of Health and the residency-research program of the Veterans Affairs Palo Alto Health Care System. Co-authors of the paper are research assistant Katherine Keller Prater; Alan Schatzberg, MD, the Kenneth T. Norris, Jr. Professor and chair of psychiatry and behavioral sciences; and Vinod Menon, PhD, associate professor of psychiatry and behavioral sciences.

Story Source:

Adapted from materials provided by Stanford University Medical Center.

http://www.sciencedaily.com/releases/2009/12/091207164850.htm

Drought Resistance Explained: Protein Structure Reveals How Plants Respond To Water Shortages

After being subjected to drought for 15 days, an Arabidopsis thaliana plant will normally be withered and dry (far left), but plants from the same species that were genetically engineered to enhance their response to ABA (centre left, centre right and right) were more resistant to drought. (Credit: P. L. Rodriguez)

ScienceDaily (Dec. 30, 2009) — Much as adrenaline coursing through our veins drives our body's reactions to stress, the plant hormone abscisic acid (ABA) is behind plants' responses to stressful situations such as drought, but how it does so has been a mystery for years.

Scientists at the European Molecular Biology Laboratory (EMBL) in Grenoble, France, and the Consejo Superior de Investigaciones Cientificas (CSIC) in Valencia, Spain discovered that the key lies in the structure of a protein called PYR1 and how it interacts with the hormone. Their study, published online today in *Nature*, could open up new approaches to increasing crops' resistance to water shortage.

Under normal conditions, proteins called PP2Cs inhibit the ABA pathway, but when a plant is subjected to drought, the concentration of ABA in its cells increases. This removes the brake from the pathway, allowing the signal for drought response to be carried through the plant's cells.

This turns specific genes on or off, triggering mechanisms for increasing water uptake and storage, and decreasing water loss. But ABA does not interact directly with PP2Cs, so how does it cause them to be inhibited? Recent studies had indicated that the members of a family of 14 proteins might each act as middle-men, but how those proteins detected ABA and inhibited PP2Cs remained a mystery -- until now.

A group of scientists headed by José Antonio Márquez from EMBL Grenoble and Pedro Luis Rodriguez from CSIC looked at one member of this family, a protein called PYR1. When they used X-ray crystallography to determine its 3-dimensional structure, the scientists found that the protein looks like a hand. In the absence of ABA, the hand remains open, but when ABA is present it nestles in the palm of the PYR1 hand, which closes over the hormone as if holding a ball, thereby enabling a PP2C molecule to sit on top of the folded fingers.

As these features seem to be conserved across most members of this protein family, these findings confirm the family as the main ABA receptors. Moreover, they elucidate how the whole process of stress response starts: by binding to PYR1, ABA causes it to hijack PP2C molecules, which are therefore not available to block the stress response.

"If you treat plants with ABA before a drought occurs, they take all their water-saving measures before the drought actually hits, so they are more prepared, and more likely to survive that water shortage -- they become more tolerant to drought," Rodriguez explains. "The problem so far," Márquez adds, "has been that ABA is very difficult -- and expensive -- to produce. But thanks to this structural biology approach,

we now know what ABA interacts with and how, and this can help to find other molecules with the same effect but which can be feasibly produced and applied."

To determine the structure of PYR1, the scientists made use of the infrastructure of the Partnership for Structural Biology, including EMBL Grenoble's high-throughput crystallisation facilities and the beamlines at the European Synchrotron Radiation Facility, located in the same campus as EMBL Grenoble.

Story Source:

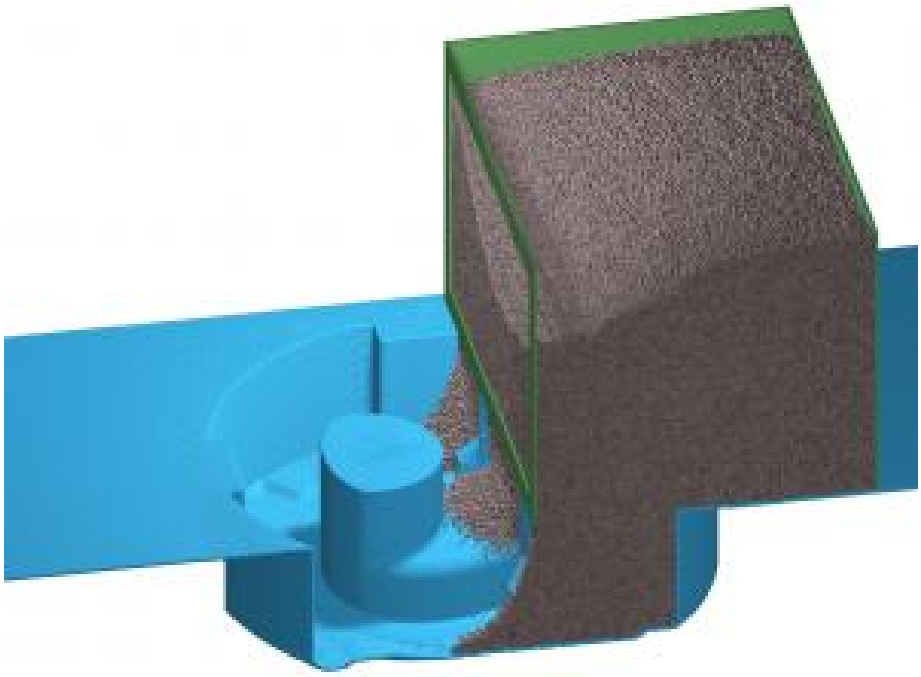
Adapted from materials provided by European Molecular Biology Laboratory.

Journal Reference:

1. Santiago, J., Dupeux, F., Round, A., Antoni, R., Park, S.Y., Jamin, M., Cutler, S.R., Rodriguez, P.R. & Márquez, J. A. **The abscisic acid receptor PYR1 in complex with abscisic acid**. *Nature*, 2009; DOI: 10.1038/nature08591

http://www.sciencedaily.com/releases/2009/11/091109121115.htm

Perfectly Proportioned: Evenly Distributed Powder Density For Manufacturing Parts



A new simulation technique helps to improve the sintering process: it calculates the best method for achieving an even density of the powder in the mold. (Credit: Copyright Fraunhofer IWM)

ScienceDaily (Dec. 30, 2009) — The manufacture of parts by compaction and sintering involves filling a die with metal powder. Research scientists have simulated this process for the first time to achieve an evenly distributed powder density. This improves the cost-efficiency of sintering.

It all happens very quickly: the feed shoe, configured as an open-bottomed box, moves across a surface in which a recess forms the shape of the desired part. The fine-grained metal powder dropping from the feed shoe settles in the mold. Stamps then compact the loose powder grains at a pressure of several hundred megapascals to produce the "green body" -- a preform in the shape of the finished part which now has to be sintered in a furnace at a temperature below the melting point of the material. This procedure ensures that the compacted grain structures become more compressed and harden.

Dry compaction and sintering are common processes in industry. They deliver precisely shaped parts that can withstand high mechanical loads. There is still potential for improvement, however, and Fraunhofer researchers aim to perfect the technique and avoid costly waste. "Filling the die is a critical step in dry compaction," states Dr. Claas Bierwisch from the Fraunhofer Institute for Mechanics of Materials IWM.

"The metal powder is not distributed 100 percent evenly in the mold. These inhomogeneous distributions of density could cause the part to warp or even crack, affecting its loadability, precision and service life," the project manager explains.

Up to now an expensive trial-and-error approach has had to be applied to obtain the best results, but this will no longer be necessary with a simulation technique developed by the research scientists for optimizing the filling process.

"By describing the powder numerically we can attach values to virtually every grain," explains Bierwisch.

The physical properties, size and shape of the grains as well as the shape of the mold are all taken into account. The research scientists then calculate how and where the powder grains flow into the mold and what the density distribution is like after filling. It is now possible for the first time to realistically simulate the production of three-dimensional parts such as toothed wheels in gear systems or washers in one-hand mixer taps for washbasins.

What's more, the researchers can draw conclusions about the filling process, including how high the speed of the feed shoe needs to be and how it should move. In some cases the shoe only needs to move forwards and backwards. For other parts the die has to oscillate as well. The scientists can simulate the sintering events through to completion of the finished part and can therefore replicate the entire process chain. They are currently optimizing the manufacture of magnetically soft coil cores for wheel hub motors, which could play an important future role in electric vehicles.

Story Source:

Adapted from materials provided by Fraunhofer-Gesellschaft.

http://www.sciencedaily.com/releases/2009/11/091106102656.htm

First Molars Provide Insight Into Evolution of Great Apes, Humans

Orangutan. (Credit: iStockphoto/David Evison)

ScienceDaily (Dec. 29, 2009) — The timing of molar emergence and its relation to growth and reproduction in apes is being reported by two scientists at Arizona State University's Institute of Human Origins in the Dec. 28 online early edition of the *Proceedings of the National Academy of Sciences* (*PNAS*).

From the smallest South American monkeys to the largest African apes, the timing of molar development and eruption is closely attuned to many fundamental aspects of a primate's biology, according to Gary Schwartz, a researcher at the Institute of Human Origins and an associate professor in the School of Human Evolution and Social Change in ASU's College of Liberal Arts and Sciences.

"Knowing the age when the first molar appears in the mouths of most primates allows researchers to predict a host of life history attributes, such as gestation length, age at sexual maturity, birth spacing, and overall lifespan. Humans are unique among primates because our life histories are so slow and thus our molars emerge relatively late. Given that apes are our closest living relatives, understanding the broader context of when the characteristic slower development of humans evolved is of great interest," Schwartz explains.

"We've known quite a bit about the timing of molar development in chimpanzees, which is important because they are our closest living relative. However, we've known virtually nothing about when this important event occurs in other wild-living ape species -- until now," says lead author Jay Kelley, a research affiliate at ASU's Institute of Human Origins and an associate professor in the Department of Oral Biology at the University of Illinois, Chicago.

Because of the difficulties in obtaining tooth emergence ages from animals in the wild, Kelley opted for other means; he searched for specimens in museums. At the Zoologische Staatssammlung in Munich he found skulls of a wild-shot orangutan (Pongo pygmaeus pygmaeus) and gorilla (Gorilla gorilla gorilla) that preserved emerging first molars.

"Like annual growth rings inside trees, the cells that produce teeth (both the enamel and underlying dentine) leave behind a trace of their presence, not as annual markers, but as growth lines that appear every day," says Kelley. By slicing the teeth in half, he and Schwartz were able to examine these incremental growth lines in ape individuals that died as their first molars were just erupting into their mouths.

"Because teeth preserve this phenomenal internal chronometer, we were able to count up how many days it took the first molars to form. In apes and monkeys, first molars start forming very close to the time of birth. As the first molars were still erupting in our specimens, development was incomplete and the final growth line was laid down on the day those animals died. Therefore, by counting backwards from the final growth line to the day of birth, we determined their age at death and thus the age at which that molar was erupting" says Schwartz.

Using this novel approach, the two scientists were able to mark the age of the gorilla's first molar emergence at 3.8 years, nearly identical to that of a wild chimpanzee's. The orangutan's age at first molar emergence was surprisingly much later, at 4.6 years, which falls closer to the age of approximately 6 years in modern humans.

"We were excited to discover this much older age for the orangutan, since orangutans have much slower life histories than the other two great apes," says Kelly.

However, he and Schwartz caution that though the later emergence age in these large Asian apes is closer to that for modern humans, these latest findings should not be taken to indicate some special evolutionary relationship between the two. "Rather, it is in keeping with what you would expect given the relatively slow pace of growth and long period of infant dependency that evolved separately in the lineage leading to orangutans and that leading to modern humans," says Schwartz.

The work by Kelley and Schwartz also has implications for understanding the evolution of human life history. "We can use the same techniques to calculate ages at first molar emergence from the fossils of early hominids that just happened to die while their first molars were erupting," says Kelley. "The close correspondence between age at first molar emergence and the timing of life history events that we found in great apes and modern humans means that we can have confidence that first molar emergence ages in the early hominids will provide equally accurate knowledge about their life histories."

Their findings are detailed in the article "Dental development and life history in living African and Asian apes."

Story Source:

Adapted from materials provided by Arizona State University, via EurekAlert!, a service of AAAS.

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http://www.sciencedaily.com/releases/2009/12/091228152350.htm

Lighting Can Influence How Wine Tastes

Wine glass in red and yellow ambient light. The same wine was rated higher when exposed to red or blue ambient light rather than green or white light. (Credit: iStockphoto)

ScienceDaily (Dec. 29, 2009) — The background lighting provided in a room has an influence on how we taste wine. This is the result of a survey conducted by researchers at the Institute of Psychology at Johannes Gutenberg University Mainz, Germany. Several sub-surveys were conducted in which about 500 participants were asked how they liked a particular wine and how much they would pay for it.It was found that the same wine was rated higher when exposed to red or blue ambient light rather than green or white light. The test persons were even willing to spend in excess of one Euro more on a specific bottle of Riesling when it was offered in red instead of green light.

"It is already known that the color of a drink can influence the way we taste it," says Dr Daniel Oberfeld-Twistel of the General Experimental Psychology division. "We wanted to know whether background lighting, for example in a restaurant, makes a difference as well." The survey showed, among other things, that the test wine was perceived as being nearly 1.5 times sweeter in red light than in white or green light. Its fruitiness was also most highly rated in red light.

Accordingly, one conclusion of the study is that the color of ambient lighting can influence how wine tastes, even when there is no direct effect on the color of the drink. "The extreme lighting conditions found in some bars can undoubtedly influence the way a wine tastes," concludes Oberfeld-Twistel. He also recommends that serious wine tasting should be conducted in a neutral light color environment.Perhaps a partial explanation of why lighting influences the way we taste wine is that in what we perceive to be pleasant lighting conditions, we also regard the wine as being more pleasant too. Additional research is planned to provide further insight into this fascinating phenomenon.

Story Source:

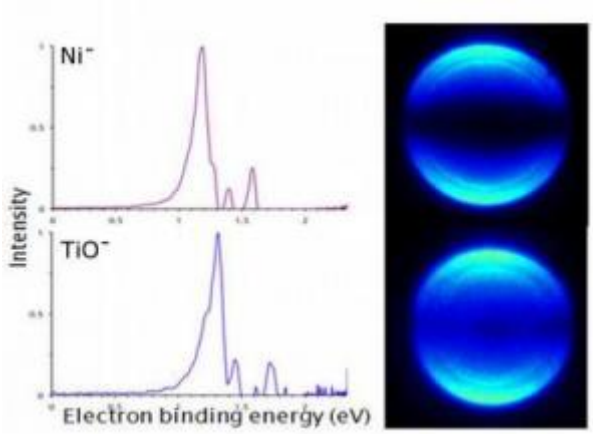
Adapted from materials provided by Mainz, Universitaet.

Journal Reference:

1. Daniel Oberfeld, Heiko Hecht, Ulrich Allendorf and Florian Wickelmaier. **Ambient lighting modifies the flavor of wine**. *Journal of Sensory Studies*, 2009; 24 (6): 797 DOI: 10.1111/j.1745-459X.2009.00239.x

http://www.sciencedaily.com/releases/2009/12/091215171510.htm

Superatoms Mimic Elements: Research Gives New Perspective on Periodic Table



The team used photoelectron imaging spectroscopy to examine similarities between a nickel atom and a titanium-monoxide molecule. Left: Graphical displays of energy peaks were similar between a nickel atom and a titanium-monoxide molecule. Right: Bright spots in the images, which correspond to the energy of the electrons emitted during their removal from the atoms' outer shells, appeared to be similar between a nickel atom (right, top) and a titanium-monoxide molecule (right, bottom). (Credit: Castleman lab, Penn State)

ScienceDaily (Dec. 29, 2009) — Transforming lead into gold is an impossible feat, but a similar type of "alchemy" is not only possible, but cost-effective too. Three Penn State researchers have shown that certain combinations of elemental atoms have electronic signatures that mimic the electronic signatures of other elements.

According to the team's leader A. Welford Castleman Jr., Eberly Distinguished Chair in Science and Evan Pugh Professor in the Departments of Chemistry and Physics, "the findings could lead to much cheaper materials for widespread applications such as new sources of energy, methods of pollution abatement, and catalysts on which industrial nations depend heavily for chemical processing."

The researchers also showed that the atoms that have been identified so far in these mimicry events can be predicted simply by looking at the periodic table. The team used advanced experimentation and theory to quantify these new and unexpected findings. "We're getting a whole new perspective of the periodic table," said Castleman.

The team's findings will be published in the 28 December 2009 early on-line issue of the journal *Proceedings of the National Academy of Sciences*, and at a later date in the print edition of the journal.

Castleman and his team -- which includes Samuel Peppernick, a former Penn State graduate student who now is a postdoctoral researcher at the Pacific Northwest National Laboratory, and Dasitha Gunaratne, a Penn State graduate student -- used a technique, called photoelectron imaging spectroscopy, to examine similarities between titanium monoxide and nickel, zirconium monoxide and palladium, and tungsten carbide and platinum.

"Photoelectron spectroscopy measures the energy it takes to remove electrons from various electronic states of atoms or molecules, while simultaneously capturing snapshots of these electron-detachment events with a digital camera," said Castleman. "The method allows us to determine the binding energies of the electrons and also to observe directly the nature of the orbitals in which the electrons resided before they were detached. We found that the amount of energy required to remove electrons from a titanium-monoxide molecule is the same as the amount of energy required to remove electrons from a nickel atom. The same is true for the systems zirconium monoxide and palladium and tungsten carbide and platinum.

The key is that all of the pairs are composed of isoelectronic species, which are atoms with the same electron configuration."

Castleman noted that, in this case, the term isoelectronic refers to the number of electrons present in the outer shell of an atom or molecule.

The team looked at images of the photoelectron spectroscopy data. Bright spots in the images, which correspond to the energy of the electrons emitted during their removal from the atoms' outer shells, appeared to be similar between the pairs of species in the three systems studied. Likewise, graphical displays of energy peaks were similar between the pairs, and theoretical calculations also resulted in the pairs having matching energy levels.

Castleman explained that the molecules titanium monoxide, zirconium monoxide, and tungsten carbide are superatoms of nickel, palladium, and platinum, respectively. Superatoms are clusters of atoms that exhibit some property of elemental atoms. Former work in Castleman's lab has involved investigating the notion of superatoms. One of his previous experiments showed that a cluster of 13 aluminum atoms behaves like a single iodine atom. Adding a single electron to this aluminum-atom system results in the cluster behaving like a rare-gas atom. Further, he showed that a cluster of 14 aluminum atoms has a reactivity similar to an alkaline earth atom.

Now, Castleman's new research takes the superatom idea to a new level and provides a sound quantitative foundation for the concept of superatoms. "It looks like we can predict which combinations of elemental atoms mimic other elemental atoms," he said. "For example, by looking at the periodic table, you can predict that titanium monoxide will be a superatom of nickel. Simply start at titanium, which has four outer-shell electrons, and move six elements to the right, because atomic oxygen possesses six outer-shell electrons. The element you end up on is nickel, whose 10 outer-shell electrons make it isoelectronic with the 10 outer-shell electron molecule resulting from the combination of titanium and oxygen. We thought this finding must be a curious coincidence, so we tried it with other atoms and we found that a pattern emerged."

Castleman said that he doesn't know if the pattern will occur across the entire periodic table or if it will be confined to only a part of it. Right now, he and his team are working through the transition-metal atoms. In the future, they plan to take the research a step further to investigate whether or not the superatoms are chemically similar to their respective single atoms. "Platinum is used in nearly all catalytic converters in automobiles, but it is very expensive," said Castleman. "In contrast, tungsten carbide, which mimics platinum, is cheap. A significant amount of money can be saved if catalytic-converter manufacturers are able to use tungsten carbide instead of platinum. Likewise, palladium is used in certain combustion processes, yet it is mimicked by zirconium monoxide, which is less expensive by a factor of 500. Our new findings are exciting from both a scientific as well as a practical point of view."

This research was funded by the Air Force Office of Scientific Research.

Story Source:

Adapted from materials provided by Penn State. Original article written by Sara LaJeunesse.

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The Body Electric
By WILLIAM SALETAN
Skip to next paragraph

THE DEPARTMENT OF MAD SCIENTISTS

How DARPA Is Remaking Our World, From the Internet to Artificial Limbs

By Michael Belfiore

295 pp. Smithsonian Books/Harper/HarperCollins Publishers. $26.99

Two years ago, in his book “Rocketeers,” Michael Belfiore celebrated the pioneers of the budding private space industry. Now he has returned to explore a frontier closer to home. The heroes of his new book, “The Department of Mad Scientists,” work for the Defense Advanced Research Projects Agency, better known as Darpa, a secretive arm of the United States government. And the revolution they’re leading is a merger of humans with machines.

The revolution is happening before our eyes, but we don’t recognize it, because it’s incremental. It starts with driving. Cruise control transfers regulation of your car’s speed to a computer. In some models, you can upgrade to adaptive cruise control, which monitors the surrounding traffic by radar and adjusts your speed accordingly. If you drift out of your lane, an option called lane keeping assistance gently steers you back. For extra safety, you can get extended brake assistance, which monitors traffic ahead of you, alerts you to collision threats and applies as much braking pressure as necessary.

With each delegation of power, we become more comfortable with computers driving our cars. Soon we’ll want more. An insurance analyst tells Belfiore that aging baby boomers will lead the way, enlisting robotic drivers to help them get around. For younger drivers, the problem is multitasking. Why put down your cellphone when you can let go of the wheel instead? Reading, texting, talking and eating in the car aren’t distractions. Driving is the distraction. Let the car do it.

That’s where Darpa comes in. Belfiore traces the agency’s origins and exploits from the 1957 Sputnik launching (which shocked the United States government into technological action) to the 1969 birth of the original Internet, known as Arpanet, to Total Information Awareness, the controversial 2002 project that was supposed to scan telecommunications data for signs of terrorism. His tone is reverential and at times

breathless, but he captures the agency's essential virtues: boldness, creativity, agility, practicality and speed.

The Army needs vehicles that can move cargo without exposing human operators to bombs or enemy fire. To encourage development of such vehicles, Darpa sponsored a 2007 contest in which cars designed by 35 teams navigated a simulated urban war zone. The cars used systems like those already in consumer vehicles: GPS, lane guidance, calibrated braking. But instead of routing their information and advice through human drivers, the cars simply acted on it.

Belfiore recounts several low-impact crashes caused by the limited ability of current software to understand complex traffic situations. But with each successive contest since Darpa's first robot-car race, the Grand Challenge, in 2004, performance has improved. In some respects, the robot cars already surpass us. Their reaction speed is better. They can see at night, thanks to laser range-finders. They have no blind spots. And when networked, they can read one another's intentions.

So maybe we'll let robots drive our cars. But would you let a robot cut you open? That's Darpa's next project. In minimally invasive surgery, doctors insert very thin instruments through keyhole-size incisions. This minimizes pain, blood loss, infection risk and recovery time, but it's hard. Surgeons have to manipulate their instruments indirectly and watch them on a video monitor. They might as well use a machine. It could execute their commands, give better video feedback and hold the instruments more steadily.

More than 850 hospitals already use such operating machines. Surgeons sit across the room from patients, connected to their instruments by game-style controls and three-dimensional video binoculars. When the machines meet resistance, the surgeons feel it. The goal is to engage the doctors' senses as fully as if the mechanical eyes and hands were theirs. In fact, they are theirs. The surgeons' minds map, orchestrate and experience the machine like an infant taking possession of its own body.

But if sensory feedback can extend a surgeon's body across a room, why stop there? A new version of the machine adds Ethernet, freeing the doctor to inhabit a mechanical body anywhere with a good cable or wireless connection. By digitizing surgical commands, we've already created transitional moments in which maneuvers have been described but not executed. Why not extend this transition, playing out the surgery in virtual reality and then editing out any errors? That's the next step: surgery with a word processor, so to speak, instead of a typewriter.

Unfortunately, the military doesn't have these luxuries. Soldiers get wounded in faraway places without broadband or doctors, and they need help fast. That's why Darpa wants mobile machines that can do surgery without human guidance. Such robots are in the works, according to Belfiore. Their initial repertory will be limited, but that's O.K. They just have to keep the wounded alive for the hour it takes to reach a hospital. And with every life they save, they'll begin to earn our trust.

So maybe you'll let a robot fix your body. But would you let one join your body? In fact, the coupling is well under way. As troops come home from Iraq and Afghanistan with limbs blown off, they get computerized arms that read the body's electrical signals. They're cyborgs.

The next step is mutual adaptation. Amputees have always had to learn how to operate their new limbs. Now the limbs are returning the favor. Their software studies each user's electrical signals, gradually becoming more accurate at interpreting commands. And though the user's brain remains in charge, his body has become negotiable. Amputees are getting surgeries to make their motor signals more readable by myoelectric arms. The human is being reconfigured for the machine.

The eventual payoff isn't just parity with unreconstructed humans. It's superiority. Some mechanical arms now exceed the reach of human arms. Last year, a disabled sprinter was forbidden to run in Olympic-level track meets on his carbon-fiber legs because they were deemed too fast. And computerized

limbs can be networked. Belfiore recalls a recent conversation with an Iraq war amputee about whether his new hand could manipulate a mouse. “Why do I need a mouse?” he asked. “Why can’t I plug my arm right into a USB port?”

For that matter, who needs a USB port? Limb designers have devised injectable sensors that can transmit motor commands to artificial arms through wireless signals. Once you can operate an arm wirelessly, you don’t need it attached to your body. You can control it from anywhere.

But your arm can also be hacked. And that raises an unsettling question: If humans marry machines, who will control the marriage? In its 2007 car contest, Darpa took elaborate measures to stop robots from going rogue. Each vehicle was outfitted with multiple shutdown devices and trailed by a human driver with a kill switch. The penalty for the slightest disobedience was immediate disqualification. But at least one team, according to Belfiore, liked to run simulations with its car’s “software aggression level cranked up into what they jokingly called Rambo mode.”

Imagine your arm in Rambo mode. Something like that has already been reported: Michael Weisskopf, a journalist who lost his right hand in Iraq, was making a turn in rush-hour traffic sometime later when, as Belfiore describes it, Weisskopf’s new hand “clenched the wheel of his car in a death grip and refused to let go.” It was just a misunderstanding. But electronic limbs are being programmed to make more and more decisions. After all, it isn’t just your body anymore. It’s theirs, too.

William Saletan writes the Human Nature column for Slate and is the author of “Bearing Right: How Conservatives Won the Abortion War.”

http://www.nytimes.com/2009/12/27/books/review/Saletan-t.html?ref=books

Devil cancer source 'identified'

By Mark Kinver
Science and environment reporter, BBC News

Researchers believe they have identified the source of fatal tumours that threaten to wipe out the wild population of Tasmanian devils.

Writing in Science, an international team of scientists suggest cells that protect nerves are the likely origin of devil facial tumour disease (DFTD).

The disease is a transmissible cancer that is spread by physical contact, and quickly kills the animals.

DFTD has caused the devil population to collapse by 60% in the past decade.

"To look more closely at the tumours' origin, we sequenced the genes that are expressed in this devil cancer and compared them with other genes that are expressed in other devil tissues," explained lead author Elizabeth Murchison, from the Australian National University in Canberra.

She told the Science podcast the team's findings delivered surprising results.

"We found that the tumours expressed genes that were normally only expressed by Schwann cells, which are cells that are found in the peripheral nervous system that protect nerves."

'Genetically distinct'

The researchers sampled 25 different tumours from all over Tasmania, the only place on the planet where the world's largest carnivorous marsupials are found.

DEVILS IN DETAIL
Scientific name: *Sarcophilus harrisii*
Devils were given their common name by early settlers, who were haunted by "demonic growls"

Largest living carnivorous marsupial
Now only found in Tasmania
Can live up to five years in wild
Weight: male 10-12kg; female 6-8kg
They favour habitats where they can shelter by day and scavenge by night

They found that the growths were genetically distinct from their hosts, but were identical to one another.

Dr Murchison, who is also a researcher at Cold Spring Harbor Laboratory, US, said the teams findings had a number of positive outcomes: "Most importantly, this has led to the development of a diagnostic test for the disease.

"Devils are susceptible to a number of different types of cancer. Just like humans, they can get breast cancer, leukaemia, etc - especially in their old age.

"Sometimes it can be difficult to tell the difference between these types of cancer and the transmissible disease.

"Now that we know that these very specific Schwann genes are expressed in the cancer, we can use these genes as diagnostic markers."

DFTD was first described in the mid-1990s, when devils with large facial tumours were photographed in north-eastern Tasmania.

By the end of 2008, the disease - which kills infected animals within nine weeks - had been confirmed at 64 locations, covering more than 60% of the Australian island state's mainland.

Experts warn that without intervention, the disease could wipe out the wild population of the world's largest carnivorous marsupial within decades.

Dr Murchison hoped identifying the catalogue of genes associated with DFTD would lead to the development of vaccines, or possibly therapies.

"As yet, unfortunately, there is nothing we can do to help the devils that have the disease," she said.

"This devil facial cancer is very unusual as it is an infection cancer; it is a little bit like an organ transplant," she said.

"In an organ transplant, you have an organ that is transplanted into an unrelated individual. In the case of the devil cancer, you have a cancer that is transplanted into another unrelated devil through biting.

"One of the big questions about this cancer is why it is not being rejected or being recognised as a foreign graft.

"If we could understand that... we could perhaps use this data to develop a vaccine that could help the devils' immune system reject the cancer before it takes hold."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8433645.stm

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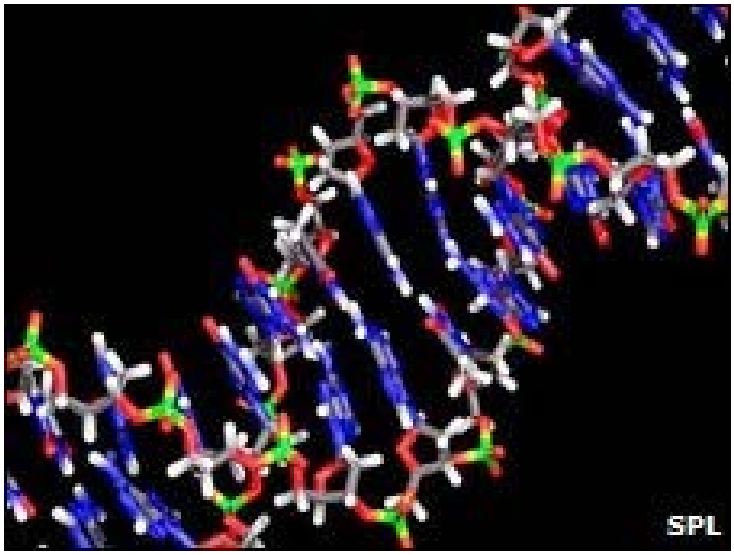
DNA analysed from early European

By Paul Rincon
Science reporter, BBC News

Scientists have analysed DNA extracted from the remains of a 30,000-year-old European hunter-gatherer.



Studying the DNA of long-dead humans can open up a window into the evolution of our species (*Homo sapiens*).

But previous studies of this kind have been hampered by scientists' inability to distinguish between the ancient human DNA and modern contamination.

In Current Biology journal, a German-Russian team details how it was possible to overcome this hurdle.

Svante Paabo, from the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, and colleagues used the latest DNA sequencing techniques to study genetic information from human remains unearthed in 1954 at Kostenki, Russia.

Excavations at Kostenki, on the banks of the river Don in southern Russia, have yielded large concentrations of archaeological finds from the Palaeolithic (roughly 40,000 years ago to 10,000 years ago). Some of the finds date back as far as 45,000 years.

" **The ironic thing is that our group has been one of those that raised this issue** "
Professor Svante Paabo, Max Planck Institue

The DNA analysed in this study comes from a male aged 20-25 who was deliberately buried in an oval pit some 30,000 years ago.

Known as the Markina Gora skeleton, it was found lying in a crouched position with fists reaching upwards and a face orientated down towards the dirt. The bones were covered in a pigment called red ochre, thought to have been used in prehistoric funeral rites.

The type of DNA extracted and analysed is that stored in mitochondria - the "powerhouses" of cells. This mitochondrial DNA (mtDNA) is passed down from a mother to her offspring, providing a unique record of maternal inheritance.

Using technology pioneered in the study of DNA from Neanderthal bones, they were able to distinguish between ancient genetic material from the Kostenki male and contamination from modern people who handled the bones, or whose DNA reached the remains by some other means.

The new approach, developed by Professor Paabo and his colleagues, exploits three features which tend to distinguish ancient DNA from modern contamination. One of these is size; fragments of ancient DNA are often shorter than those from modern sources.

Previous ancient DNA studies used the widespread polymerase chain reaction (PCR) technology. PCR amplifies a few pieces of genetic material, generating thousands to millions of copies of a sequence. But the researchers found many fragments of ancient DNA were too small to be amplified by PCR.

A second characteristic of ancient DNA was its tendency to show particular changes, or mutations, in the genetic sequence at the ends of DNA molecules.

A third feature was a characteristic breakage of molecules at particular positions in the DNA strand.

Trust issues

The apparent ease with which modern DNA can infiltrate ancient remains has led many researchers to doubt even those studies employing the most rigorous methods to weed out contamination by modern genetic material.

"The ironic thing is that our group has been one of those that raised this issue," Professor Paabo told BBC News.

"To take animal studies on cave bears, for example, if we use PCR primers specific for human DNA on cave bear bones, we can retrieve modern human DNA on almost every one. That has made me think: 'how can I trust anything on this'."

Using the new techniques, the researchers were able to sequence the entire mitochondrial genome of the Markina Gora individual.

Future studies like the one in Current Biology could help shed light on whether the humans living in Europe 30,000 years ago are the direct ancestors of modern populations or whether they were replaced by immigrants who introduced farming to the continent several thousand years ago.

The modern gene pool contains a wide variety of mtDNA lineages. Studying these maternal lineages provides scientists with clues to the origins and histories of human populations.

Scientists look for known genetic signatures in order to classify an individual's mtDNA into different types, or "haplogroups". These haplogroups represent major branches on the family tree of *Homo sapiens* .

Early arrival

The researchers were able to assign the Kostenki individual to haplogroup "U2", which is relatively uncommon among modern populations.

U2 appears to be scattered at low frequencies in populations from South and Western Asia, Europe and North Africa.

Despite its rarity, the very presence of this haplogroup in today's Europeans suggests some continuity between Palaeolithic hunters and the continent's present-day inhabitants, argue the authors of the latest study.

U2, along with closely related haplogroups such as U5, are among those which could plausibly have arrived in Europe during the Palaeolithic.

Geneticists use well-established techniques to "date" particular genetic events, such as when a haplogroup first diversified. The "U" branch (comprising haplogroups U1, U2, U3 and so on) appears to be more ancient than many other genetic lineages found in Europe.

A recent study found a very high percentage of U types in the skeletal remains of ancient hunter-gatherers from Central Europe compared with later farming immigrants and modern people from the region.

Meanwhile, an analysis last year of mtDNA from 28,000-year-old remains unearthed at Paglicci Cave in Italy showed this individual belonged to haplogroup "H" - the most common type found in modern Europeans.

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Story from BBC NEWS:
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'Lifeless' prions can 'evolve'

Scientists have shown for the first time that "lifeless" prion proteins, devoid of all genetic material, can evolve just like higher forms of life.

The Scripps Research Institute in the US says the prions can change to suit their environment and go on to develop drug resistance.

Prions are associated with 20 different brain diseases in humans and animals.

The scientists say their work suggests new approaches might be necessary to develop therapies for these diseases.

In the study, published in the journal Science, the scientists transferred prion populations from brain cells to other cells in culture and observed the prions that adapted to the new cellular environment out-competed their brain-adapted counterparts.

When returned to the brain cells, the brain-adapted prions again took over the population.

Charles Weissmann, head of Scripps Florida's department of infectology who led the study, said: "On the face of it, you have exactly the same process of mutation and adaptive change in prions as you see in viruses.

" **This is a timely reminder that prion concerns are not going away and that controls to stop abnormal prions being transmitted to humans through the food system or through blood transfusions must be vigorously maintained** "
Professor John Collinge, Medical Research Council Prion Unit

"This means that this pattern of Darwinian evolution appears to be universally active.

"In viruses, mutation is linked to changes in nucleic acid sequence that leads to resistance.

"Now, this adaptability has moved one level down- to prions and protein folding - and it's clear that you do not need nucleic acid (DNA or RNA) for the process of evolution."

Mammalian cells normally produce cellular prion protein or PrPC.

During infections, such as the human form of mad cow disease known as vCJD, abnormal or misfolded proteins convert the normal host prion protein into its toxic form by changing its conformation or shape.

"It was generally thought that once cellular prion protein was converted into the abnormal form, there was no further change", Mr Weissmann said.

"But there have been hints that something was happening.

"When you transmit prions from sheep to mice, they become more virulent over time.

PRION DISEASES

Human prion diseases such as Creutzfeldt Jakob disease (CJD) can arise sporadically, be acquired by infection or be inherited because of a mutant gene coding for the prion protein

They are relatively rare but have occurred in epidemic form in Papua New Guinea as a result of brain cannibalism

Animal prion diseases include scrapie in sheep and goats, chronic wasting disease in deer and elk and transmissible mink encephalopathy

Bovine spongiform encephalopathy (BSE) first appeared in UK in mid-1980s

It is estimated that more than two million UK cattle were infected

Variant CJD (vCJD) caused by the same prion strain as BSE was first recognised in the mid-1990s

"Now we know that the abnormal prions replicate, and create variants, perhaps at a low level initially.

"But once they are transferred to a new host, natural selection will eventually choose the more virulent and aggressive variants."

Professor John Collinge, of the Medical Research Council's (MRC) Prion Unit, described the research as exciting confirmation of a hypothesis that he had proposed two years ago, that there could be a "cloud" or whole array of prion proteins in the body.

He called it the cloud hypothesis.

He said: "The prion protein is not a clone, it is a quasi-species that can create different protein strains even in the same animal.

"The abnormal prion proteins multiply by converting normal prion proteins.

"The implication of Charles Weissmann's work is that it would be better to cut off that supply of normal prion proteins rather than risk the abnormal prion adapting to a drug and evolving into a new more virulent form.

"You would do this by trying to block the sites on the normal prion protein that the abnormal form locks on to to do its conversion.

"We know there is an antibody that can do this in mice and the Medical Research Council's Prion Unit have managed to engineer a human antibody to do this.

Chemical libraries

"It is currently undergoing safety tests and we hope to move to clinical trials by the end of 2011"

Professor Collinge said the MRC was also trying to find more conventional chemical compounds to do this and has been collaborating with the chemical company GlaxoSmithKline (GSK).

He said: "They have given us access to their chemical libraries, which contain millions of compounds, and we have already identified some that may work well.

"This is a timely reminder that prion concerns are not going away and that controls to stop abnormal prions being transmitted to humans through the food system or through blood transfusions must be vigorously maintained."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8435320.stm

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Final Moments of Bee Landing Tactics Revealed

Bees manage their approach by monitoring the speed of images moving across their eyes. By slowing so that the speed of the looming landing pad's image on the retina remains constant, bees manage to control their approach. (Credit: iStockphoto/Amit Erez)

ScienceDaily (Jan. 2, 2010) — Landing is tricky: hit the ground too fast and you will crash and burn; too slow and you may stall and fall. Bees manage their approach by monitoring the speed of images moving across their eyes. By slowing so that the speed of the looming landing pad's image on the retina remains constant, bees manage to control their approach. But what happens in the final few moments before touch down? And how do bees adapt to landing on surfaces ranging from the horizontal to upside-down ceilings?

Flies land on a ceiling by simply grabbing hold with their front legs and somersaulting up as they zip along, but a bee's approach is more sedate. Mandyam Srinivasan, an electrical engineer from the Queensland Brain Institute, The University of Queensland and the Australian Research Council's Vision Centre, knew that bees must be doing something different from daredevil flies. Curious to know more about bee landing strategies Srinivasan teamed up with Carla Evangelista, Peter Kraft, and Judith Reinhard from the University of Queensland, and Marie Dacke, visiting from Lund University.

The team used a high-speed camera to film the instant of touch down on surfaces at various inclinations and publish their discoveries about bee landing tactics in The *Journal of Experimental Biology* on December 28 2009 at http://jeb.biologists.org.

First the scientists built a bee-landing platform that could be inclined at any angle from horizontal to inverted (like a ceiling), then they trained bees to land on it and began filming. Having collected movies of the bees landing on surfaces ranging from 0deg. to 180deg., and every 10deg. inclination between, Evangelista began the painstaking task of manually analysing the bees landing strategies, and saw that the bees' approach could be broken down into 3 phases.

Initially the bees approached from almost any direction and at any speed, however, as they got closer to the platforms, they slowed dramatically, almost hovering, until they were 16mm from the platform when they ground to a complete halt, hovering for anything ranging from 50ms to over 140ms. When the surface was horizontal or inclined slightly, the bees' hind legs were almost within touching distance of the surface, so it was simply a matter of the bee gently lowering itself and grabbing hold with its rear feet before lowering the rest of the body.

However, when the insects were landing on surfaces ranging from vertical to 'ceilings', their antennae were closest to the surface during the hover phase. The team saw that the antennae grazed the surface and this contact triggered the bees to reach up with the front legs, grasp hold of the surface and then slowly heave their middle and hind legs up too. 'We had not expected the antennae to play a role and the fact that there is a mechanical aspect of this is something that we hadn't thought about,' admits Srinivasan.

Looking at the antennae's positions, the team realised that in the final stages as the insects approached inverted surfaces, they held their antennae roughly perpendicular to the surface. 'The bee is able to estimate the slope of the surface to orient correctly the antennae, so it is using its visual system,' explains Srinivasan. But this is surprising, because the insects are almost completely stationary while hovering and unable to use image movement across the eye to estimate distances. Srinivasan suspects that the bees could be using stereovision over such a short distance, and is keen to test the idea.

Finally the team realised that bees are almost tailor made to land on surfaces inclined at angles of 60deg. to the horizontal. 'When bees are flying fast their bodies are horizontal, but when they are flying slowly or hovering their abdomen tilts down so that the tips of the legs and antennae lie in a plane that makes an angle of 60deg.' explains Srinivasan: so the legs and antennae all touch down simultaneously on surfaces inclined at 60deg. 'It seems like they are adapted to land on surfaces tilted to 60deg. and we are keen to find out whether many flowers have this natural tilt,' says Srinivasan.

Srinivasan is optimistic that he will eventually be able to use his discoveries in the design of novel flight control systems.

Story Source:

Adapted from materials provided by The Company of Biologists, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Evangelista, C., Kraft, P., Dacke, M., Reinhard, J. and Srinivasan, M. V. **The moment before touchdown: landing manoeuvres of the honeybee Apis mellifera**. *Journal of Experimental Biology*, 2010 [link]

http://www.sciencedaily.com/releases/2009/12/091223074657.htm

It's Never Too Late to Quit Smoking and Save Your Vision

ScienceDaily (Jan. 2, 2010) — Need a little extra incentive to kick the habit?

Just in time for New Year's resolutions, a UCLA study finds that even after age 80, smoking continues to increase one's risk for age-related macular degeneration (AMD), the leading cause of blindness in Americans over 65.The *American Journal of Ophthalmology* publishes the findings in its January edition.

"The take-home message is that it's never too late to quit smoking," said lead author Dr. Anne Coleman, professor of ophthalmology at the Jules Stein Eye Institute at UCLA. "We found that even older people's eyes will benefit from kicking the habit."AMD causes progressive damage to the macula, the center of the retina that allows us to see fine details. When the macula degenerates, people experience darkness or blurring in their central vision, preventing them from being able to read, drive and recognize faces.

After age, smoking is the second most common risk factor for AMD. This study sought to determine whether age influences the effects of smoking on AMD risk.Coleman and her colleagues followed a group of 1,958 women who underwent retinal photographs at five-year intervals, starting with a baseline exam at age 78. Four percent, or 75 of the women, smoked.

The researchers compared the retinal images at ages 78 and 83 to check for the appearance of AMD, and evaluate whether smoking affected the women's likelihood of developing the disease."Age is the strongest predictor for AMD, yet most of the research in this field has been conducted in people younger than 75," explained Coleman. "Our population was considerably older than those previously studied. This research provides the first accurate snapshot of how smoking affects AMD risk later in life."

Overall, women who smoked had 11 percent higher rates of AMD than other women their same age. In women over 80, however, those who smoked were 5.5 times more likely to develop AMD than women their age who did not smoke."We saw a slightly higher rate of AMD in women after age 80, but the rate was dramatically higher in older women who smoked," said Coleman. "The bottom line is that AMD risk increases with age. And if you smoke, your risk of developing the disease rises even more."

Cigarette smoking has been hypothesized to increase AMD risk by reducing serum antioxidant levels, altering blood flow to the eyes and decreasing retinal pigments."This study provides yet another compelling reason to stop smoking and suggests that it is never too late to quit," said Dr. Paul Sieving, director of the National Eye Institute.The National Eye Institute and National Institute on Aging funded the research. About 1.75 million U.S. residents suffer from advanced AMD with vision loss; the number is expected to grow to almost 3 million by 2020.

Coleman's coauthors included Carol Mangione, Robin Seitzman and Fei Yu of UCLA; Steven Cummings and Katie Stone of the California Pacific Medical Center Research Institute; Jane Cauley from the University of Pittsburgh; Kristine Ensrud from the University of Minnesota; Marc Hochberg from the University of Maryland; Kathryn Pedula from the Kaiser Permanente Center for Health Research; and Edgar Thomas from the Retina Vitreous Associates Medical Group.

Story Source:

Adapted from materials provided by University of California - Los Angeles, via EurekAlert!, a service of AAAS.
http://www.sciencedaily.com/releases/2009/12/091231082825.htm

Fast Pace of Glacier Melt in the 1940s: Lower Aerosol Pollution

Gorner glacier. In the 1940s, the glaciers were melting at a faster pace than today. (Credit: Matthias Huss / ETH Zurich)

ScienceDaily (Jan. 1, 2010) — The most recent studies by researchers at ETH Zurich show that in the 1940s Swiss glaciers were melting at an even-faster pace than at present. This is despite the fact that the temperatures in the 20th century were lower than in this century. Researchers see the main reason for this as the lower level of aerosol pollution in the atmosphere.

In Switzerland, the increase in snow in wintertime and the glacier melt in summertime have been measured at measurement points at around 3,000 metres above sea level -- on the Clariden Firn, the Great Aletsch glacier and the Silvretta glacier -- without interruption for almost 100 years. As part of his doctoral work, Matthias Huss used this unique range of measurements to examine how climate change in the last century affected the glaciers. The work was carried out under the supervision of Martin Funk, professor and head of the Department for Glaciology at the Laboratory for Hydraulics, Hydrology and Glaciology ('VAW') at ETH Zurich, who is also co-author of the study.

Solar radiation as the decisive factor

In its work, the research team took into account the solar radiation measured on the Earth's surface in Davos since 1934. Studies over the past two decades have shown that solar radiation varies substantially due to aerosols and clouds, and this is assumed to influence climate fluctuations. Recent years have seen the emergence of the terms 'global dimming' and 'global brightening' to describe these phenomena of reduced and increased solar radiation respectively. These two effects are currently the subject of more and more scientific research, in particular by ETH Zurich, as experts feel that they should be taken into account in the climate models.

The new study, published in the journal 'Geophysical Research Letters', confirms this requirement. This is because, taking into account the data recorded for the level of solar radiation, the scientists made a surprising discovery: in the 1940s and in the summer of 1947 especially, the glaciers lost the most ice since measurements commenced in 1914. This is in spite of the fact that temperatures were lower than in the past two decades. "The surprising thing is that this paradox can be explained relatively easily with radiation," says Huss, who was recently appointed to the post of senior lecturer at the Department of Geosciences at the University of Fribourg in Switzerland.

On the basis of their calculations, the researchers have concluded that the high level of short-wave radiation in the summer months is responsible for the fast pace of glacier melt. In the 1940s, the level was 8% higher than the long-term average and 18 Watts per square metres above the levels of the past ten

years. Calculated over the entire decade of the 1940s, this resulted in 4% more snow and ice melt compared with the past ten years.

Furthermore, the below-average melt rates at the measurement points during periods in which the glacier snouts were even advancing correlate with a phase of global dimming, between the 1950s and the 1980s.

Less snow fall and longer melt periods

The researchers arrived at their findings by calculating the daily melt rates with the aid of climate data and a temperature index model, based on the half-yearly measurements on the glaciers since 1914. These results were then compared with the long-term measurements of solar radiation in Davos.

Huss points out that the strong glacier melt in the 1940s puts into question the assumption that the rate of glacier decline in recent years "has never been seen before." "Nevertheless," says the glaciologist, "this should not lead people to conclude that the current period of global warming is not really as big of a problem for the glaciers as previously assumed." This is because it is not only the pace at which the Alpine glaciers are currently melting that is unusual, but the fact that this sharp decline has been unabated for 25 years now.

Another aspect to consider -- and this is evidenced by the researchers' findings -- is that temperature-based opposing mechanisms came into play around 30 years ago. These have led to a 12% decrease in the amount of precipitation that falls as snow as a percentage of total precipitation, accompanied by an increase of around one month in the length of the melt period ever since this time. Scientists warn that these effects could soon be matched by the lower level of solar radiation we have today compared with the 1940s.

Story Source:

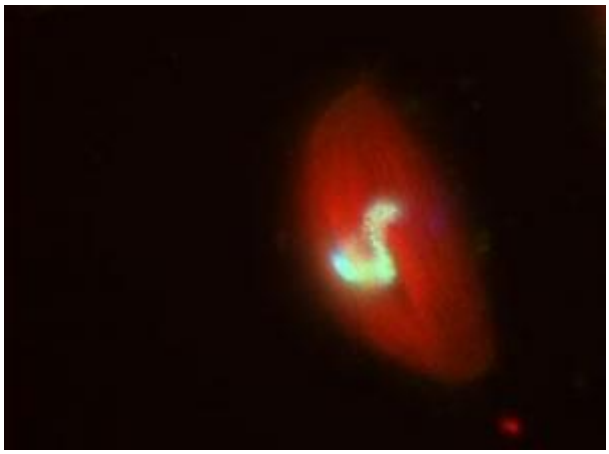
Adapted from materials provided by ETH Zurich.

Journal Reference:

1. Huss et al. **Strong Alpine glacier melt in the 1940s due to enhanced solar radiation**. *Geophysical Research Letters*, 2009; 36 (23): L23501 DOI: 10.1029/2009GL040789

http://www.sciencedaily.com/releases/2009/12/091231124858.htm

New Molecule Identified in DNA Damage Response



Stabilizing DNA. Researchers have identified the molecule SMARCAL1 as involved in cells' elaborate system for recognizing and repairing DNA damage during cell division. The protein is pictured above (green) in the presence of DNA (blue) as the chromosomes align along the mitotic spindle (red). (Credit: Image courtesy of Rockefeller University)

ScienceDaily (Jan. 1, 2010) — In the harsh judgment of natural selection, the ultimate measure of success is reproduction. So it's no surprise that life spends lavish resources on this feat, whether in the courtship behavior of birds and bees or replicating the cells that keep them alive. Now research has identified a new piece in an elaborate system to help guarantee fidelity in the reproduction of cells, preventing potentially lethal mutations in the process.

In experiments to be published in the December 18 issue of the *Journal of Biological Chemistry*, researchers at The Rockefeller University identified the molecule SMARCAL1 as part of cells' damage control response to malfunctioning DNA replication. In typical cell division, many different molecules have roles in guaranteeing the daughter strands of DNA are as identical as possible to their parent. Some molecules check for errors or 'proofread' the offspring for typos, for instance; others, when alerted to a problem, arrest the replication process and conduct repairs.

Lisa Postow, a postdoctoral fellow in Hironori Funabiki's Laboratory of Chromosome and Cell Biology, used mass spectroscopy to identify SMARCAL1 as involved in this intricate quality control process. Working with Brian T. Chait's Laboratory of Mass Spectrometry and Gaseous Ion Chemistry, Postow found the protein in a proteomics screen for molecules that were drawn to a dangerous DNA repair problem called a double-strand break.

In both human cells and in cells from African clawed frog egg extract, Postow found that at double-strand breaks, SMARCAL1 gathered with another molecule called RPA, which is known to coat broken strands of DNA and protect them while damage is repaired. SMARCAL1 had an added interest, too: A mutation in the gene that produces it is involved in a rare but lethal disease called Schimke immuno-osseous dysplasia, a disorder that causes wide-ranging problems including kidney malfunction, immunodeficiency and growth inhibition.

To Postow's surprise, she found that removing SMARCAL1 had little effect on double-strand break repair. However, it did facilitate a different aspect of the DNA damage response called replication fork stabilization, a process that holds steady the junction between parental and daughter strands -- the replication fork -- when replication is stalled because a problem has been detected. "For a mutation that causes such wide-ranging and severe physiological effects, it is surprising that the protein has such a relatively small effect at the cellular level," Postow says.

Postow's findings were largely corroborated by independent new research into SMARCAL1, which was published this fall in four back-to-back papers in *Genes & Development.* The work reveals another piece of the complex safeguards the body has in place to protect against dangerous mutations.

"This study also proves that the proteomic approach that Lisa has developed with Dr. Chait can efficiently identify proteins involving the DNA-damage recognition and repair process," says Funabiki. "Many more excitements are ahead of us."

Story Source:

Adapted from materials provided by Rockefeller University.

Journal Reference:

1. Postow et al. **Identification of SMARCAL1 as a Component of the DNA Damage Response**. *Journal of Biological Chemistry*, 2009; 284 (51): 35951 DOI: 10.1074/jbc.M109.048330

http://www.sciencedaily.com/releases/2009/12/091231152519.htm

Window Opens Into Moon's Past Volcanism

ScienceDaily (Jan. 1, 2010) — Lava tubes, underground cave-like channels through which lava once flowed, are commonly found on Earth. Scientists have debated whether these tubes could form on the Moon as well, but no studies have yet conclusively identified features that indicate the presence of lunar lava tubes.Using images from the SELENE (also known as Kaguya) spacecraft's high-resolution cameras, Haruyama et al. have identified a vertical hole that they believe is a skylight in an intact lava tube. The hole is located in the Marius Hills region, a volcanic area on the Moon's nearside.

The authors find that the nearly circular hole is about 65 meters (213 feet) in diameter and about 80-88 m (262-289 ft) deep. They consider possible formation mechanisms and conclude that the skylight most likely formed when part of the lava tube roof collapsed. The authors believe that the discovery could have implications for studies of lunar volcanism.

In addition, because lava tubes are sheltered from the harsh environment on the Moon's surface, such tubes could one day be useful for lunar bases.

The research is published in *Geophysical Research Letters*.

Authors include Junichi Haruyama, Tomokatsu Morota, Yasuhiro Yokota, and Makiko Ohtake: ISAS, JAXA, Sagamihara, Japan; Kazuyuki Hioki and Seiichi Hara: NTT DATA CCS Corporation, Tokyo, Japan; Motomaro Shirao: Tokyo, Japan; Harald Hiesinger and Carolyn H. van der Bogert: Institut für Planetologie, Westfälische Wilhelms-Universität, Münster, Germany; Hideaki Miyamoto: University Museum, University of Tokyo, Tokyo, Japan; Akira Iwasaki: Research Center for Advanced Science and Technology, University of Tokyo, Tokyo, Japan; Tsuneo Matsunaga: Center for Global Environmental Research, NIES, Tsukuba, Japan; Shunsuke Nakanotani: Mitsubishi Space Software Co., Ltd., Tsukuba, Japan; and Carle M. Pieters: Department of Geological Sciences, Brown University, Providence, Rhode Island, USA.

Story Source:

Adapted from materials provided by American Geophysical Union, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Haruyama et al. **Possible lunar lava tube skylight observed by SELENE cameras**. *Geophysical Research Letters*, 2009; 36 (21): L21206 DOI: 10.1029/2009GL040635

http://www.sciencedaily.com/releases/2009/12/091230184030.htm

Looking Back in Time 12 Billion Years With New Instruments on Herschel Space Observatory

This is the Herschel Space Observatory. (Credit: European Space Agency)

ScienceDaily (Jan. 1, 2010) — An instrument package developed in part by the University of Colorado at Boulder for the $2.2 billion orbiting Herschel Space Observatory launched in May by the European Space Agency has provided one of the most detailed views yet of space up to 12 billion years back in time.

The December images have revealed thousands of newly discovered galaxies in their early stages of formation, said CU-Boulder Associate Professor Jason Glenn, a co-investigator on the Spectral and Photometric Imaging Receiver, or SPIRE instrument, riding aboard Herschel. The new images are being analyzed as part of the Herschel Multi-tiered Extragalactic Survey, or HerMES, which involves more than 100 astronomers from six countries.

Equipped with three cameras including SPIRE, the Herschel Space Observatory was launched in May 2009 from Europe's Spaceport in French Guiana. The spacecraft -- about one and one-half times the diameter of the Hubble Space Telescope -- is orbiting nearly 1 million miles from Earth.

Herschel is the first space observatory to make high-resolution images at submillimeter wavelengths, which are longer than visible and infrared light waves and shorter than radio waves. SPIRE was designed to look for emissions from clouds and dust linked to star-forming regions in the Milky Way and beyond, said Glenn. The most recent observations were made in the constellation Ursa Major, which includes the Big Dipper.

CU-Boulder is receiving roughly $2 million from NASA for the combined support of SPIRE instrument development and science data analysis during the lifetime of the orbiting telescope, said Glenn, an associate professor in CU-Boulder's astrophysical and planetary sciences department. NASA's Jet Propulsion Laboratory and CU-Boulder built essential instrumentation for the telescope used to make the most recent observations, said Glenn, also a member of CU-Boulder's Center for Astrophysics and Space Astronomy.

"The submillimeter sky is absolutely paved with galaxies," Glenn said. The newest images are "amazingly clear and deep," which enables astronomers to detect distant galaxies they would have no

chance of discovering with current ground-based telescopes, he said. Since the light being observed with Herschel left the galaxies billions of years ago on its journey toward our solar system, the images are helping to reveal early star formation activity as well as the growth of supermassive black holes in galaxies.

The Herschel team expects to discover hundreds of thousands of new galaxies at very early stages of their formations -- some more than 10 billion years old, he said. A single image from Herschel released in December revealed 10 times as many galaxies as have been seen before by all of the world's telescopes observing the skies in submillimeter wavelengths, said Glenn.

A major goal of the Herschel mission is to discover how early galaxies formed and evolved to give rise to present-day galaxies like our own, he said. Distant galaxies imaged by Herschel are so far away astronomers actually are looking at conditions as early as just over a billion or so years after the Big Bang some 13 billion years ago. The SPIRE camera allows Herschel to detect radiation from very cold and distant objects, such as young stars and evolving galaxies.

The SPIRE team is studying the physical and chemical processes that take place in the distant interstellar medium to learn more about how stars are formed from molecular clouds, Glenn said. The submillimeter colors of the galaxies in the new images reveal information about their temperatures and distances -- bluer galaxies are relatively hotter and nearer, while the redder galaxies are cooler and farther away, he said.

Glenn said CU-Boulder also is partnering on a ground-based telescope project known as the Cornell Caltech Atacama Telescope, or CCAT -- slated for completion in 2013 in the Atacama desert of Chile at 18,400 feet in altitude -- which will be able to zoom in on regions imaged by Herschel and isolate individual galaxies with 10 times greater detail. CASA is working to raise roughly $5 million in private capital toward the cost of CCAT, Glenn said.

SPIRE is one of three instruments on Herschel and has both a camera and a spectrometer. Led by the United Kingdom, SPIRE also includes participation by a number of American, Canadian and Chinese institutions. Glenn's group is particularly interested in characterizing the faintest, most distant galaxies, "which will push the orbiting observatory to its limits of sensitivity," he said.

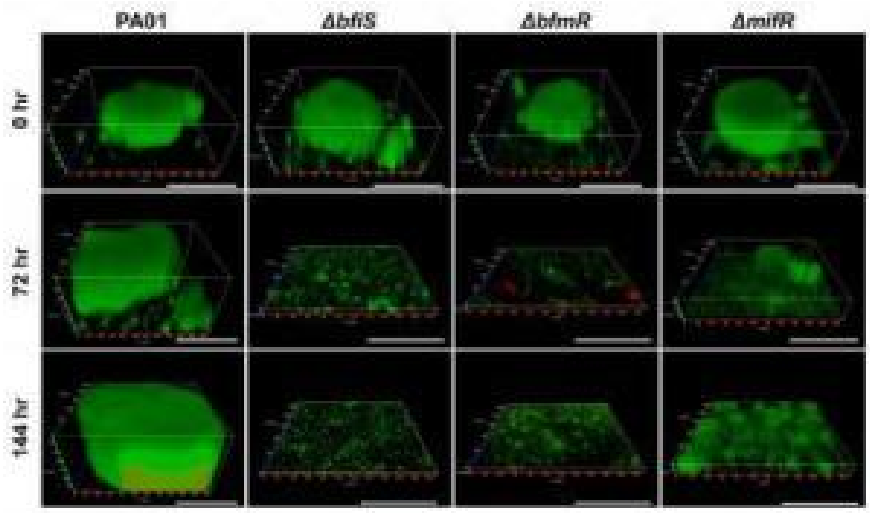
"Herschel is providing a whole new window on the universe," said Glenn. "This project provides a fantastic opportunity for top scientists from around the world to work together to understand how stars and galaxies form and evolve."

Story Source:

Adapted from materials provided by University of Colorado at Boulder.

http://www.sciencedaily.com/releases/2009/12/091230154511.htm

Biofilms: Researchers Discover New Ways to Treat Chronic Infections



Inactivation of the expression of three key regulators bfiS, bfmR, and mifR in mature biofilms results in biofilm architectural collapse and biomass loss. P. aeruginosa mutants complemented with plasmid-borne copies of the respective genes placed under the regulation of the arabinose-inducible PBAD were grown under continuous flow conditions in glutamate minimal medium in the presence of 0.1% arabinose for 144 hr after which time the biofilms were visualized by confocal microscopy (0 hr). Then, arabinose was eliminated from the growth medium and the biofilm architecture monitored post arabinose removal at the times indicated. PAO1 strain harboring the empty pJN105 vector was used as control. White bars = 100 ¼m. (Credit: Karin Sauer)

ScienceDaily (Jan. 1, 2010) — Researchers at Binghamton University, State University of New York, have identified three key regulators required for the formation and development of biofilms. The discovery could lead to new ways of treating chronic infections.

Biofilms -- communities of bacteria in self-produced slime -- may be found almost anywhere that solids and liquids meet, whether in nature, in hospitals or in industrial settings. Biofilms are implicated in more than 80 percent of chronic inflammatory and infectious diseases caused by bacteria, including ear infections, gastrointestinal ulcers, urinary tract infections and pulmonary infections in cystic fibrosis patients, according to the Centers for Disease Control.

Biofilms are difficult to eradicate with conventional antimicrobial treatments since they can be nearly 1,500-fold more resistant to antibiotics than planktonic, free-floating cells. Biofilms also pose a persistent problem in many industrial processes, including drinking water distribution networks and manufacturing.

Karin Sauer, associate professor of biology at Binghamton University, and graduate student Olga Petrova published their findings of key regulatory events required for the formation and development of *Pseudomonas aeruginosa* biofilms in *PLoS Pathogens,* a peer-reviewed, open-access journal published online by the Public Library of Science.

"We have found a pathway of how the formation of biofilms is controlled," Sauer said. "If we can figure out how to make use of this newly discovered genetic program, we can interfere with the formation of biofilms and either prevent or treat biofilm infections more successfully."

Pseudomonas aeruginosa, an opportunistic pathogenic bacterium, is considered one of the primary causes of death in patients with cystic fibrosis, a common and life-threatening hereditary disease.

Petrova documented a previously unknown genetic program composed of several regulators by looking for changes in phosphorylation patterns in *Pseudomonas aeruginosa*. These regulators cannot only be used to stop the development of biofilms at various stages in their growth but also to revert established biofilms to an earlier developmental stage.

"The problem you have when you have a chronic infection is that your immune system is trying to clear the infection but is unable to," Sauer said. "And the longer the chronic infection goes on, the more damage there will be to tissue at the site of the infection. That's because the immune response often involves the release of toxic compounds that have no effect on biofilms but can damage the surrounding tissues."

Sauer's research is driven by several key questions, she said: "Can we outsmart the biofilms? Can we interfere with biofilm antibiotic resistance? Can we figure out how to prevent biofilms from forming and becoming resistant to antibiotics?"

Some recent findings seem to offer a resounding yes to these questions. In addition to regulators required for biofilm formation, Sauer and her team recently identified a regulator that is only expressed in biofilms and which seems to be responsible for regulating antibiotic resistance.

"We can modulate the resistance of biofilms now by over-expressing or inactivating this particular regulator," she said. "We hope to use these discoveries to treat infections by interfering with the way biofilms are growing and by reverting biofilms back to a state where they're more easily treatable."

Sauer's research is supported by the National Institutes of Health, which has awarded her more than $3 million, and the Army Research Office. Her two major NIH-funded projects, which began this fall, look at different aspects of biofilms. One focuses on antibiotic resistance and the mechanism behind it; the other centers on dispersion, the process by which a biofilm breaks down into individual bacterial cells.

"Dispersed cells -- or planktonic cells -- are way easier to treat," Sauer said. "We want to understand how bacteria decide when to leave the biofilm. We can use that as a way to treat chronic infections."

Story Source:

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

Journal Reference:

1. Olga E. Petrova, Karin Sauer. **A Novel Signaling Network Essential for Regulating Pseudomonas aeruginosa Biofilm Development**. *PLoS Pathogens*, 2009; 5 (11): e1000668 DOI: 10.1371/journal.ppat.1000668

http://www.sciencedaily.com/releases/2009/12/091218151327.htm

A Facial Expression Is Worth a Thousand Words

Interpreting this facial expression correctly (as a "baffled" expression) is very difficult based on this photo alone. When showing the corresponding video sequence, however, recognition becomes easy, which underlines the importance of the temporal dimension for effective communication. (Credit: Christian Wallraven / Max Planck Institute for Biological Cybernetics)

ScienceDaily (Dec. 31, 2009) — Communication is a central aspect of everyday life, a fact that is reflected in the wide variety of ways that people exchange information, not only with words, but also using their face and body. Scientists from the Max Planck Institute for Biological Cybernetics in Tübingen, Germany, found out that we are able to recognize facial expressions in motion -- for example, in a movie -- far better than in a static photograph. The video sequence needs to be at least as long as one tenth of a second to gain this dynamic advantage.

A facial expression can state a lot. A nod indicates understanding, a frown may say: "Please explain that again!" Scientists from the Max Planck Institute for Biological Cybernetics discovered that we are able to classify an expression much better when it moves naturally rather than when it is "frozen" in a photograph. In order to gain the advantage of dynamic information, we need to see the expression moving for at least 100 milliseconds. If the video sequence is shorter, our brain is less capable of interpreting the facial motion. Some expressions rely on changes in head orientation, for example, a nod or a shake of the head, others on the complex deformation of facial parts, such as wrinkling our nose to signalize disgust or a frown.

In order to examine to what extent we are able to recognize -- based on facial expressions -- the mood of a person with whom we are interacting, the scientists showed participants pictures of humans with various different expressions. Among them were simple, emotional expressions, such as "happy" and "sad," but also more complex ones such as agreement, confusion, or surprise, which are usually used to emphasize or modify statements in a conversation. In order to investigate whether these expressions are recognized more easily in motion or in static pictures, a short video sequence was shown to the participants. The video recordings began at a neutral expression, showed an emotion, and ended at the last frame before the face started to head back to a neutral expression. The frame used in the static conditions was the last, so-

called 'peak' frame of each dynamic sequence. The participants were then asked to identify the expressions based on the shown sequence or single frame.

In further experiments, the video sequences were converted to a series of photographs that was shown to the participants. Nevertheless, the expressions were still recognized more accurately in the video sequence. This showed that the dynamic advantage is not due to the presence of multiple images, but that some form of dynamic information is being used. In order to figure the degree to which facial expression recognition relies on natural movement, the frames were presented as a movie, but in a random order. Comparisons of the performance in this scrambled condition to the original video sequence shows that the recognition rates were still higher in the original than in the scrambled version.

The chronological direction is of importance as well. If the video sequences are temporally reversed, they are again identified less accurately. Finally, the more temporal information we receive, the better we are able to recognize expressions -- at least up to 100 milliseconds. The results show that neither pictures, nor motion alone are of importance, but that we need a combination of the correct temporal sequence and the correct facial motion to reliably interpret facial expressions.

"Facial expressions, like gestures and body motion, are a dynamic phenomenon and need to be investigated with the help of video sequences in order to get a better understanding of the dynamic information that is being processed," says Dr. Christian Wallraven, co-author of the study. "Our results also have implications for the area of computer animation, since its goal is to create artificial avatars and facial animations that are able to communicate realistically and believably," says the physicist and perception scientist.

For more information, see: http://www.kyb.mpg.de/projects.html?user=walli

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Story Source:

Adapted from materials provided by Max Planck Institute for Biological Cybernetics, via AlphaGalileo.

Journal Reference:

1. Cunningham, D. W. & Wallraven, C. **Dynamic information for the recognition of conversational expressions**. *Journal of Vision*, 9 (13):7, 1-17 DOI: 10.1167/9.13.7

http://www.sciencedaily.com/releases/2009/12/091223215119.htm

Lithium-Air Batteries Could Displace Gasoline in Future Cars

Argonne researcher Lynn Trahey loads a coin-sized cell on a testing unit used to evaluate electrochemical cycling performance in batteries. (Credit: Photo by Wes Agresta / Courtesy of Argonne National Laboratory)

ScienceDaily (Dec. 31, 2009) — In excess of seven million barrels of gasoline are consumed by vehicles in the United States every day. As scientists race to find environmentally sound solutions to fuel the world's ever-growing transportation needs, battery researchers are exploring the promise of lithium-air battery technology.

Li-air batteries use a catalytic air cathode that supplies oxygen, an electrolyte and a lithium anode. The technology has the potential to store almost as much energy as a tank of gasoline, and will have a capacity for energy storage that is five to 10 times greater than that of Li-ion batteries, a bridge technology. That potential, however, will not be realized until critical scientific challenges have been solved.

Researchers at the U. S. Department of Energy's (DOE) Argonne National Laboratory are leveraging their broad and deep understanding of safe, high-energy and long-life Li-ion battery development to leap the high hurdles required for the development of commercially viable Li-air batteries.

"The obstacles to Li-air batteries becoming a viable technology are formidable and will require innovations in materials science, chemistry and engineering," said Argonne Director Eric Isaacs. "We have a history of taking on scientific challenges and overcoming them. Argonne is committed to developing Li-air battery technologies. In fact, we've made it a 'grand research challenge' at the laboratory."

Argonne has researched a variety of battery technologies during the last four decades, and in the process has built a deep well of scientific and engineering expertise. As a result, the lab has become a leader in the development of new materials for advanced batteries, including Li-ion batteries.

"This is not a near-term technology," added Jeff Chamberlain, Senior Account Manager in Argonne's Office of Technology Transfer. "It is going to take time and collaborations across several scientific disciplines to address the four main challenges of this battery development effort: safety, cost, life and performance."

To accomplish this task, Argonne's research will continue to span basic, applied and theoretical sciences and will leverage the lab's world-class research facilities -- the Advanced Photon Source, the Center for Nanoscale Materials and Argonne's Leadership Computing Facility.

While the potential of Li-air batteries is great, the research to get there will take time and involve working with industry, which will eventually adopt the technology for commercial application.

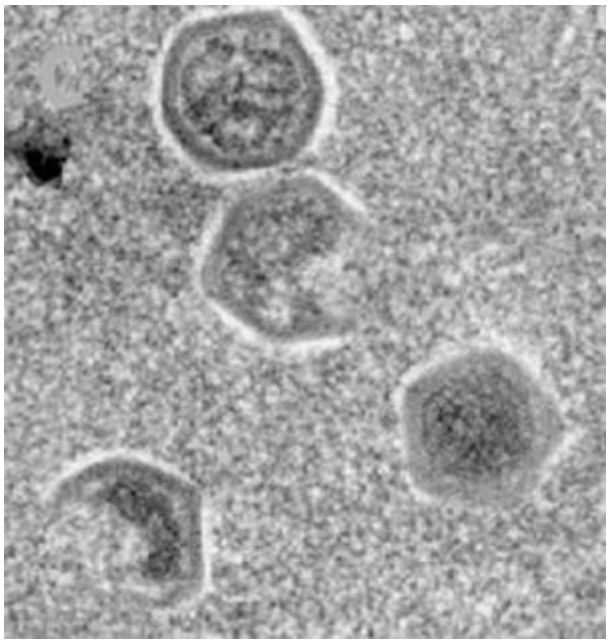
Argonne has worked with several industrial partners on the commercialization of Li-ion batteries and battery materials, including companies such as EnerDel, Envia, BASF and Toda America. The lab is working with the Commonwealth of Kentucky to develop the Kentucky-Argonne National Battery Manufacturing Center, which will support the development of a viable U.S. battery manufacturing industry. And more recently, DOE awarded the lab $8.8 million to build out and outfit three battery research facilities that will be used for battery prototyping, materials production scale-up and post-test analysis.

Story Source:

Adapted from materials provided by DOE/Argonne National Laboratory.

http://www.sciencedaily.com/releases/2009/12/091230024401.htm

Marseillevirus -- A New Member of the Giant Viruses



Marseillevirus at different stages of its formation in an amoeba. (Credit: Copyright Raoult / URMITE)

ScienceDaily (Dec. 31, 2009) — After Mimivirus, Mamavirus and the virophage, the group of giant viruses now has a new member called Marseillevirus.

Discovered in an amoeba by the team led by Didier Raoult at the Unité de Recherche sur les Maladies Infectieuses et Tropicales Emergentes research group (CNRS/Université Aix-Marseille 2), a description of this new virus was published online in the *Proceedings of the National Academy of Sciences (PNAS).* These findings suggest the exchange of genes in amoebae that may lead to the constitution of different gene repertoires that could be a source of new pathogens.

Amoebae are single-cell, eukaryote (possessing a nucleus) living organisms, some of which are human or animal parasites and may cause a variety of pathologies. Most amoebae live in water, damp soils or mosses. They are mobile and capable of ingesting a wide variety of different organisms (for example, viruses or bacteria with extraordinarily broadly ranging sizes and lifestyles). Thus amoebae provide a site for numerous exchanges of genetic material arising from the many organisms that "colonize" them.

The team led by Didier Raoult at URMITE (CNRS/Université Aix-Marseille 2)[1] has recently discovered, in an amoeba, a member of a new family of giant viruses, which it has called the Marseillevirus, smaller than Mimivirus, which is the largest giant virus known at present.

With a chimeric genome (containing both DNA and RNA) of 368,000 base pairs, Marseillevirus is indeed the fifth largest viral genome to be sequenced. It has an icosahedral shape and a diameter of about 250 nanometers (or 250 millionths of a millimeter).

In addition, the researchers discovered that it contained genes from markedly differing sources, i.e. of bacterial, viral or eukaryote origin, or arising from Archae.[2] The genome of Marseillevirus, a mosaic of genes from very different organisms, thus demonstrates the exchange of genes between the organisms that "colonize" amoebae.

These studies have also revealed the role of amoebae, and more generally phagocytic protists (or single-cell eukaryotes) that feed on microbes in the environment, in the constitution of new gene "repertoires"

which may be capable of generating new agents that will be pathogenic to multicellular organisms such as animals, plants or humans.

Notes:

1. URMITE: Unité de Recherche sur les Maladies Infectieuses et Tropicales Emergentes (CNRS/Université Aix-Marseille 2)

2. The archaea are a major group of single-cell microorganisms which, like bacteria, have neither a nucleus nor intracellular organelles.

Story Source:

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

Journal Reference:

1. Boyer M., Raoult D. et al. **Giant Marseillevirus highlights the role of amoebae as a melting pot in emergence of chimeric microorganisms**. *Proceedings of the National Academy of Sciences*, 2009; 106 (51): 21848 DOI: 10.1073/pnas.0911354106

http://www.sciencedaily.com/releases/2009/12/091230113210.htm

No Rise of Airborne Fraction of Carbon Dioxide in Past 160 Years, New Research Finds

New research finds that the airborne fraction of carbon dioxide has not increased either during the past 150 years or during the most recent five decades, contrary to some recent studies. (Credit: iStockphoto)

ScienceDaily (Dec. 31, 2009) — Most of the carbon dioxide emitted by human activity does not remain in the atmosphere, but is instead absorbed by the oceans and terrestrial ecosystems. In fact, only about 45 percent of emitted carbon dioxide stays in the atmosphere.

However, some studies have suggested that the ability of oceans and plants to absorb carbon dioxide recently may have begun to decline and that the airborne fraction of anthropogenic carbon dioxide emissions is therefore beginning to increase.

Many climate models also assume that the airborne fraction will increase. Because understanding of the airborne fraction of carbon dioxide is important for predicting future climate change, it is essential to have accurate knowledge of whether that fraction is changing or will change as emissions increase.

To assess whether the airborne fraction is indeed increasing, Wolfgang Knorr of the Department of Earth Sciences at the University of Bristol reanalyzed available atmospheric carbon dioxide and emissions data since 1850 and considers the uncertainties in the data.

In contradiction to some recent studies, he finds that the airborne fraction of carbon dioxide has not increased either during the past 150 years or during the most recent five decades.

The research is published in *Geophysical Research Letters.*

Story Source:

Adapted from materials provided by American Geophysical Union, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Knorr, W. **Is the airborne fraction of anthropogenic CO_2 emissions increasing?** *Geophysical Research Letters*, 2009; 36 (21): L21710 DOI: 10.1029/2009GL040613

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Body's Own Veins Provide Superior Material for Aortic Grafts

A vascular surgical technique pioneered by Dr. G. Patrick Clagett that replaces infected aortic grafts with the body's own veins has proved more durable and less prone to new infection than procedures using synthetic and cadaver grafts. (Credit: Image courtesy of UT Southwestern Medical Center)

ScienceDaily (Dec. 31, 2009) — A vascular surgical technique pioneered at UT Southwestern Medical Center and designed to replace infected aortic grafts with the body's own veins has proved more durable and less prone to new infection than similar procedures using synthetic and cadaver grafts.

Aortic graft infections are one of the most serious complications in patients undergoing aortic grafting procedures for peripheral arterial disease (PAD) and aortic aneurysms. PAD reduces blood circulation in the pelvis and lower extremities, and aortic aneurysms result in a weakening of the aortic wall that can cause lethal rupture of the aorta, the largest artery in the body. Patients with PAD and aortic aneurysms often require surgery, and aortic grafting procedures using synthetic grafts are typically the first line of treatment.

For patients with PAD, the procedure restores blood circulation to the legs, and for patients with aneurysm, it replaces the weakened aortic wall and prevents rupture. Synthetic grafts made of Dacron, a polyester material, are placed in the aorta and femoral arteries in the abdomen and groin, which feed blood to the legs. But in about 1 percent to 2 percent of these patients, the grafts become infected -- a complication that causes amputation and death if left untreated.

Dr. G. Patrick Clagett, chief of vascular surgery at UT Southwestern, pioneered a technique called the neo-aortoiliac system (NAIS) that repairs these aortic-graft infections. The procedure involves removing the infected graft and replacing it with sections of femoral-popliteal veins harvested from the patient's thighs, rather than another synthetic graft or vessels harvested from human cadavers.

In a recent study published in the *Journal of Vascular Surgery*, Dr. Clagett and his team reported on 187 patients at UT Southwestern treated for aortic graft infections who underwent the NAIS procedure from 1990 to 2006. It is the largest group of such patients ever studied, and the researchers found that the incidence of re-infection was lower and the procedure resulted in superior durability with much lower long-term amputation rates when compared with other operations to treat this condition.

"This operation has gained favor worldwide in the treatment of this devastating condition," said Dr. Clagett. "Since performing the first operation here in the 1990s, we have accumulated data over the years and have found this procedure to be far superior in overall patient outcomes."

Simply replacing the old Dacron graft with a new synthetic graft can result in devastating infection of the new one, said Dr. Clagett, who is immediate past president of the Society for Vascular Surgery. His team and others also have found that the new synthetic or cadaver grafts tend to develop clots and new blockages.

"When we use the patient's own tissue to construct a new graft, it provides an advantage because they are less likely to form clots within the graft and less likely to develop new blockages," Dr. Clagett said. "Patients also need fewer subsequent procedures, a common problem with the other treatments for this complication."

He added that patients who have the NAIS procedure don't need to be on lifelong antibiotic therapy. Because the aortic reconstruction is fashioned with the patient's own tissue, there is no foreign material that is prone to re-infection.

Other UT Southwestern researchers who contributed to the study included Dr. J. Gregory Modrall, associate professor of surgery; Dr. R. James Valentine, professor of surgery; and Jennie Hocking, assistant professor of physician assistant studies. Dr. Ahsan Ali, a former vascular surgery fellow at UT Southwestern now at the University of Arkansas, was the lead author of the study.

Story Source:

Adapted from materials provided by UT Southwestern Medical Center.

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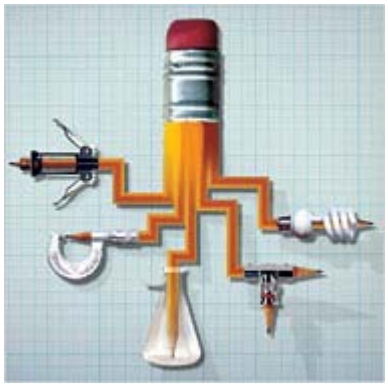
Making College 'Relevant'
By KATE ZERNIKE



THOMAS COLLEGE, a liberal arts school in Maine, advertises itself as Home of the Guaranteed Job! Students who can't find work in their fields within six months of graduation can come back to take classes free, or have the college pay their student loans for a year.

The University of Louisiana, Lafayette, is eliminating its philosophy major, while Michigan State University is doing away with American studies and classics, after years of declining enrollments in those majors.

And in a class called "The English Major in the Workplace," at the University of Texas, Austin, students read "Death of a Salesman" but also learn to network, write a résumé and come off well in an interview.

Even before they arrive on campus, students — and their parents — are increasingly focused on what comes after college. What's the return on investment, especially as the cost of that investment keeps rising? How will that major translate into a job?

The pressure on institutions to answer those questions is prompting changes from the admissions office to the career center. But even as they rush to prove their relevance, colleges and universities worry that students are specializing too early, that they are so focused on picking the perfect major that they don't allow time for self-discovery, much less late blooming.

"The phrase drives me crazy — 'What are you going to do with your degree?' — but I see increasing concerns about that," says Katharine Brooks, director of the liberal arts career center at the University of Texas, Austin, and author of "You Majored in What? Mapping Your Path From Chaos to Career." "Particularly as money gets tighter, people are going to demand more accountability from majors and departments."

Consider the change captured in the annual survey by the University of California, Los Angeles, of more than 400,000 incoming freshmen. In 1971, 37 percent responded that it was essential or very important to be "very well-off financially," while 73 percent said the same about "developing a meaningful philosophy of life." In 2009, the values were nearly reversed: 78 percent identified wealth as a goal, while 48 percent were after a meaningful philosophy.

The shift in attitudes is reflected in a shifting curriculum. Nationally, business has been the most popular major for the last 15 years. Campuses also report a boom in public health fields, and many institutions are building up environmental science and just about anything prefixed with "bio." Reflecting the new economic and global realities, they are adding or expanding majors in Chinese and Arabic. The University of Michigan has seen a 38 percent increase in students enrolling in Asian language courses since 2002, while French has dropped by 5 percent.

Of course, universities have always adjusted curriculum to reflect the changing world; Kim Wilcox, the provost and vice president for academic affairs at Michigan State, notes that universities, his included, used to offer majors in elocution and animal husbandry. In a major re-examination of its curriculum, Michigan State has added a dozen or so new programs, including degrees in global studies and, in response to a growing industry in the state, film studies. At the same time, it is abandoning underperformers like classical studies: in the last four years, only 13 students have declared it their major.

Dropping a classics or philosophy major might have been unthinkable a generation ago, when knowledge of the great thinkers was a cornerstone of a solid education. But with budgets tight, such programs have come to seem like a luxury— or maybe an expensive antique — in some quarters.

When Louisiana's regents voted to eliminate the philosophy major last spring, they agreed with faculty members that the subject is "a traditional core program of a broad-based liberal arts and science institution." But they noted that, on average, 3.4 students had graduated as philosophy majors in the previous five years; in 2008, there were none. "One cannot help but recognize that philosophy as an essential undergraduate program has lost some credence among students," the board concluded.

In one recent survey, two-thirds of public institutions said they were responding to budget cuts with extensive reviews of their programs. But Dr. Wilcox says curriculum changes at Michigan State have just as much to do with what students, and the economy, are demanding. "We could have simply reduced the campus operating budget by X percent," he says, "but we wouldn't have positioned ourselves any differently for the future."

In Michigan, where the recession hit early and hard, universities are particularly focused on being relevant to the job market. "There's been this drumbeat that Michigan has got to diversify its economy," says Mary Sue Coleman, the president of the University of Michigan.

Dr. Coleman says she had an "aha" moment five years ago, when the director of admissions was describing the incoming class and noted that 10 percent — some 600 students — had started a business in high school. The university has responded with about 100 entrepreneurship courses across the curriculum, including "Financing Research Commercialization" and "Engineering Social Venture Creation," for students interested in creating businesses that not only do well financially but also do society good. Next year, the university will begin offering a master's to students who commit to starting a high-tech company.

At the same time, Dr. Coleman is wary of training students for just one thing — "creating them to do some little widget," as she says. Michigan has begun a speaker series featuring alumni or other successful entrepreneurs who come in to talk about how their careers benefited from what Dr. Coleman calls "core knowledge."

"We believe that we do our best for students when we give them tools to be analytical, to be able to gather information and to determine the validity of that information themselves, particularly in this world where people don't filter for you anymore," Dr. Coleman says. "We want to teach them how to make an argument, how to defend an argument, to make a choice." These are the skills that liberal arts colleges in particular have prided themselves on teaching. But these colleges also say they have the hardest time explaining the link between what they teach and the kind of job and salary a student can expect on the other end.

"There's no immediate impact, that's the problem," says John J. Neuhauser, the president of St. Michael's College, a liberal arts school in Vermont. "The humanities tend to educate people much farther out. They're looking for an impact that lasts over decades, not just when you're 22."

When prospective students and their parents visit, he says, they ask about placement rates, internships and alumni involvement in job placement. These are questions, he says, that he never heard 10 years ago.

St. Michael's, like other colleges, has adapted its curriculum to reflect demand. The college had to create new sections of chemistry labs and calculus on the spot during summer registration, and it raised the cap on the number of students in a biology lab. "I'd say, given the vagaries of the business cycle, people are looking for things that they know will always be needed — accountants, scientists, mathematicians," says Jeffrey A. Trumbower, dean of the college. "Those also happen to be some of the most challenging majors academically, so we'll see how these trends hold up."

Still, Dr. Neuhauser finds the careerism troubling. "I think people change a great deal between 18 and 22," he says. "The intimate environment small liberal arts colleges provide is a great place to grow up. But there's no question that smacks of some measure of elitism now."

There's evidence, though, that employers also don't want students specializing too soon. The Association of American Colleges and Universities recently asked employers who hire at least 25 percent of their workforce from two- or four-year colleges what they want institutions to teach. The answers did not suggest a narrow focus. Instead, 89 percent said they wanted more emphasis on "the ability to effectively communicate orally and in writing," 81 percent asked for better "critical thinking and analytical reasoning skills" and 70 percent were looking for "the ability to innovate and be creative."

"It's not about what you should major in, but that no matter what you major in, you need good writing skills and good speaking skills," says Debra Humphreys, a vice president at the association. The organization has conducted focus groups with employers before and heard the same thing. With the recession, she says, they weren't sure the findings would hold. "But it's even more intense. Companies are demanding more of employees. They really want them to have a broad set of skills." She adds that getting employer feedback is the association service that "college leaders find the most valuable, because they can answer the question when parents ask, 'Is this going to help in getting a job?' "

Career advisers say that colleges and universities need to do a better job helping students understand the connection between a degree and a job. At some institutions, this means career officers are heading into the classroom.Last fall at the University of Maryland, Baltimore County, the career office began integrating workplace lessons into capstone research seminars for humanities majors. In one of three classes taught by Anne Scholl-Fiedler, the director, she asks students to develop a 30-second commercial on their "personal brand." "When somebody asks, 'How are you going to use that English degree?' you need to be able to clearly articulate what you are able to do," she says. "If you don't know, employers probably won't either."

At the University of Texas, Ms. Brooks says, many parents drop their children off freshman year asking, "How can my child transfer to the business school?" She tries to establish the value of the liberal arts with a series of courses called "The Major in the Workplace." Students draw what she calls a "major map," an inventory of things they have learned to do around their major. Using literature — "The Great Gatsby," perhaps, or "Death of a Salesman" — she gets students to think about how the themes might apply to a workplace, then has them read Harvard Business Review case studies. The goal, she says, is to get students to think about how an English major (or a psychology or history major) might view the world differently, and why an employer might value that.

"There's this linear notion that what you major in equals your career," Ms. Brooks says. "I'm sure it works for some majors. If you want to be an electrical engineer, that major looks pretty darn good.

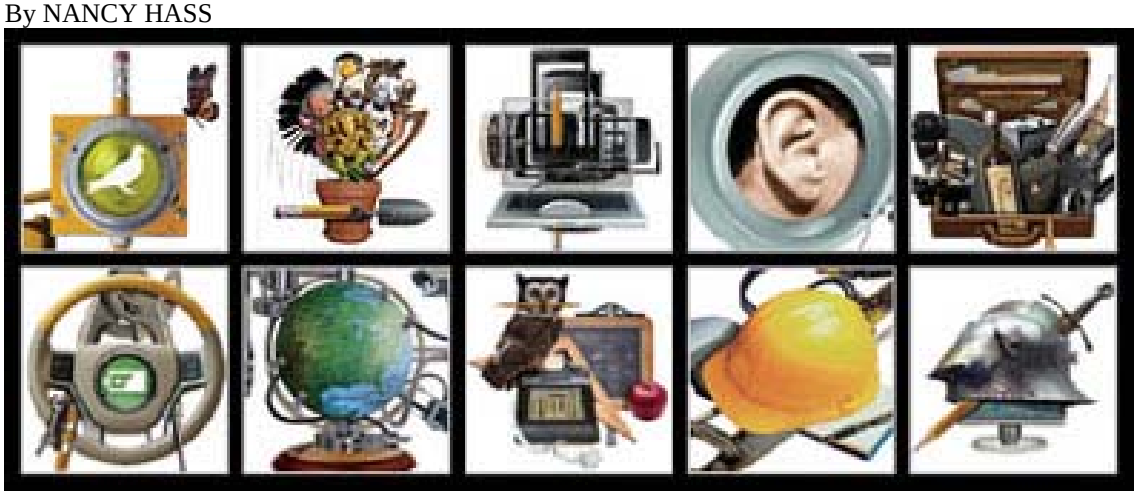
"The truth is," she says, "students think too much about majors. But the major isn't nearly as important as the toolbox of skills you come out with and the experiences you have."

Kate Zernike is a national reporter for The Times. Rachel Aviv contributed reporting.

http://www.nytimes.com/2010/01/03/education/edlife/03careerism-t.html?ref=edlife

Ten Master's of the New Universe

By NANCY HASS



ONCE upon a time there were largely two kinds of master's degrees: one was a way station to a doctorate and the other overqualified you to be underpaid as a social worker or helped you get a salary bump as a public school teacher.

And then came the quiet revolution. Spawned by a realization in university circles that master's programs could be wildly profitable — especially within low-cost departments of continuing education — and a growing sense that in a shifting employment market the best jobs would require specialized training, such degrees have exploded. Nearly twice as many master's degrees were awarded in 2008 than in 1980.

These programs provide a field guide to the zeitgeist. There are degrees to fit every niche and new twist in the culture, whether homeland security, social networking, hybrid cars or narrative medicine. The following pages highlight just a handful of them. While there is an argument to be made — and plenty of intellectual heavyweights have made it — that the tight focus on highly specialized career training dilutes the mission of the academy, many say the trend is merely a recognition of modern realities. Colleges are strapped for cash, and master's programs are a low-cost way to get it: they don't require undergraduate services like dorms or the high student-teacher ratio of doctoral programs. Master's candidates, unlike Ph.D.'s, almost always pay full freight, often $30,000 or more a year.

Students, both recent college graduates and career changers, seem to believe that setting their sights on a particular industry and getting the right credential will help them stand out from the throng of applicants — and command better pay. On average, a master's degree results in 20 percent more pay than does a bachelor's, according to the Bureau of Labor Statistics.

"It's amazing to see students thronging to these new programs, many of which are extremely unconventional," says Maria T. Allison, a vice provost and dean at Arizona State, which has created 25 new master's since 2005. "A lot of them feel this is the time to know what you want and to find the right place to get it."

http://www.nytimes.com/2010/01/03/education/edlife/03intro-t.html

Learning to Listen
By GINA KOLATA

DR. RITA CHARON, professor of clinical medicine at the College of Physicians and Surgeons of Columbia University, is well aware of the power of storytelling. She has a Ph.D. in English — training that changed her medical practice.

Through literature, she learned how stories are built and told, and translated that to listening to, and better understanding, patients. She could let them tell their own stories without interruptions and see how people described their symptoms as part of the larger story of their life.

Dr. Charon was not the first to connect literature and medicine, but she has become the leading advocate of the emerging discipline known as narrative medicine, which aims to treat the whole person, not just the illness. The British Medical Journal and other professional publications have run articles on the approach, and medical schools have added writing seminars and reading groups.

Dr. Charon had spent several years teaching workshops on developing “narrative competence,” but she feared participants weren’t prepared enough to return to their schools to start programs. There was no comprehensive training in how to practice it.

She proposed something new to Columbia: a Master of Science in narrative medicine. The one-year program — two if pursued part time — began this fall at its School of Continuing Education.

“We hoped to get 8 to 10 people willing to pay the $50,000,” she says. The program ended up with 28 students, most of them midcareer professionals — doctors, nurses, social workers, lawyers, literary scholars. Others included recent college graduates headed toward medical school.

Courses this semester focus on philosophy, literary theory, psychoanalytic theory, autobiography and the close reading of literature involving experiences of illness.

Dr. Charon says there’s no obvious job market for people with a master’s degree in narrative medicine. But with new programs starting all the time, she says, “our graduates will be particularly well prepared to join such efforts.”

Some who enrolled, like Dr. Susan Ball, say they hope to become better doctors. Dr. Ball, associate professor of medicine at New York Hospital Cornell Medical Center, says she also would like to start a narrative medicine program at Cornell for resident physicians and older doctors.

Karen Schmidt is not sure what she will do with the new degree. A deputy director at Columbia’s Earth Institute, she works on public health projects in Africa. Ms. Schmidt is a part-time student and so, she says, “I have a couple of years to work it out.”

http://www.nytimes.com/2010/01/03/education/edlife/03narrative.html?ref=edlife

Safety First
By CECILIA CAPUZZI SIMON

BEFORE 9/11, the term “homeland security” didn’t exist. Neither did the academic discipline. The events of that day changed that. Security experts — like Vincent Henry, a police officer turned Fulbright scholar who heads the Homeland Security Management Institute at Long Island University — recognized that an entirely new, specialized industry would have to be formed, and that managers and executives would have to be schooled in the ways of domestic and international terrorism to fill a security void.

Eight years later, homeland security is still an emergent field, says Jim Ramsay, coordinator of the homeland security program at Embry-Riddle Aeronautical University in Daytona Beach, Fla. Mr. Ramsay describes homeland security as a “meta-discipline, much like medicine, within which there are tons of different functions and specialties — from the guy who wears Kevlar and walks the Mexican border to the cerebral policy analyst” who sets the national security agenda. Education and training, he says, are essential in building this workforce.

But, he notes, “Our capacity to produce homeland security professionals is below our ability to absorb them in the marketplace.”

By 2012, nearly a quarter of all federal jobs will be related to homeland security, according to the nonprofit Partnership for Public Service, which promotes government service to students in college and graduate school. The Department of Homeland Security itself employs 208,000 people. Looking at the federal job Web site (usajobs.opm.gov/homeland.asp), you get the picture; a recent search pulled up more than 1,000 homeland security openings. Some are surprising: a call for veterinarians to work as food safety inspectors at the Department of Agriculture (salary up to $135,000). Some are not: upper management at FEMA, overseeing national disaster-relief projects (up to $153,000).

To meet the demand, many colleges and universities have created master’s degrees in the field. Expect to study domestic and international terrorism, emergency management, the intelligence-system structure and homeland security law and policy. Long Island University’s master’s program is heavy on theory and solely online because Mr. Henry wants to instill a “broad representation of the national view.” Students include the sheriff of a rural town in New Mexico, military personnel deployed in Iraq and Afghanistan, business executives from around the country, as well as police and other first responders from the New York City area.

At Embry-Riddle, Mr. Ramsay experimented by placing 10 students in internships in 2006 because he was unsure if “the field was ready to absorb students with a homeland security degree.” The practicums, at the F.B.I., the Department of Homeland Security, the Transportation Administration and elsewhere, were “wildly successful” and are now required.

With so much need, colleges and universities have hastily assembled programs, and educators caution of a buyer-beware marketplace. Three years ago, there were 30 homeland security programs. Now there are about 320 (about 140 are certificate programs), says Stanley Supinski of the Naval Postgraduate School in Monterey, Calif. His institution offers a hybrid online/on-ground master’s degree for mid- and high-level executives.

Mr. Supinski was key in setting up the Homeland Security and Defense Education Consortium Association, which has developed a curriculum endorsed by the government that is being offered free to schools in the hopes of standardizing what is taught. By spring, the association, which has 200 member schools, expects to be approved as an accrediting organization.

Not all security experts support the one-size-fits-all approach of a homeland security degree. Daniel J. Kaniewski, deputy director of the Homeland Security Policy Institute at George Washington University, points out that degrees in any number of disciplines — emergency management, law enforcement,

engineering, even zoonotics (the study of the transmission of disease from animals to humans) — can lead to jobs in the field.

“Having been on the other side,” Mr. Kaniewski says, “when I look at a résumé the first thing I look for is not the master’s in homeland security but has the applicant demonstrated expertise in the area I need?” Mr. Kaniewski himself came up through the ranks, from firefighter to special assistant to President George W. Bush for homeland security (with an M.A. in national security and Ph.D. in policy and administration in between). “You don’t have to look for schools with the best homeland security degree,” he says. “It’s a marketing strategy for universities.”

Mr. Henry begs to differ. He believes employers value the extra focus on homeland security. “It credentializes you in a way that the marketplace understands.”

Tip: Fluency in a second language can increase pay (the Secret Service adds a recruiting bonus of 25 percent of salary for it). The Department of Homeland Security lists academic programs by state at careervoyages.gov/homelandsecurity-main.cfm.

http://www.nytimes.com/2010/01/03/education/edlife/03homeland.html?ref=edlife

Wanted: 'Cyber Ninjas'

By CHRISTOPHER DREW

FOR a regional competition last spring, eight students from California State Polytechnic University, Pomona, spent six months of Saturdays practicing how to defend a typical business computer network from attacks. Then, over two grueling days, they outscored teams from five other schools at blocking worms and other efforts to disrupt their e-mail and Internet systems.

For the six seniors in the group, all in computer information systems, the victory was even sweeter. Boeing, the giant aerospace and military company, offered them jobs.

Boeing's decision to snap up all the graduates on the team shows how urgent the demand for computer-security experts has become, and helps explain why colleges are scrambling to add courses and specialized degrees in the once-exotic field.

In fact, as attacks on vital computer systems proliferate, surveys show a serious shortage of talent to combat them. Banks, military contractors and software companies, along with federal agencies, are looking for "cyber ninjas" to fend off a sophisticated array of hackers, from criminals stealing credit card numbers to potential military adversaries.

"There is a huge demand, and a lot more schools have created programs," says Nasir Memon, a professor at the Polytechnic Institute of New York University in Brooklyn. "But to be honest, we're still not producing enough students."

Mr. Memon's school created a master's degree in cybersecurity last fall. So did Indiana University, whose security degree is in "informatics," an academic field in which students find new uses for information technology. Starting in the fall, Georgia Tech will offer a master's degree in information security online; the program is aimed at computer professionals who want to learn to deal with computer threats. N.Y.U. Poly, whose master's program is also online, prefers students with bachelor's degrees in computers, math, science or engineering. But it will consider career changers who will take basic computer classes. Carnegie Mellon in Pittsburgh; Purdue in West Lafayette, Ind.; and George Mason in Fairfax, Va., are among other universities with master's programs in cybersecurity.

Jeffrey M. Henbest, one of the Cal Poly students hired by Boeing, says cybersecurity is seen at his school "as the most technically demanding field, kind of like the fighter pilot of the information technology industry."

While perhaps just a few thousand jobs are available now, government officials involved in cybersecurity expect the number to grow rapidly. (Professor Memon says pay starts at $50,000 with a bachelor's, $60,000 to $80,000 with a master's.)

One concern, says Dale W. Meyerrose, the vice president for cyberprograms at the Harris Corporation, a military contractor, is the shortage of young Americans interested in pursuing careers involving math and science.

But Barbara G. Fast, Boeing's vice president for cybersolutions, says that young people's familiarity with posting and chatting, and the fascination with virtual gaming, could make cybersecurity seem like fun. In puzzling out security problems, she says, it can be hard to imagine how far a computer network extends and who the intruders might be.

"It's a real, three-dimensional, visualization challenge that we have."

http://www.nytimes.com/2010/01/03/education/edlife/03cybersecurity.html?ref=edlife

A Step Beyond Anthropology

By MIREYA NAVARRO

MOST people see sustainability as pertaining to the physical environment, and the need to preserve it for coming generations. But in academe, sustainability can have as much to do with social science as science science.

Goucher College, the liberal arts college in Baltimore, is extending the concept: to preserving the traditional values, as well as the arts, dress, customs and cuisines, of communities threatened by globalization and modernization, whether inner-city neighborhoods or third-world villages. Goucher calls it cultural sustainability, and is offering a Master of Arts.

“Our program is about social justice and sustaining communities and in that way sustaining the environment,” says Deborah A. Cebula, the director of professional graduate programs and lifelong learning.

Though students are required to attend Goucher for two one-week residencies, most of the curriculum, drawn from ethnography, anthropology and social entrepreneurship, is online. Courses cover oral history documentation, cultural policy, management of events like festivals, use of exhibits and new media, advocacy, grant writing and fund-raising.

Many students come already “deeply embedded” in the communities where they wish to work, Ms. Cebula says. The first class ranges from new graduates to midcareer professionals hoping to become teachers, community organizers or arts workers. Ms. Cebula imagines other job opportunities: with a museum trying to reach a new constituency, say, or a business marketing local crafts.

The program begins this semester. Students will work on projects in both rural and urban areas in the United States and overseas: in Kenya, collecting stories from children to help preserve native languages, for example; in Namibia, getting artists from disparate backgrounds to work together on programs.

About 200 sustainability programs exist at colleges and universities around the country, according to Paul Rowland, the executive director for the Association for the Advancement of Sustainability in Higher Education. Most have sprung up in the last five years, usually in grad schools and often with a narrow focus, like design or agriculture. The Goucher model, Mr. Rowland says, has an anthropological slant “different from what I’m seeing anywhere else.”

http://www.nytimes.com/2010/01/03/education/edlife/03sustain.html?ref=edlife

Sustainability Comes of Age
By HENRY FOUNTAIN

WHEN Andrew Pattison was looking to pursue a graduate degree in sustainability, he drew on his post-college experience working as a conservation biologist in upstate New York. Butterflies were his thing, and he produced numerous recommendations about what should be done to protect them. “I found that quote-unquote important people who were decision makers would read the reports I filed and then not follow them,” Mr. Pattison says.

Those frustrations led him in a different direction. “I knew I wanted to study the way decisions were made on environmental policy,” he says. He also knew where many of the important decisions were made: in cities. With energy and climate policy, he says, “the problem is global, but all politics are local.”

Mr. Pattison, 32, is now a doctoral student in the sustainable urban infrastructure program at the University of Colorado, Denver. It’s one of a growing number of graduate programs in sustainability where the issues affecting cities are front and center.

“We’ve seen a growth in programs that are more focused, either on a particular geographic area or on a discipline,” says Paul Rowland, executive director of the Association for the Advancement of Sustainability in Higher Education. The organization’s Web site, aashe.org, lists nine universities offering doctoral or master’s degrees in urban sustainability studies, and many more programs include the urban environment as a central part of their studies.

In some ways, the shift reflects a coming-of-age of sustainability as a field, away from the back-to-nature ethos of earlier efforts and toward a realization that there are grittier problems — and solutions. “The environmental movement has expanded to understand that people are at the center of these issues,” Mr. Pattison says. “It’s not just save the trees for the trees’ sake.”

But beyond that, sustainability programs are also beginning to better reflect the demographics of their students.

“Too much of environmental planning and policy focuses on wilderness and rural areas,” says Julian Agyeman, professor and chairman of the department of urban and environmental policy and planning at Tufts University in Medford, Mass. “Yet most students’ lives are lived in the urban environment.”

Mr. Agyeman’s department is one of the pioneers of urban environmental studies — it was founded in 1973 by Herman Field, who had been planning director for the university’s school of medicine from 1961 to 1972. Writing some years later about why he created the program, he said, “I was appalled by the mindless despoiling of the physical environment essential to any quality of life, urban or otherwise.”

The University of Colorado’s program began in 2003 with money from the Department of Education, but expanded in 2007 with a five-year National Science Foundation grant to finance 26 doctoral students, according to the program’s director, Anu Ramaswami, a professor of environmental engineering. The program has about the same number of master’s students.

In New York, City College announced in October that it would begin a master’s program in sustainability in the urban environment. The plan is to enroll 18 to 20 students the first year, says Latif Jiji, the program’s director, and students will be able to focus either on architecture — sustainability issues relating to buildings and parks — or engineering, where recycling and clean power will be major subjects.

But as with most such programs, the emphasis will be interdisciplinary. “The philosophy is that the problems these people are going to face are really complex,” Mr. Jiji says. “They don’t fit into nice little categories. We want people with different backgrounds to work together.”

Like other students in Colorado's multidisciplinary program, Meghan Bernard is working with a city — in her case, Broomfield, northwest of Denver — as she pursues her master's in engineering. Much of the work has involved crunching numbers to come up with a baseline greenhouse-gas inventory for Broomfield — the climate-related costs of transportation, shelter, food and other aspects of urban life. But now she will be working with residents to develop an action plan for improving the city's carbon footprint.

"I don't see myself as an engineer or a policy person," Ms. Bernard says. "I enjoy the hard numbers, but the engagement part is important for me as well."

Mr. Pattison's area of concentration is public policy — he's been working with the university on analyzing its carbon footprint and developing a climate action plan, and with his class work done he will soon be starting a job as the university's sustainability officer for its downtown campus. But as he put it, the program has not involved "just sitting in a room full of policy geeks."

"Here you are taking classes with engineers and planners, and hearing about different things — it's like, 'Wow, that wasn't even on my radar screen.' "

http://www.nytimes.com/2010/01/03/education/03urbansustain.html?ref=edlife

Skills to Fix Failing Schools
By LAURA PAPPANO

SOME things never change. For example, children still collect soda cans and box tops to buy classroom equipment. But much in K-12 public education is being turned on its head, especially in urban districts where fixing failing schools has become a national focus.

This means new education leadership jobs: running charter schools, directing turnarounds of troubled schools and founding nonprofits with creative answers to education challenges.

Such work demands educators who are more M.B.A./policy-wonk than Mr. Chips, which is why universities are unveiling degree programs that pull professors from schools of education, business and public policy. In September, the Harvard Graduate School of Education announced a tuition-free, three-year doctoral program in education leadership, the first new degree at the school in 74 years.

“If you are going to be an effective leader, particularly in urban districts, you will need different skills than ed schools have traditionally offered,” says Robert B. Schwartz, academic dean of the Harvard education school. “You need to be leading large-scale change, overseeing operations,” he says. “You need some political skills.”

One month before the deadline, Mr. Schwartz says, 1,363 had started the application process — for 25 spots. The first students will arrive in August.

While such programs include public policy training (school change can be a political minefield), the emphasis is on business. That’s because more money is flowing into education. The White House has committed more than $4 billion for improving schools. The maturing of the charter school movement and the interest of philanthropists like Bill Gates in school reform mean leaders need a grasp not only of budgets but also of fund-raising, strategic partnering, grant writing and administering dramatic culture change.

“The field is transforming pretty radically,” says Debra Meyerson, co-founder of the five-year-old policy, organization and leadership studies program at the Stanford School of Education. “People who have a growing amount of influence are people who can at least speak in business terms or at least be familiar with that way of thinking.”

Stanford, which has long offered a two-year joint M.B.A. and M.A. in education, has added a nine-month program to give students access to coursework with more policy and business content.

The business grounding is so critical that Joe Nathan, director of the Center for School Change at Macalester College in St. Paul, consulted 25 chief executives before starting the Leadership Academy for Minnesota Charter and Alternative Public Schools two years ago (it’s free for no credit; for $950, credit can be applied toward a master’s at Minnesota State). The program matches each participant with one mentor who works in education and one from the business world.

“It’s not because we think they have all the answers,” says Mr. Nathan. While schools are not businesses, he says, education leaders can nonetheless use corporate skills. Harvard’s program places third-year students in a partner organization, much as medical schools place interns. (They earn $65,000.) Mr. Schwartz hopes the program will attract those heading into public policy, business or law school “who want to change education.”

Other programs are drawing people looking for high-level job training or flexibility. That’s who’s filling Central Michigan University’s online charter school leadership program, which graduated its first class on Dec. 12. One student, Patrick Kissel, 44, a retired Army master sergeant, wants to change careers, and

appreciates the opportunity to earn his master's while working as chief of business operations at Letterkenny Army Depot in Pennsylvania.

He will not graduate until August 2011 but has already been contacted by a charter school group in Canada. That's not unusual, says David E. Whale, the program director. "People are reaching out to me saying, 'We want to talk to your graduates,' " he says, noting that starting salaries for charter school directors are $60,000 to $80,000 a year.

Sergeant Kissel, who chose charter schools "because they are mission-driven," became interested in education while serving in Bosnia and Kosovo, where he was charged with rebuilding schools and, he saw, children's lives: "It was sort of like a passion to give these young kids skills they could actually use."

http://www.nytimes.com/2010/01/03/education/edlife/03educ.html?ref=edlife

Ladies and Gentlemen, Start Your Engine Programs
By TOM ZELLER

FOR all the excitement surrounding the development of electric vehicles, a fundamental limiting factor remains: storage. How, after all, does one coax more miles out of a fully electric vehicle without creating a battery so big, and so heavy, that it cripples the car?

To the extent that the Obama administration has made answering that question a national priority, it's not surprising that nearly $40 million in federal stimulus funds for battery and electric car education — much of it at the graduate level — was announced in August.

"If we really are going to go toward electric vehicles or hybrid vehicles, the storage capacity simply has to improve," says Mary Sue Coleman, the president of the University of Michigan, which received $2.5 million for programs at both graduate and undergraduate levels. "There just hasn't been a breakthrough."

Although the subdisciplines of battery and electric vehicle development are not entirely new in engineering programs, few universities have created master's degree programs that specialize in next-generation transportation. But with a total of $2.4 billion in stimulus funds aimed specifically at spurring the manufacture and deployment of electric cars and advanced batteries, the need for such specialization has increased.

The University of Michigan created a master's of energy systems engineering program a couple of years ago, with a concentration in transportation power. Of the nine colleges and universities that received federal funds for battery and electric vehicle programs, seven, including Purdue, Colorado State and West Virginia University, have ambitions to create or expand their graduate level degrees.

Not surprisingly, however, universities in Michigan — ground zero in the collapse of the American auto industry — drew about 25 percent of the education money, with $5 million going to Wayne State University, in Detroit, and $3 million to Michigan Technological University, in the Upper Peninsula.

"It's important to have a master's-degree-level program for this particular industry," says Simon Ng, the director of the Alternative Energy Technology program at Wayne State.

The complexities of the field demand expertise across the engineering spectrum: chemical engineers can push battery technology forward; mechanical engineers can manage system dynamics unique to electric cars; and industrial and manufacturing engineers can rethink product development in a postcombustion-engine age.

Another major challenge, Mr. Ng says, is heat. Anyone familiar with the sensation of a warm laptop pressed against the thighs knows that batteries heat up when they're working overtime. As electric vehicle batteries are pushed to their limits, thermal management becomes a significant safety concern.

"All of these are ongoing issues," Mr. Ng says. "This is a totally new market, and when you have a new market and a totally new technology, you need new engineers with new skills."

Wayne State expects to begin offering its master's degree program next fall, pending curriculum development and approval — and presumably, the arrival of $5 million from the Energy Department.

"We still haven't got the check yet," Mr. Ng says.

http://www.nytimes.com/2010/01/03/education/edlife/03hybrids.html?ref=edlife

Building More Than Résumés
By CHARLES V. BAGLI

WHEN it comes to construction, most of us think hammers, nails and concrete. Who knew that an advanced degree would be in order for this largely blue-collar industry or, in this economy, that it would be in demand?

In fact, construction administration involves financing (bidding, estimating, cost control), people skills (labor negotiations) and management (project planning). Average salary: a lofty $90,000 in 2008, according to the Bureau of Labor Statistics. And every level of credential, from certificate to Ph.D., is offered at every kind of institution, from Ivy League (Columbia University) to for-profit (University of Phoenix Online).

At New York University, applications for this spring's master's program in construction management were up 33 percent over last year. Numbers were even higher for the graduate certification program, which usually takes a year to complete.

James P. Stuckey, a former real estate developer who heads N.Y.U.'s Schack Institute of Real Estate, attributes the rising interest to the federal stimulus program's emphasis on building highways, railroads and other infrastructure. At the same time, green construction requires a higher level of technological knowledge.

"I believe people are recognizing that there's going to be a lot of work in those areas," Mr. Stuckey says.

Is that notion shared by employers, or is graduate school simply a way station while construction companies slash payrolls? (Some 530 construction projects are stalled in New York City alone.)

"If you do go for a master's in construction management you're pretty eligible to work for us," says Peter Davoren, chairman of Turner Construction, a national company with 5,500 employees and over $10 billion in annual billings. Turner typically visits some 100 colleges and universities looking for the 250 recruits it hires every year. While the bulk of them are civil, mechanical and environmental engineers, a full 25 percent have degrees in construction management.

Kevin Haney, a project manager at Plaza Construction in New York City, worked at a variety of construction jobs after graduating from Villanova University in 1994 with a degree in civil engineering. He later enrolled in the graduate engineering program at Columbia, with a minor in construction management.

"It was definitely worthwhile, in my case," Mr. Haney says. "I got some experience — overseas and in New York — and then I went back to school. The classes I took, at night, were directly related to the work I was doing during the day."

http://www.nytimes.com/2010/01/03/education/edlife/03construction.html?ref=edlife

The Business of Zeroing In
By NANCY HASS

WHEN Adam Krueckeberg, 37, decided to leave his job as a vice president at Fidelity, the mutual fund giant, to return to school for an M.B.A., he didn't look at top-ranked schools like Harvard or the University of Pennsylvania's Wharton School, although his résumé was stellar and his scores strong. The only place that interested him was Boston College, the Jesuit-run institution that has been offering a dual M.B.A./M.S. in church management and pastoral ministry since 2005.

"I wanted a career that was more spiritually fulfilling," says Mr. Krueckeberg, who plans to work in a Catholic diocese or university when he graduates, in 2012. "I wouldn't have been able to train for that in a more traditional setting."

The trend toward specialization has crept into most fields over the past few decades, but few have embraced the shift more enthusiastically than graduate schools of business. Since 1990, the year that the Association to Advance Collegiate Schools of Business International, the main accreditation board for business schools, changed its guidelines to encourage innovative curriculums, schools have focused on areas like aerospace, wine management, luxury goods, real estate and energy management.

The percentage of business school students enrolled in specialized programs has risen about 4 percent each year since 2001, according to Daniel R. LeClair, the organization's vice president for knowledge services. More than a fifth of business school students are now seeking such degrees.

Instead of exposing them to theory or the big picture of their discipline, specialized programs tend to zero in on practical and commercial applications. It's an approach more likely to be seen outside the top tier of M.B.A. programs. Institutions like the University of Chicago and Columbia, whose graduates are much sought-after, have mostly kept the general M.B.A., with broad areas of concentration like finance and marketing. But for many others, specialization is a way to stand out among the more than 500 accredited programs here and abroad.

"If you're not one of those few obvious schools, you need to be able to offer students and employers real depth," says Blair Sanford, assistant dean and director of M.B.A. career services at the business school at the University of Wisconsin, Madison, which enrolls about 125 students a year.

The university is widely considered the pioneer in niche M.B.A. programs, having established some of the first specialized institutes within its business school in the 1990s. The university did away entirely with the general M.B.A. in 2004, opting instead for 13 specializations, including market research and real estate. Niche M.B.A. programs tend to attract students who know exactly to which industry they are heading, as well as older students with business experience who may want to change fields, says Mr. LeClair. "In this kind of economic environment, people do tend to get very focused."

Some niche programs, such as the energy concentration at the University of Oklahoma's Price College of Business, capitalize on geography. Located smack in the middle of oil country, the program has a pool of local employers likely to seek custom-trained executives. With major pharmaceutical firms like Merck and Johnson & Johnson headquartered in the state, Rutgers University in New Jersey offers an M.B.A. in pharmaceutical management.

European business schools were early adopters of the specialization model, especially in France. The international luxury brand management program at Essec Business School near Paris is conducted entirely in English and attracts about 40 students a year, most of them not French. Students in the wine and spirits M.B.A. program at the Bordeaux Management School in western France enrich their studies with stints at cooperating universities in Australia and northern California.

Investing as much as $30,000 in such a narrowly focused degree may be risky — especially if the market for a particular job dries up suddenly (the tightening of the real estate industry is a good example) — but going deep instead of wide seems to fit right in with an increasingly segmented world.

“I knew what I wanted and where I wanted to be eventually,” says Mr. Kruekeberg. “I didn’t need to waste time relearning the things I already knew how to do. I wanted every minute to be something valuable and new.”

http://www.nytimes.com/2010/01/03/education/edlife/03mba.html?ref=edlife

The Interactive Entrepreneur
By BRIAN STELTER

THE announcement last year that Birmingham City University in central England would offer a master's in social networking attracted international coverage — and comment, appropriately on Twitter and Mashable, on the nature of Facebook and My-Space as academic discipline.

Jon Hickman, a Birmingham lecturer, defended the program's rigor in an e-mail message: "This semester, we have been exploring business models, and considering social media as a cultural activity."

Whatever the merits, the potential of social networking, blogs, wikis and other interactive vehicles — what's being called Web 2.0 — can hardly be overestimated. Social media sites are among the most visited on the Internet, and traditional media providers are increasingly tapping social networking to deliver coverage and interact with their audience.

Schools of communication are concluding that single courses are insufficient, and they are developing fuller curriculums. Last summer, Elon University in North Carolina began a master's in interactive media for students aiming to produce Web sites with user-generated content, interactive advertising or multimedia. One of the electives is dedicated to "citizen and participatory news."

The mission of the University of Southern California's master's in online communities, in its fourth year, is to breed leaders of social media. With a $10,000 budget (much of it going for hiring programmers), students form teams to conceptualize, build and manage an interactive site.

One of last year's graduates was Nonny de la Peña, a documentarian and "immersive journalist" (her virtual Guantánamo Bay detention center on Second Life was financed by the MacArthur Foundation). As a team project, Ms. de la Peña developed her idea for a video-editing and -sharing site (www.Stroome.com) that found financing and went online last month.

"You're introduced to venture capitalists," she says, "and get support from people who know what they're doing. We got to meet one of the attorneys involved with Skype." Without the program, she adds, "I just wouldn't have had access."

The degree requires a heavy lift. Eight courses and an internship are compressed into a year. "We want them through fast," explains Karen North, the director, "since the digital world is evolving so fast. It's essentially a moving target from a business standpoint. A year ago we wouldn't be talking about Twitter. Four years ago we would not be talking about Facebook. You'd barely be talking about MySpace."

She adds: "We're now talking about Web 3.0, whatever that is."

http://www.nytimes.com/2010/01/03/education/edlife/03socialnetwork-t.html?ref=edlife

How to Train the Aging Brain

By BARBARA STRAUCH

I LOVE reading history, and the shelves in my living room are lined with fat, fact-filled books. There's "The Hemingses of Monticello," about the family of Thomas Jefferson's slave mistress; there's "House of Cards," about the fall of Bear Stearns; there's "Titan," about John D. Rockefeller Sr.

The problem is, as much as I've enjoyed these books, I don't really remember reading any of them. Certainly I know the main points. But didn't I, after underlining all those interesting parts, retain anything else? It's maddening and, sorry to say, not all that unusual for a brain at middle age: I don't just forget whole books, but movies I just saw, breakfasts I just ate, and the names, oh, the names are awful. Who are you?

Brains in middle age, which, with increased life spans, now stretches from the 40s to late 60s, also get more easily distracted. Start boiling water for pasta, go answer the doorbell and — whoosh — all thoughts of boiling water disappear. Indeed, aging brains, even in the middle years, fall into what's called the default mode, during which the mind wanders off and begin daydreaming.

Given all this, the question arises, can an old brain learn, and then remember what it learns? Put another way, is this a brain that should be in school?

As it happens, yes. While it's tempting to focus on the flaws in older brains, that inducement overlooks how capable they've become. Over the past several years, scientists have looked deeper into how brains age and confirmed that they continue to develop through and beyond middle age.

Many longheld views, including the one that 40 percent of brain cells are lost, have been overturned. What is stuffed into your head may not have vanished but has simply been squirreled away in the folds of your neurons.

One explanation for how this occurs comes from Deborah M. Burke, a professor of psychology at Pomona College in California. Dr. Burke has done research on "tots," those tip-of-the-tongue times when you know something but can't quite call it to mind. Dr. Burke's research shows that such incidents increase in part because neural connections, which receive, process and transmit information, can weaken with disuse or age.

But she also finds that if you are primed with sounds that are close to those you're trying to remember — say someone talks about cherry pits as you try to recall Brad Pitt's name — suddenly the lost name will pop into mind. The similarity in sounds can jump-start a limp brain connection. (It also sometimes works to silently run through the alphabet until landing on the first letter of the wayward word.)

This association often happens automatically, and goes unnoticed. Not long ago I started reading "The Prize," a history of the oil business. When I got to the part about Rockefeller's early days as an oil refinery owner, I realized, hey, I already know this from having read "Titan." The material was still in my head; it just needed a little prodding to emerge.

Recently, researchers have found even more positive news. The brain, as it traverses middle age, gets better at recognizing the central idea, the big picture. If kept in good shape, the brain can continue to build pathways that help its owner recognize patterns and, as a consequence, see significance and even solutions much faster than a young person can.

The trick is finding ways to keep brain connections in good condition and to grow more of them.

"The brain is plastic and continues to change, not in getting bigger but allowing for greater complexity and deeper understanding," says Kathleen Taylor, a professor at St. Mary's College of California, who has studied ways to teach adults effectively. "As adults we may not always learn quite as fast, but we are set up for this next developmental step."

Educators say that, for adults, one way to nudge neurons in the right direction is to challenge the very assumptions they have worked so hard to accumulate while young. With a brain already full of well-connected pathways, adult learners should "jiggle their synapses a bit" by confronting thoughts that are contrary to their own, says Dr. Taylor, who is 66.

Teaching new facts should not be the focus of adult education, she says. Instead, continued brain development and a richer form of learning may require that you "bump up against people and ideas" that are different. In a history class, that might mean reading multiple viewpoints, and then prying open brain networks by reflecting on how what was learned has changed your view of the world.

"There's a place for information," Dr. Taylor says. "We need to know stuff. But we need to move beyond that and challenge our perception of the world. If you always hang around with those you agree with and read things that agree with what you already know, you're not going to wrestle with your established brain connections."

Such stretching is exactly what scientists say best keeps a brain in tune: get out of the comfort zone to push and nourish your brain. Do anything from learning a foreign language to taking a different route to work.

"As adults we have these well-trodden paths in our synapses," Dr. Taylor says. "We have to crack the cognitive egg and scramble it up. And if you learn something this way, when you think of it again you'll have an overlay of complexity you didn't have before — and help your brain keep developing as well."

Jack Mezirow, a professor emeritus at Columbia Teachers College, has proposed that adults learn best if presented with what he calls a "disorienting dilemma," or something that "helps you critically reflect on the assumptions you've acquired."

Dr. Mezirow developed this concept 30 years ago after he studied women who had gone back to school. The women took this bold step only after having many conversations that helped them "challenge their own ingrained perceptions of that time when women could not do what men could do."

Such new discovery, Dr. Mezirow says, is the "essential thing in adult learning."

"As adults we have all those brain pathways built up, and we need to look at our insights critically," he says. "This is the best way for adults to learn. And if we do it, we can remain sharp."

And so I wonder, was my cognitive egg scrambled by reading that book on Thomas Jefferson? Did I, by exploring the flaws in a man I admire, create a suitably disorienting dilemma? Have I, as a result, shaken up and fed a brain cell or two?

And perhaps it doesn't matter that I can't, at times, recall the given name of the slave with whom Jefferson had all those children. After all, I can Google a simple name.

Sally.

Barbara Strauch is The Times's health editor; her book "The Secret Life of the Grown-Up Brain" will be published in April.

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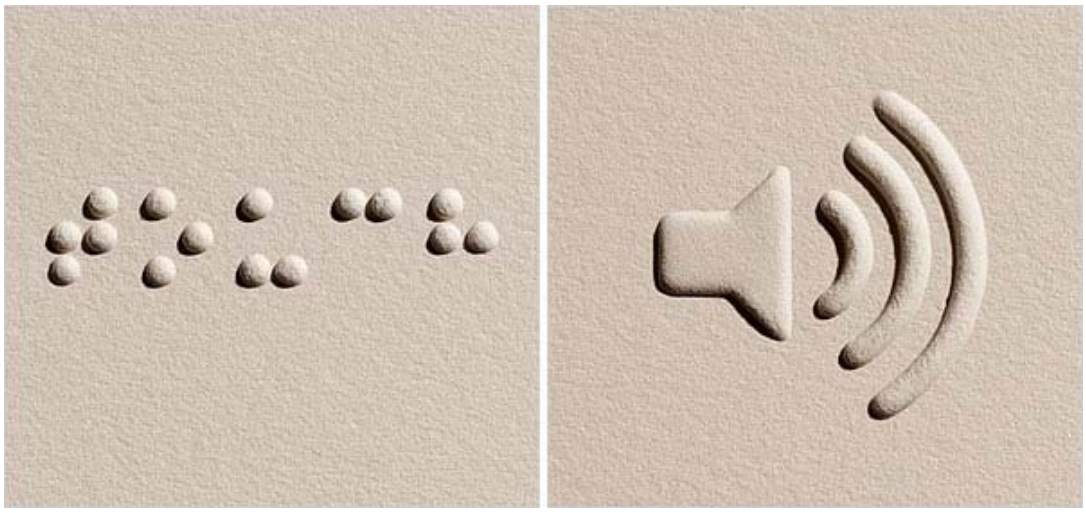
Listening to Braille

By RACHEL AVIV



AT 4 O'CLOCK each morning, Laura J. Sloate begins her daily reading. She calls a phone service that reads newspapers aloud in a synthetic voice, and she listens to The Wall Street Journal at 300 words a minute, which is nearly twice the average pace of speech. Later, an assistant reads The Financial Times to her while she uses her computer's text-to-speech system to play The Economist aloud. She devotes one ear to the paper and the other to the magazine. The managing director of a Wall Street investment management firm, Sloate has been blind since age 6, and although she reads constantly, poring over the news and the economic reports for several hours every morning, she does not use Braille. "Knowledge goes from my ears to my brain, not from my finger to my brain," she says. As a child she learned how the letters of the alphabet sounded, not how they appeared or felt on the page. She doesn't think of a comma in terms of its written form but rather as "a stop on the way before continuing." This, she says, is the future of reading for the blind. "Literacy evolves," she told me. "When Braille was invented, in the 19th century, we had nothing else. We didn't even have radio. At that time, blindness was a disability. Now it's just a minor, minor impairment."

A few decades ago, commentators predicted that the electronic age would create a postliterate generation as new forms of media eclipsed the written word. Marshall McLuhan claimed that Western culture would return to the "tribal and oral pattern." But the decline of written language has become a reality for only the blind. Although Sloate does regret not spending more time learning to spell in her youth — she writes by dictation — she says she thinks that using Braille would have only isolated her from her sighted peers. "It's an arcane means of communication, which for the most part should be abolished," she told me. "It's just not needed today."

Braille books are expensive and cumbersome, requiring reams of thick, oversize paper. The National Braille Press, an 83-year-old publishing house in Boston, printed the Harry Potter series on its Heidelberg cylinder; the final product was 56 volumes, each nearly a foot tall. Because a single textbook can cost more than $1,000 and there's a shortage of Braille teachers in public schools, visually impaired students often read using MP3 players, audiobooks and computer-screen-reading software.

A report released last year by the National Federation of the Blind, an advocacy group with 50,000 members, said that less than 10 percent of the 1.3 million legally blind Americans read Braille. Whereas roughly half of all blind children learned Braille in the 1950s, today that number is as low as 1 in 10, according to the report. The figures are controversial because there is debate about when a child with residual vision has "too much sight" for Braille and because the causes of blindness have changed over the decades — in recent years more blind children have multiple disabilities, because of premature births. It is clear, though, that Braille literacy has been waning for some time, even among the most intellectually

capable, and the report has inspired a fervent movement to change the way blind people read. “What we’re finding are students who are very smart, very verbally able — and illiterate,” Jim Marks, a board member for the past five years of the Association on Higher Education and Disability, told me. “We stopped teaching our nation’s blind children how to read and write. We put a tape player, then a computer, on their desks. Now their writing is phonetic and butchered. They never got to learn the beauty and shape and structure of language.”

For much of the past century, blind children attended residential institutions where they learned to read by touching the words. Today, visually impaired children can be well versed in literature without knowing how to read; computer-screen-reading software will even break down each word and read the individual letters aloud. Literacy has become much harder to define, even for educators.

“If all you have in the world is what you hear people say, then your mind is limited,” Darrell Shandrow, who runs a blog called Blind Access Journal, told me. “You need written symbols to organize your mind. If you can’t feel or see the word, what does it mean? The substance is gone.” Like many Braille readers, Shandrow says that new computers, which form a single line of Braille cells at a time, will revive the code of bumps, but these devices are still extremely costly and not yet widely used. Shandrow views the decline in Braille literacy as a sign of regression, not progress: “This is like going back to the 1400s, before Gutenberg’s printing press came on the scene,” he said. “Only the scholars and monks knew how to read and write. And then there were the illiterate masses, the peasants.”

UNTIL THE 19TH CENTURY, blind people were confined to an oral culture. Some tried to read letters carved in wood or wax, formed by wire or outlined in felt with pins. Dissatisfied with such makeshift methods, Louis Braille, a student at the Royal Institute for Blind Youth in Paris, began studying a cipher language of bumps, called night writing, developed by a French Army officer so soldiers could send messages in the dark. Braille modified the code so that it could be read more efficiently — each letter or punctuation symbol is represented by a pattern of one to six dots on a matrix of three rows and two columns — and added abbreviations for commonly used words like “knowledge,” “people” and “Lord.” Endowed with a reliable method of written communication for the first time in history, blind people had a significant rise in social status, and Louis Braille was embraced as a kind of liberator and spiritual savior. With his “godlike courage,” Helen Keller wrote, Braille built a “firm stairway for millions of sense-crippled human beings to climb from hopeless darkness to the Mind Eternal.”

At the time, blindness was viewed not just as the absence of sight but also as a condition that created a separate kind of species, more innocent and malleable, not fully formed. Some scholars said that blind people spoke a different sort of language, disconnected from visual experience. In his 1933 book, “The Blind in School and Society,” the psychologist Thomas Cutsforth, who lost his sight at age 11, warned that students who were too rapidly assimilated into the sighted world would become lost in “verbal unreality.” At some residential schools, teachers avoided words that referenced color or light because, they said, students might stretch the meanings beyond sense. These theories have since been discredited, and studies have shown that blind children as young as 4 understand the difference in meaning between words like “look,” “touch” and “see.” And yet Cutsforth was not entirely misguided in his argument that sensory deprivation restructures the mind. In the 1990s, a series of brain-imaging studies revealed that the visual cortices of the blind are not rendered useless, as previously assumed. When test subjects swept their fingers over a line of Braille, they showed intense activation in the parts of the brain that typically process visual input.

These imaging studies have been cited by some educators as proof that Braille is essential for blind children’s cognitive development, as the visual cortex takes more than 20 percent of the brain. Given the brain’s plasticity, it is difficult to make the argument that one kind of reading — whether the information is absorbed by ear, finger or retina — is inherently better than another, at least with regard to cognitive function. The architecture of the brain is not fixed, and without images to process, the visual cortex can reorganize for new functions. A 2003 study in Nature Neuroscience found that blind subjects consistently surpassed sighted ones on tests of verbal memory, and their superior performance was caused, the authors suggested, by the extra processing that took place in the visual regions of their brains.

Learning to read is so entwined in the normal course of child development that it is easy to assume that our brains are naturally wired for print literacy. But humans have been reading for fewer than 6,000 years (and literacy has been widespread for no more than a century and a half). The activity of reading itself alters the anatomy of the brain. In a report released in 2009 in the journal Nature, the neuroscientist Manuel Carreiras studies illiterate former guerrillas in Colombia who, after years of combat, had abandoned their weapons, left the jungle and rejoined civilization. Carreiras compares 20 adults who had recently completed a literacy program with 22 people who had not yet begun it. In M.R.I. scans of their brains, the newly literate subjects showed more gray matter in their angular gyri, an area crucial for language processing, and more white matter in part of the corpus callosum, which links the two hemispheres. Deficiencies in these regions were previously observed in dyslexics, and the study suggests that those brain patterns weren't the cause of their illiteracy, as had been hypothesized, but a result.

There is no doubt that literacy changes brain circuitry, but how this reorganization affects our capacity for language is still a matter of debate. In moving from written to spoken language, the greatest consequences for blind people may not be cognitive but cultural — a loss much harder to avoid. In one of the few studies of blind people's prose, Doug Brent, a professor of communication at the University of Calgary, and his wife, Diana Brent, a teacher of visually impaired students, analyzed stories by students who didn't use Braille but rather composed on a regular keyboard and edited by listening to their words played aloud. One 16-year-old wrote a fictional story about a character named Mark who had "sleep bombs":

He looked in the house windo that was his da windo his dad was walking around with a mask on he took it off he opend the windo and fell on his bed sleeping mark took two bombs and tosed them in the windo the popt his dad lept up but before he could grab the mask it explodedhe fell down asleep.

In describing this story and others like it, the Brents invoked the literary scholar Walter Ong, who argued that members of literate societies think differently than members of oral societies. The act of writing, Ong said — the ability to revisit your ideas and, in the process, refine them — transformed the shape of thought. The Brents characterized the writing of many audio-only readers as disorganized, "as if all of their ideas are crammed into a container, shaken and thrown randomly onto a sheet of paper like dice onto a table." The beginnings and endings of sentences seem arbitrary, one thought emerging in the midst of another with a kind of breathless energy. The authors concluded, "It just doesn't seem to reflect the qualities of organized sequence and complex thought that we value in a literate society."

OUR DEFINITION of a literate society inevitably shifts as our tools for reading and writing evolve, but the brief history of literacy for blind people makes the prospect of change particularly fraught. Since the 1820s, when Louis Braille invented his writing system — so that blind people would no longer be "despised or patronized by condescending sighted people," as he put it — there has always been, among blind people, a political and even moral dimension to learning to read. Braille is viewed by many as a mark of independence, a sign that blind people have moved away from an oral culture seen as primitive and isolating. In recent years, however, this narrative has been complicated. Schoolchildren in developed countries, like the U.S. and Britain, are now thought to have lower Braille literacy than those in developing ones, like Indonesia and Botswana, where there are few alternatives to Braille. Tim Connell, the managing director of an assistive-technology company in Australia, told me that he has heard this described as "one of the advantages of being poor."

Braille readers do not deny that new reading technology has been transformative, but Braille looms so large in the mythology of blindness that it has assumed a kind of talismanic status. Those who have residual vision and still try to read print — very slowly or by holding the page an inch or two from their faces — are generally frowned upon by the National Federation of the Blind, which fashions itself as the leader of a civil rights movement for the blind. Its president, Marc Maurer, a voracious reader, compares Louis Braille to Abraham Lincoln. At the annual convention for the federation, held at a Detroit Marriott last July, I heard the mantra "listening is not literacy" repeated everywhere, from panels on the Braille crisis to conversations among middle-school girls. Horror stories circulating around the convention featured children who don't know what a paragraph is or why we capitalize letters or that "happily ever after" is made up of three separate words.

Declaring your own illiteracy seemed to be a rite of passage. A vice president of the federation, Fredric Schroeder, served as commissioner of the Rehabilitation Services Administration under President Clinton and relies primarily on audio technologies. He was openly repentant about his lack of reading skills. “I am now over 50 years old, and it wasn’t until two months ago that I realized that ‘dissent,’ to disagree, is different than ‘descent,’ to lower something,” he told me. “I’m functionally illiterate. People say, ‘Oh, no, you’re not.’ Yes, I am. I’m sorry about it, but I’m not embarrassed to admit it.”

While people like Laura Sloate or the governor of New York, David A. Paterson, who also reads by listening, may be able to achieve without the help of Braille, their success requires accommodations that many cannot afford. Like Sloate, Paterson dictates his memos, and his staff members select pertinent newspaper articles for him and read them aloud on his voice mail every morning. (He calls himself “overassimilated” and told me that as a child he was “mainstreamed so much that I psychologically got the message that I’m not really supposed to be blind.”) Among people with fewer resources, Braille-readers tend to form the blind elite, in part because it is more plausible for a blind person to find work doing intellectual rather than manual labor.

A 1996 study showed that of a sample of visually impaired adults, those who learned Braille as children were more than twice as likely to be employed as those who had not. At the convention this statistic was frequently cited with pride, so much so that those who didn’t know Braille were sometimes made to feel like outsiders. “There is definitely a sense of peer pressure from the older guard,” James Brown, a 35-year-old who reads using text-to-speech software, told me. “If we could live in our own little Braille world, then that’d be perfect,” he added. “But we live in a visual world.”

When deaf people began getting cochlear implants in the late 1980s, many in the deaf community felt betrayed. The new technology pushed people to think of the disability in a new way — as an identity and a culture. Technology has changed the nature of many disabilities, lifting the burdens but also complicating people’s sense of what is physically natural, because bodies can so often be tweaked until “fixed.” Arielle Silverman, a graduate student at the convention who has been blind since birth, told me that if she had the choice to have vision, she was not sure she would take it. Recently she purchased a pocket-size reading machine that takes photographs of text and then reads the words aloud, and she said she thought of vision like that, as “just another piece of technology.”

The modern history of blind people is in many ways a history of reading, with the scope of the disability — the extent to which you are viewed as ignorant or civilized, helpless or independent — determined largely by your ability to access the printed word. For 150 years, Braille books were designed to function as much as possible like print books. But now the computer has essentially done away with the limits of form, because information, once it has been digitized, can be conveyed through sound or touch. For sighted people, the transition from print to digital text has been relatively subtle, but for many blind people the shift to computerized speech is an unwelcome and uncharted experiment. In grappling with what has been lost, several federation members recited to me various takes on the classic expression Scripta manent, verba volant: What is written remains, what is spoken vanishes into air.

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http://www.nytimes.com/2010/01/03/magazine/03Braille-t.html?th&emc=th

Phys Ed: How Little Exercise Can You Get Away With?

By GRETCHEN REYNOLDS

Erik Isakson/Getty Images

Recently researchers trawled through a vast database of survey information about the health and habits of men and women in Scotland, hoping to determine how much exercise is needed to keep the Scots from feeling gloomy (or in technical terms, experiencing "psychological distress"). The answer, according to a study published in this month's British Journal of Sports Medicine: a mere 20 minutes a week of any physical activity, whether sports, walking, gardening or even housecleaning, the last not usually associated with bringing out the sunshine. The researchers found that more activity conferred more mental-health benefits and that "participation in vigorous sports activities" tended to be the "most beneficial for mental health." But their overall conclusion was that being active for as little as 20 minutes a week is sufficient, if your specific goal is mental health.

The question of how much exercise is enough gains special piquancy at this time of year, when many of us dust off last year's New Year's resolutions and promise to be more diligent about working out in the coming year. Unfortunately, figuring out an ideal exercise dosage is not simple, in part because the amount of exercise needed depends on the benefits you hope to gain. Twenty minutes a week of vacuuming or other activity may, according to the Scottish study, increase your contentment, but it certainly won't do much for your cardiovascular fitness and is unlikely to lessen your risks for a multitude of diseases and, ultimately, of premature death, benefits that a greater amount of exercise may provide. It also won't help much with weight loss. That said, anyone resolving to increase the amount of housecleaning they do in the New Year is welcome to begin their regimen at my home.

In general, a wide reading of the latest sports science makes it clear that the "amount of physical activity necessary to produce health benefits cannot yet be identified with a high degree of precision," according to the authors of the 2008 Physical Activity Guidelines for Americans report, which was produced by the Department of Health and Human Services and was based on the recommendations of an advisory committee scientists. These experts waded through dozens of studies on the health effects of exercise, looking at the impacts that exercise can have on people's risks for heart disease, obesity, diabetes, cancer, depression and, in general, premature death. In some studies that were cited, exercise actually seemed to confer little if any disease-fighting benefits. In others, the benefits kicked in only if the exercise was quite strenuous; in yet others, a gentle stroll a few times a week was enough to lessen the risk of early death.

Despite the inconsistent results, caused in some part by even more inconsistent methodologies between the different studies, the advisory committee did ultimately reach some conclusions about how much —

or, really, how little — exercise we each should be doing. That minimum amount of exercise required to see a significant lowering of your risk of dying prematurely was, they concluded, 500 MET minutes of exercise a week. Of course, unless you're an exercise scientist, there's a good chance you don't know what a MET minute is. A single MET, or Metabolic Equivalent of Task, is the amount of energy a person uses at rest. Two METs represent twice the energy burned at rest; four METs, four times the energy used at rest; and so on. Walking at three miles per hour is a 3.3-MET activity, while running at 6 miles an hour is a 10-MET activity. The committee concluded that a person needs to accumulate a weekly minimum of 500 MET minutes of exercise, which does not mean 500 minutes of exercise. Instead, 150 minutes a week (two and a half hours) of a moderate, three- to five-MET activity, such as walking, works out to be about 500 MET minutes. Half as much time (an hour and 15 minutes per week) spent on a 6-plus MET activity like easy jogging seems, according to the committee, to have similar health effects.

Interestingly, they did not find that exercise beyond a certain point conferred significant additional health benefits. Instead, the "dose response" for exercise, the committee found, is "curvilinear." In other words, people who are the least active to start with get the most health benefit from starting to exercise. People who already are fit don't necessarily get a big additional health benefit from adding more workout time to their regimens. Which is not to say that if you are, for instance, a devoted runner or cyclist, you should reduce your workout time in 2010 to 500 MET minutes per week. You're already well ahead in terms of health benefits. According to the Physical Activity Guidelines report, "It has been estimated that people who are physically active for approximately seven hours a week have a 40 percent lower risk of dying early than those who are active for less than 30 minutes a week."

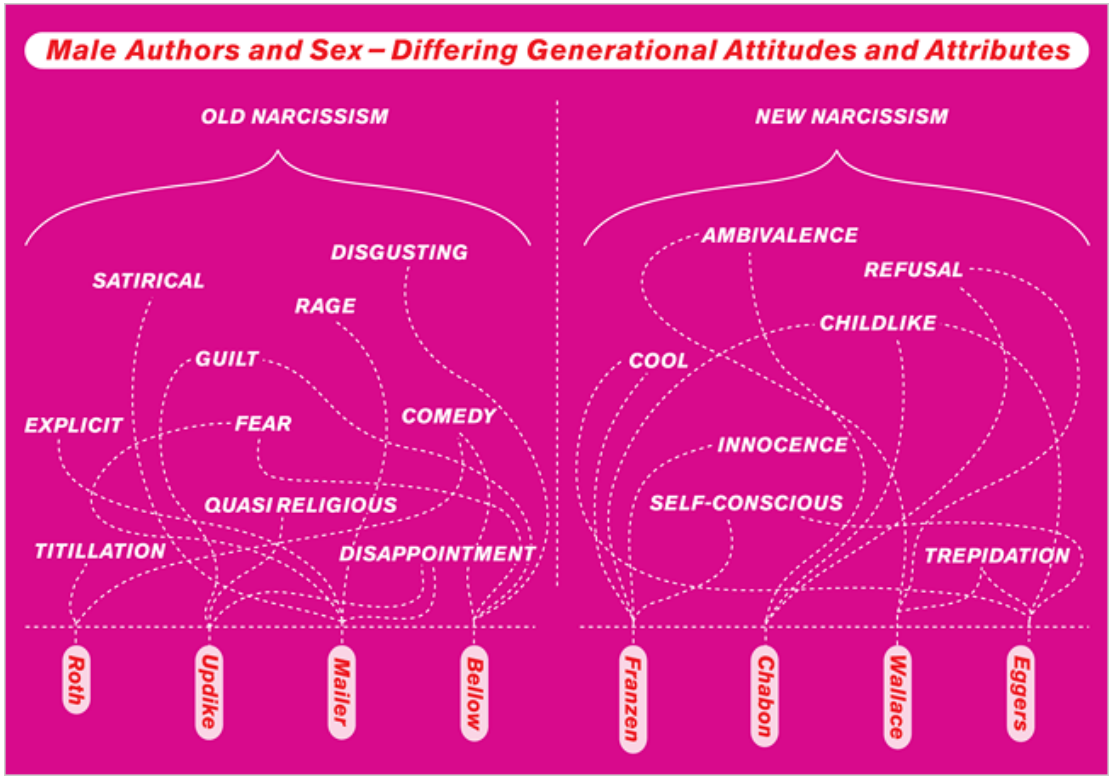
Whether there might be an upper limit to the advisable amount of exercise is an issue that was not addressed by the group. It hasn't been directly studied much by science, either, in part because of logistical and ethical barriers; you can't run people until they drop. But there have been intimations that you can be too avid. As I reported in this column in October, laboratory mice that were made to run to exhaustion were more likely than mice that ran moderately to succumb to the flu. Similarly, a few small but provocative studies of the coronary health of long-time, competitive marathon runners have suggested that their efforts may not, in every case, be doing their hearts good, as I also reported this year.

So what does all this mean as you plan your 2010 exercise routines? First, because "activity affects so many organs and pre-disease states," according to Frank Booth, a professor in the department of biomedical sciences at the University of Missouri at Columbia, who has extensively studied the health effects of exercise, "any activity is better than no activity." For those contemplating their first regular exercise routine, consult a doctor before starting, of course. Then, get out and walk, working your way up to least 150 minutes a week. Although not all of the studies under review found health benefits from such relatively light aerobic exercise, enough of them did to support the recommendation of regular brisk walks or other moderate activities. (Moderate exercise, by the way, is defined by the Department of Health and Human Services as activities of between three and six METs, equivalent to about 45 to 64 percent of your maximum heart rate — or in simpler terms, activities during which it is possible for you to talk to a companion but too hard for you to sing the words to your favorite song.)

You do not necessarily have to divide your exercise time into daily allotments, either. Existing "scientific evidence does not allow researchers to say, for example, whether the health benefits of 30 minutes on five days a week are any different from the health benefits of 50 minutes on three days a week," according to the activity guidelines. Do what suits your schedule. But, Mr. Booth says, do something. "Inactivity is looking more and more like one of the underlying causes of many chronic diseases," he says. If, he adds, "you want to live to be 100," which happens to be my New Year's resolution, "then don't just sit all day."

http://well.blogs.nytimes.com/2009/12/30/phys-ed-how-much-exercise-to-avoid-feeling-gloomy/?ref=magazine

The Naked and the Conflicted
By KATIE ROIPHE



For a literary culture that fears it is on the brink of total annihilation, we are awfully cavalier about the Great Male Novelists of the last century. It has become popular to denounce those authors, and more particularly to deride the sex scenes in their novels. Even the young male writers who, in the scope of their ambition, would appear to be the heirs apparent have repudiated the aggressive virility of their predecessors.

After reading a sex scene in Philip Roth's latest novel, "The Humbling," someone I know threw the book into the trash on a subway platform. It was not exactly feminist rage that motivated her. We have internalized the feminist critique pioneered by Kate Millett in "Sexual Politics" so completely that, as one of my students put it, "we can do the math ourselves." Instead my acquaintance threw the book away on the grounds that the scene was disgusting, dated, redundant. But why, I kept wondering, did she have to throw it out? Did it perhaps retain a little of the provocative fire its author might have hoped for? Dovetailing with this private and admittedly limited anecdote, there is a punitive, vituperative quality in the published reviews that is always revealing of something larger in the culture, something beyond one aging writer's failure to produce fine enough sentences. All of which is to say: How is it possible that Philip Roth's sex scenes are still enraging us?

In the early novels of Roth and his cohort there was in their dirty passages a sense of novelty, of news, of breaking out. Throughout the '60s, with books like "An American Dream," "Herzog," "Rabbit, Run," "Portnoy's Complaint" and "Couples," there was a feeling that their authors were reporting from a new frontier of sexual behavior: adultery, anal sex, oral sex, threesomes — all of it had the thrill of the new, or at least of the newly discussed. When "Couples," John Updike's tour de force of extramarital wanderlust set in a small New England town called Tarbox, came out in 1968, a Time magazine cover article declared that "the sexual scenes, and the language that accompanies them, are remarkably explicit, even for this new age of total freedom of expression."

These novelists were writing about the bedrooms of middle-class life with the thrill of the censors at their backs, with the 1960 obscenity trial over “Lady Chatterley’s Lover” fresh in their minds. They would bring their talent, their analytic insights, their keen writerly observation, to the most intimate, most unspeakable moments, and the exhilaration, the mischief, the crackling energy was in the prose. These young writers — Mailer, Roth, Updike — were taking up the X-rated subject matter of John O’Hara and Henry Miller, but with a dash of modern journalism splashed in.

In Philip Roth’s phenomenally successful 1969 novel “Portnoy’s Complaint,” the Jewish hero sleeps his way into mainstream America through the narrow loins of a series of crazy harridans and accommodating lovelies. But are the sex scenes meant to be taken seriously? In “The Counterlife,” Roth’s alter ego, the writer Nathan Zuckerman, calls himself a “sexual satirist,” and in that book and others Roth’s sex scenes do manage to be both comic and dirty at the same time: “The sight of the Zipper King’s daughter sitting on the edge of the bathtub with her legs flung apart, wantonly surrendering all 5 feet 9 inches of herself to a vegetable, was as mysterious and compelling a vision as any Zuckerman had ever seen.”

Roth’s explicit passages walk a fine, difficult line between darkness, humor and lust, and somehow the male hero emerges from all the comic clauses breathless, glorified. There is in these scenes rage, revenge and some garden-variety sexism, but they are — in their force, in their gale winds, in their intelligence — charismatic, a celebration of the virility of their bookish, yet oddly irresistible, protagonists. As the best scenes spool forward, they are maddening, beautiful, eloquent and repugnant all at once. One does not have to like Roth, or Zuckerman, or Portnoy, to admire the intensely narrated spectacle of their sexual adventures. Part of the suspense of a Roth passage, the tautness, the brilliance, the bravado in the sentences themselves, the high-wire performance of his prose, is how infuriating and ugly and vain he can be without losing his readers (and then every now and then he actually goes ahead and loses them).

In 1960, the 28-year-old Updike solidified his emerging reputation as the author of eerily beautiful stories with his novel “Rabbit, Run,” about a lanky ex-basketball player turned kitchen utensil salesman, Harry (Rabbit) Angstrom, who runs off from his family, has sex with a plump and promiscuous mistress and comes home to a wife who has drunkenly drowned their newborn baby. A few years later, Norman Mailer told Updike he should get back in the whorehouse and stop worrying about his prose style. But that was Updike’s unnerving gift: to be frank and aestheticizing all at once, to do poetry and whorehouse. In “Couples,” a graphic description of oral sex includes “the floral surfaces of her mouth.” In “Rabbit, Run,” we read of “lovely wobbly bubbles, heavy: perfume between. Taste, salt and sour, swirls back with his own saliva.” The hallmark of Updike’s sex scenes is the mingling of his usual brutal realism with a stepped-up rapture, a harsh scrutiny combined with prettiness. Everything is rose, milky, lilac, and then suddenly it is not.

For Rabbit, as with many Updike characters, sex offers an escape, an alternate life — a reprieve, even, in its finest moments, from mortality. In the Time cover article, Updike describes adultery as an “imaginative quest.” In “Marry Me,” among other books, he expands on the theme that leaving one marriage for another doesn’t resolve our deeper malaise, but he is interested in the motion, in the fantasy, in the impulse toward renewal: it is Rabbit running that he loves. As one of the characters in “Couples” puts it, adultery “is a way of giving yourself adventures. Of getting out in the world and seeking knowledge.”

Saul Bellow shared Updike’s interest in sexual adventuring, in a great, splashy, colorful comic-book war between men and women. Moses Herzog, he writes, “will never understand what women want. What do they want? They eat green salad and drink human blood.” Bellow’s novels are populated with dark, voluptuous, generous, maybe foreign Renatas and Ramonas, who are mistresses; and then there are the wives, shrewish, smart, treacherous, angular. While his sex scenes are generally more gentlemanly than those of Roth et al., he manages to get across something of his tussle with these big, fleshy, larger-than-life ladies: “Ramona had not learned those erotic monkey-shines in a manual, but in adventure, in confusion, and at times probably with a sinking heart, in brutal and often alien embraces.”

In his disordered, sprawling novels, Mailer takes a hopped-up, quasi-religious view of sex, with flights of D. H. Lawrence-inspired mysticism and a special interest in sodomy. In “An American Dream,” he describes a woman’s genitals: “It was no graveyard now, no warehouse, no, more like a chapel now, a modest decent place, but its walls were snug, its odor was green, there was a sweetness in the chapel.”

Mailer’s most controversial obsession is the violence in sex, the urge toward domination in its extreme. A sampling: “I wounded her, I knew it, she thrashed beneath me like a trapped little animal, making not a sound.” “He must subdue her, absorb her, rip her apart and consume her.” It is part of Mailer’s existentialism, his singular, loopy philosophy, that violence is good, natural and healthy, and it is this in his sex scenes that provokes. As in many of Mailer’s ventures, like his famous campaign for mayor of New York, it’s not entirely clear how much he means it and how much is for fun, for the virile show.

It would be too simple to call the explicit interludes of this new literature pornographic, as pornography has one purpose: to arouse. These passages are after several things at once — sadness, titillation, beauty, fear, comedy, disappointment, aspiration. The writers were interested in showing not just the triumphs of sexual conquest, but also its loneliness, its failures of connection. In his unruly defense of sexually explicit male literature in “The Prisoner of Sex,” Mailer wrote: “He has spent his literary life exploring the watershed of sex from that uncharted side which goes by the name of lust and it is an epic work for any man. . . . Lust exhibits all the attributes of junk. It dominates the mind and other habits, it appropriates loyalties, generalizes character, leaches character out, rides on the fuel of almost any emotional gas — whether hatred, affection, curiosity, even the pressures of boredom — yet it is never definable because it can alter to love or be as suddenly sealed from love.”

In the intervening decades, the feminists objected; the public consumed; the novelists themselves were much decorated. And then somewhat to their surprise, the old guard got old. In books like Roth’s “Exit Ghost” and Updike’s “Toward the End of Time,” they began to take up the subject of impotence in various forms. Was it possible that the young literary gods had fallen? Roth wrote in “Zuckerman Unbound”: “Life has its own flippant ideas about how to handle serious fellows like Zuckerman. All you have to do is wait and it teaches you all there is to know about the art of mockery.”

And so we come back to the copy of “The Humbling” in the garbage can on the subway platform. The problem with the sex scenes in Philip Roth’s late work is not that they are pornographic, but that they fail as pornography. One feels that the author’s heart is not in it, that he is just going through the motions; one feels the impatient old master mapping out scenes (dildo, threesome), not writing them. The threesome in “The Humbling” has none of the quirkiness, the energy, the specificity of the threesomes in “Portnoy’s Complaint,” either the one where “the Monkey” eats a banana and gets her name, or the one where they pick up an Italian prostitute who later brings her son, all dressed up in his Sunday best, to see them. In the stripped-down later novels (“Everyman,” “Exit Ghost,” “Indignation”), Roth seems to have dispensed with the detail and idiosyncratic richness of his earlier work. As he writes about old men failing at sex, and raging about failing at sex, we see the old writer failing at writing about sex, which is, of course, a spectacle much more heartbreaking.

At this point, one might be thinking: enter the young men, stage right. But our new batch of young or youngish male novelists are not dreaming up Portnoys or Rabbits. The current sexual style is more childlike; innocence is more fashionable than virility, the cuddle preferable to sex. Prototypical is a scene in Dave Eggers’s road trip novel, “You Shall Know Our Velocity,” where the hero leaves a disco with a woman and she undresses and climbs on top of him, and they just lie there: “Her weight was the ideal weight and I was warm and wanted her to be warm”; or the relationship in Benjamin Kunkel’s “Indecision”: “We were sleeping together brother-sister style and mostly refraining from outright sex.”

Characters in the fiction of the heirs apparent are often repelled or uncomfortable when faced with a sexual situation. In “Infinite Jest,” David Foster Wallace writes: “He had never once had actual intercourse on marijuana. Frankly, the idea repelled him. Two dry mouths bumping at each other, trying to kiss, his self-conscious thoughts twisting around on themselves like a snake on a stick while he bucked and snorted dryly above her.” With another love interest, “his shame at what she might on the other hand

perceive as his slimy phallocentric conduct toward her made it easier for him to avoid her, as well." Gone the familiar swagger, the straightforward artistic reveling in the sexual act itself. In Kunkel's version: "Maybe I was going to get lucky, something which, I reminded myself, following her up the stairs to our room and giving her ass a good review, wasn't always a piece of unmixed luck, and shouldn't automatically be hoped for any more than feared."

Rather than an interest in conquest or consummation, there is an obsessive fascination with trepidation, and with a convoluted, postfeminist second-guessing. Compare Kunkel's tentative and guilt-ridden masturbation scene in "Indecision" with Roth's famous onanistic exuberance with apple cores, liver and candy wrappers in "Portnoy's Complaint." Kunkel: "Feeling extremely uncouth, I put my penis away. I might have thrown it away if I could." Roth also writes about guilt, of course, but a guilt overridden and swept away, joyously subsumed in the sheer energy of taboo smashing: "How insane whipping out my joint like that! Imagine what would have been had I been caught red-handed! Imagine if I had gone ahead." In other words, one rarely gets the sense in Roth that he would throw away his penis if he could.

The literary possibilities of their own ambivalence are what beguile this new generation, rather than anything that takes place in the bedroom. In Michael Chabon's "Mysteries of Pittsburgh," a woman in a green leather miniskirt and no underwear reads aloud from "The Story of O," and the protagonist says primly, "I refuse to flog you." Then take the following descriptions from Jonathan Franzen's novel "The Corrections": "As a seducer, he was hampered by ambivalence." "He had, of course, been a lousy, anxious lover." "He could hardly believe she hadn't minded his attacks on her, all his pushing and pawing and poking. That she didn't feel like a piece of meat that he'd been using." (And of course there are writers like Jonathan Safran Foer who avoid the corruptions of adult sexuality by choosing children and virgins as their protagonists.)

The same crusading feminist critics who objected to Mailer, Bellow, Roth and Updike might be tempted to take this new sensitivity or softness or indifference to sexual adventuring as a sign of progress (Mailer called these critics "the ladies with their fierce ideas.") But the sexism in the work of the heirs apparent is simply wilier and shrewder and harder to smoke out. What comes to mind is Franzen's description of one of his female characters in "The Corrections": "Denise at 32 was still beautiful." To the esteemed ladies of the movement I would suggest this is not how our great male novelists would write in the feminist utopia.

The younger writers are so self-conscious, so steeped in a certain kind of liberal education, that their characters can't condone even their own sexual impulses; they are, in short, too cool for sex. Even the mildest display of male aggression is a sign of being overly hopeful, overly earnest or politically untoward. For a character to feel himself, even fleetingly, a conquering hero is somehow passé. More precisely, for a character to attach too much importance to sex, or aspiration to it, to believe that it might be a force that could change things, and possibly for the better, would be hopelessly retrograde. Passivity, a paralyzed sweetness, a deep ambivalence about sexual appetite, are somehow taken as signs of a complex and admirable inner life. These are writers in love with irony, with the literary possibility of self-consciousness so extreme it almost precludes the minimal abandon necessary for the sexual act itself, and in direct rebellion against the Roth, Updike and Bellow their college girlfriends denounced. (Recounting one such denunciation, David Foster Wallace says a friend called Updike "just a penis with a thesaurus").

This generation of writers is suspicious of what Michael Chabon, in "Wonder Boys," calls "the artificial hopefulness of sex." They are good guys, sensitive guys, and if their writing is denuded of a certain carnality, if it lacks a sense of possibility, of expansiveness, of the bewildering, transporting effects of physical love, it is because of a certain cultural shutting down, a deep, almost puritanical disapproval of their literary forebears and the shenanigans they lived through.

In a vitriolic attack on Updike's "Toward the End of Time," David Foster Wallace said of the novel's narrator, Ben Turnbull, that "he persists in the bizarre adolescent idea that getting to have sex with whomever one wants whenever one wants is a cure for ontological despair," and that Updike himself "makes it plain that he views the narrator's impotence as catastrophic, as the ultimate symbol of death

itself, and he clearly wants us to mourn it as much as Turnbull does. I'm not especially offended by this attitude; I mostly just don't get it."

In this same essay, Wallace goes on to attack Updike and, in passing, Roth and Mailer for being narcissists. But does this mean that the new generation of novelists is not narcissistic? I would suspect, narcissism being about as common among male novelists as brown eyes in the general public, that it does not. It means that we are simply witnessing the flowering of a new narcissism: boys too busy gazing at themselves in the mirror to think much about girls, boys lost in the beautiful vanity of "I was warm and wanted her to be warm," or the noble purity of being just a tiny bit repelled by the crude advances of the desiring world.

After the sweep of the last half-century, our bookshelves look different than they did to the young Kate Millett, drinking her nightly martini in her downtown apartment, shoring up her courage to take great writers to task in "Sexual Politics" for the ways in which their sex scenes demeaned, insulted or oppressed women. These days the revolutionary attitude may be to stop dwelling on the drearier aspects of our more explicit literature. In contrast to their cautious, entangled, ambivalent, endlessly ironic heirs, there is something almost romantic in the old guard's view of sex: it has a mystery and a power, at least. It makes things happen.

Kate Millett might prefer that Norman Mailer have a different taste in sexual position, or that Bellow's fragrant ladies bear slightly less resemblance to one another, or that Rabbit not sleep with his daughter-in-law the day he comes home from heart surgery, but there is in these old paperbacks an abiding interest in the sexual connection.

Compared with the new purity, the self-conscious paralysis, the self-regarding ambivalence, Updike's notion of sex as an "imaginative quest" has a certain vanished grandeur. The fluidity of Updike's Tarbox, with its boozy volleyball games and adulterous couples copulating alfresco, has disappeared into the Starbucks lattes and minivans of our current suburbs, and our towns and cities are more solid, our marriages safer; we have landed upon a more conservative time. Why, then, should we be bothered by our literary lions' continuing obsession with sex? Why should it threaten our insistent modern cynicism, our stern belief that sex is no cure for what David Foster Wallace called "ontological despair"? Why don't we look at these older writers, who want to defeat death with sex, with the same fondness as we do the inventors of the first, failed airplanes, who stood on the tarmac with their unwieldy, impossible machines, and looked up at the sky?

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http://www.nytimes.com/2010/01/03/books/review/Roiphe-t.html?nl=books&emc=booksupdateema1

Many ignorant on 'waist fat' risk

Almost nine in 10 people are not aware of the risks of carrying extra fat around their waistline.

A survey of 12,000 Europeans found most had no idea that a thick waist was a sign of a build-up of a dangerous type of fat around the internal organs.

The report from GlaxoSmithKline, who make weight loss drug Alli, said this "visceral fat" is strongly linked with type 2 diabetes and heart disease.

Most people would lose weight once they found out the risk, the survey found.

Report author Dr Terry Maguire, honorary senior lecturer at Queen's University in Belfast, said people did not know that visceral fat, which you cannot see or feel and which sits around the organs in the abdomen, is there or that it poses a problem.

It is thought that the danger of visceral fat is related to the release of proteins and hormones that can cause inflammation, which in turn can damage arteries and enter the liver, and affect how the body breaks down sugars and fats.

" **It is the weight around your belly which really does the harm** "
Professor Steve Field, Royal College of GPs

Only a quarter of those questioned in the Europe-wide study thought being overweight was a risk to long-term health at all.

"Most overweight people still see themselves as having a body image issue not a health problem and they need to understand the health benefits of weight loss as well as the cosmetic results," he said.

Waist measurement

Research has shown that waist circumference is a good indicator of visceral fat and therefore of a person's risk of diseases associated with being overweight, such as type 2 diabetes.

The report pointed out that when weight is lost visceral fat is more easily broken down for energy than the fat immediately under the skin and even a small amount of weight loss can cause a difference.

When asked about losing weight, two-thirds of respondents said they would go on a diet in the New Year.

WAIST SIZE

Diabetes UK advises that the following waist measurements put people at risk: Women: 31.5 inches (80 cm) White men and black men: 37 inches (94cm) South Asian men: 35 inches (90cm)

But the report's co-author Professor David Haslam, chair of the UK National Obesity Forum, cautioned that steady sustainable weight loss is important and that crash diets were likely to be unsuccessful.

"They can actually do more harm than good," he said.

"Invariably weight is put back on, with some of the weight regained accumulating as visceral fat."

It comes as the Department of Health announced that more than 300 of the 1,500 babies who were likely to have been born this New Year's Day could be overweight or obese by the time they start school unless action is taken.

Professor Steve Field, chair of the Royal College of GPs, said most of the focus in recent years had been on weight.

"It is the weight around your belly which really does the harm.

"A lot of these things take a while to get into people's heads especially as there has been so much focus on weight and body mass index.

"I'm not surprised at the findings because it will take more than a few academic papers to really change people's minds."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8436409.stm

Published: 2010/01/04 00:59:00 GMT

Long-term fitness 'fights ageing'

Long-term physical activity has an anti-ageing effect at the cellular level, a German study suggests.

Researchers focused on telomeres, the protective caps on the chromosomes that keep a cell's DNA stable but shorten with age.

They found telomeres shortened less quickly in key immune cells of athletes with a long history of endurance training. The study, by Saarland University, appears in the journal Circulation.

" **This is direct evidence of an anti-ageing effect of physical exercise** "
Dr Ulrich Laufs Saarland University

In a separate study of young Swedish men, cardiovascular fitness has been linked to increased intelligence and higher educational achievement.

Telomeres are relatively short sections of specialised DNA that sit at the ends of all our chromosomes.

They have been compared to the plastic tips at the ends of shoelaces that prevent the laces from unravelling. Each time a cell divides, its telomeres shorten and the cell becomes more susceptible to dying.

National athletes

The researchers measured the length of telomeres in blood samples from two groups of professional athletes and two groups of people who were healthy non-smokers, but who did not take regular exercise.

One group of professional athletes included members of the German national track and field athletics team, who had an average age of 20.

The second group was made up of middle-aged athletes who had regularly run long distances - an average of 80km a week - since their youth.

The researchers found evidence that the physical exercise of the professional athletes led to activation of an enzyme called telomerase, which helped to stabilise telomeres.

This reduced the telomere shortening in leukocytes, a type of white blood cell that plays a key role in fighting infection and disease.

The most pronounced effect was found in athletes who had been regularly endurance training for several decades.

Potency of training

Lead researcher Dr Ulrich Laufs said: "This is direct evidence of an anti-ageing effect of physical exercise.

"Our data improves the molecular understanding of the protective effects of exercise and underlines the potency of physical training in reducing the impact of age-related disease."

" **It is still difficult to separate cause and effect from these studies - as longer telomeres may still be a marker of fitness** "
Professor Tim Spector Kings College London

Professor Tim Spector, an expert on genetics and ageing at Kings College London, said other studies had suggested more moderate exercise had a beneficial effect on ageing.

He said: "It is still difficult to separate cause and effect from these studies - as longer telomeres may still be a marker of fitness.

"Nevertheless - this is further evidence that regular exercise may retard aging."

Professor Kay-Tee Khaw, of the University of Cambridge, an expert on ageing, said: "The benefits of physical activity for health are well established from many large long-term population studies.

"Even moderate levels of physical activity are related to lower levels of many heart disease risk factors such as blood pressure and cholesterol and lower risk of many chronic diseases associated with ageing such as heart disease, stroke, diabetes and some cancers."

Intelligence link

In the second study, published in Proceeding of the National Academy of Sciences, a team from the University of Gothenburg analysed data on more than 1.2 million Swedish men born from 1950-1976 who enlisted for military service at age 18.

They found that good heart health was linked to higher intelligence, better educational achievement and raised status in society.

By studying twins in the study, the researchers concluded that environmental and lifestyle factors were key, rather than genetics.

They said the findings suggested that campaigns to promote physical exercise might help to raise standards of educational achievement across the population.

Lead researcher Professor Georg Kuhn said cardiovascular exercise increased blood flow to the brain, which in turn might help forge more and stronger connections between nerve cells.

However, he said it was also possible that intelligent people tended to make more exercise.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8385700.stm

Published: 2010/01/04 00:39:01 GMT

Biosensors offer brain insights

Scientists have developed biological cells that can give insight into the chemistry of the brain.

The cells, which change colour when exposed to specific chemicals, have been used to show how a class of schizophrenia drug works.

The researchers hope they will also help shed light on how many other drugs work on the brain.

The study, by the University of California - San Diego, is published in Nature Neuroscience.

" **It's a world of signalling between cells that we were blind to before** "
Professor David Kleinfeld University of California - San Diego

Schizophrenia is most commonly associated with symptoms such as delusions and hallucinations.

But people with the illness also struggle to sustain attention or recall information.

A class of drugs called atypical neuroleptics has become commonly prescribed, in part because they seem to improve these problems.

However, the way they altered brain chemistry was uncertain.

It was known that the drugs trigger the release of a large amount of a chemical called acetylcholine, which enables brain cells to communicate with each other.

However, the drugs have also been shown to hobble a receptor on the surface of the receiving cell, which would effectively block the message.

The San Diego team designed biological cells - called CNiFERs - which changed colour when acetylcholine latched onto this particular class of receptors - an event scientists have not previously been able to detect in a living brain.

They implanted the cells into rat brains, then stimulated a deeper part of the brain in a way known to release acetylcholine nearby.

In response, CNiFERs changed colour - proving that they were working.

They then gave the rats one of two atypical neuroleptics. In both cases the drug severely depressed the response from the CNiFERs.

This suggested that the drugs' receptor-blocking action over-rides the increase they trigger in acetylcholine.

Researcher Professor David Kleinfeld said the new cells had great potential to reveal the mysteries of chemical action in the brain.

He said: "It's a world of signalling between cells that we were blind to before."

The researchers say they are already working to redesign CNiFERS so they can detect the activity of other types of receptors as well.

Paul Corry, of the mental health charity Rethink, said: "This study shows the value of mental health research.

"It is eliciting new information that could lead to the development of more effective drug treatments for schizophrenia, which have fewer of the debilitating side-effects associated with even the most modern atypical medicines.

"That in itself would benefit millions of people around the world.

"But the research also offers a new technique for understanding the workings of the brain that could also be developed for use across broad areas of medicine.

"We really do need to recognise that mental health research is starved of funds compared to other areas of medicine and recognise also that much of it takes place at the frontiers of our understanding which means that results from it could have far-reaching applications."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8407559.stm

Published: 2010/01/04 00:20:58 GMT

Mind Reading

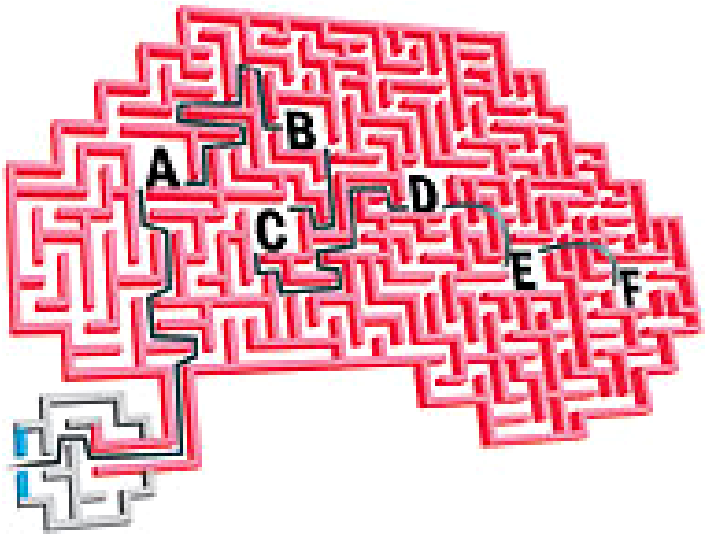
By ALISON GOPNIK
Skip to next paragraph

READING IN THE BRAIN

The Science and Evolution of a Human Invention

By Stanislas Dehaene

Illustrated. 388 pp. Viking. $27.95



At this very moment, you are actually moving your eyes over a white page dotted with black marks. Yet you feel that you are simply lost in the universe of The New York Times Book Review, alert to the seductive perfume of a promising new novel and the acrid bite of a vicious critical attack. That transformation from arbitrary marks to vivid experience is one of the great mysteries of the human mind. It's especially mysterious because reading is a relatively recent invention, dating to some 5,000 to 10,000 years ago. Our brains didn't evolve to read.

Stanislas Dehaene, a distinguished French cognitive scientist, has helped unravel that mystery. His gifts, on display in "Reading in the Brain," include an aptitude for complex experiments and an appetite for detail. This makes for excellent science but not, paradoxically, easy reading. Still, his book will repay careful study, even if it doesn't inspire blissful absorption.

Dehaene begins by describing the remarkably complicated neural circuitry devoted to getting from marks to thoughts. He then explains how reading developed historically (from Sumerian inscriptions and Egyptian hieroglyphics to the Greek and Roman alphabets and Chinese characters), how we learn to read as children and why dyslexia makes reading so hard.

Every time you complete a word recognition security test on a Web site, you are paying unconscious homage to the sophistication and subtlety of the reading brain. The most advanced spambots can't even recognize letters as well as we can, let alone recover the meaning that lurks behind them. Cognitive science has shown that the simplest experiences — talking, seeing, remembering — are the result of fiendishly complex computations. Dehaene's work, along with that of others, adds reading to the list.

But Dehaene also makes an argument that goes beyond reading, an argument about human nature itself. In "Reading in the Brain," he adopts the rhetoric of innateness, a complex of ideas developed by Noam Chomsky 50 years ago and popularized by evolutionary psychologists like Steven Pinker. He argues that reading is highly constrained by fixed, innate brain structures with only a little flexibility, just enough to allow this unprecedented skill to emerge at all.

But there are two very different kinds of innateness. Chomsky proposed that we are born with specific, genetically determined neural and cognitive structures, structures that go far beyond a few general learning mechanisms. This kind of innateness has become the established wisdom in cognitive science. The brain is not a blank slate.

However, the other, more significant, kind of innateness concerns not the history of the mind but its future. Chomsky also argued that innate structure places very strong constraints on the human mind. Evolutionary psychologists who echo Chomsky say we are stuck with the same brains as our hunter-gatherer ancestors, with just a little tinkering around the edges.

Many social scientists reject this second claim. A new generation of cognitive scientists and neuroscientists are starting to reject it, too. In the past few years, computer scientists have developed new machine learning techniques that allow computers to make genuinely new discoveries, and cognitive scientists have begun to discover that even young children's minds learn in much the same way. At the same time, neuroscientists have discovered that the brain is much more plastic — more influenced by experience — than we used to think. The brain is highly structured, but it is also extremely flexible. It's not a blank slate, but it isn't written in stone either.

Dehaene describes some fascinating and convincing evidence for the first kind of innateness. In one of the most interesting chapters, he argues that the shapes we use to make written letters mirror the shapes that primates use to recognize objects. After all, I could use any arbitrary squiggle to encode the sound at the start of "Tree" instead of a T. But actually the shapes of written symbols are strikingly similar across many languages.

It turns out that T shapes are important to monkeys, too. When a monkey sees a T shape in the world, it is very likely to indicate the edge of an object — something the monkey can grab and maybe even eat. A particular area of its brain pays special attention to those significant shapes. Human brains use the same area to process letters. Dehaene makes a compelling case that these brain areas have been "recycled" for reading. "We did not invent most of our letter shapes," he writes. "They lay dormant in our brains for millions of years, and were merely rediscovered when our species invented writing and the alphabet."

However, the very fact that our brains have become so exquisitely adapted for reading looks like an argument against the second kind of innateness — the written in stone kind. Dehaene also endorses the Chomskyan view that reading is highly constrained — that "new cultural inventions can only be acquired insofar as they fit the constraints of our brain architecture" — but it's not so clear that he really believes it himself. For example, he argues that the primate brain has evolved to treat symmetrical shapes, like the letter pairs p and q, or b and d, as if they were the same. This explains why children, and dyslexics, have so much trouble distinguishing these letters. It also explains our extraordinary ability to "mirror-read" and "mirror-write." Many children spontaneously reverse not just single letters but whole paragraphs of text.

But if reading is so tightly constrained by innate brain structure, we'd expect that we would simply never use letters like b and d at all. Instead, Dehaene shows how the reading brain has developed a new ability to discriminate these symmetries, even at the neural level. A developing brain that is exposed to symmetrical letters with different meanings will rewire and overcome its natural symmetry-blindness.

We are born with a highly structured brain. But those brains are also transformed by our experiences, especially our early experiences. More than any other animal, we humans constantly reshape our environment. We also have an exceptionally long childhood and especially plastic young brains. Each

new generation of children grows up in the new environment its parents have created, and each generation of brains becomes wired in a different way. The human mind can change radically in just a few generations.

These changes are especially vivid for 21st-century readers. At this very moment, if you are under 30, you are much more likely to be moving your eyes across a screen than a page. And you may be simultaneously clicking a hyperlink to the last "Colbert Report," I.M.-ing with friends and Skyping with your sweetheart.

We are seeing a new generation of plastic baby brains reshaped by the new digital environment. Boomer hippies listened to Pink Floyd as they struggled to create interactive computer graphics. Their Generation Y children grew up with those graphics as second nature, as much a part of their early experience as language or print. There is every reason to think that their brains will be as strikingly different as the reading brain is from the illiterate one.

Should this inspire grief, or hope? Socrates feared that reading would undermine interactive dialogue. And, of course, he was right, reading is different from talking. The ancient media of speech and song and theater were radically reshaped by writing, though they were never entirely supplanted, a comfort perhaps to those of us who still thrill to the smell of a library.

But the dance through time between old brains and new ones, parents and children, tradition and innovation, is itself a deep part of human nature, perhaps the deepest part. It has its tragic side. Orpheus watched the beloved dead slide irretrievably into the past. We parents have to watch our children glide irretrievably into a future we can never reach ourselves. But, surely, in the end, the story of the reading, learning, hyperlinking, endlessly rewiring brain is more hopeful than sad.

Alison Gopnik is the author of "The Philosophical Baby: What Children's Minds Tell Us About Truth, Love, and the Meaning of Life."

http://www.nytimes.com/2010/01/03/books/review/Gopnik-t.html?partner=rss&emc=rss

Teen depression 'linked to sleep'

Going to bed earlier protects teenagers against depression and suicidal thoughts, New York research suggests.

Of 15,500 12 to 18-year-olds studied, those who went to bed after midnight were 24% more likely to have depression than those who went before 2200.

And those who slept fewer than five hours a night had a 71% higher risk of depression than those who slept eight hours, the journal Sleep reports.

It is estimated 80,000 UK children and young people have depression.

The researchers from Columbia University Medical Center in New York looked at data from 15,500 teenagers collected in the 1990s.

One in 15 of those studied were found to have depression.

" **Enough sleep, good food and regular exercise and all essential to stay emotionally healthy** "
Sarah Brennan, YoungMinds

As well as the higher risk of depression, those who were set a bedtime by their parents of after midnight were 20% more likely to think about suicide than those whose bedtime was 2200 or earlier.

Those who had less than five hours sleep a night were thought to have a 48% higher risk of suicidal thoughts compared with those who had eight hours of sleep.

Teenagers who reported they "usually get enough sleep" were 65% less likely to be depressed.

Depression and suicidal thoughts were also more likely in girls, older teenagers and in those who had a lower self-perception of how much parents care about them.

Most of the parents of the adolescents in the study set a bedtime of 2200 or earlier.

A quarter set a bedtime of midnight or later.

On average the teenagers were having seven hours and 53 minutes sleep a night - less than the nine hours recommended at that age.

Study leader Dr James Gangwisch said although it it was possible that youngsters with depression struggle to sleep, the fact that parental set bedtimes were linked with depression suggests that a lack of sleep is somehow underpinning the development of the condition.

He said a lack of sleep could affect emotional brain responses and lead to moodiness that hindered the ability to cope with daily stresses.

This moodiness could affect judgment, concentration and impulse control.

Regular exercise

"Adequate quality sleep could therefore be a preventative measure against depression and a treatment for depression," he added.

Sarah Brennan, chief executive at the mental health charity YoungMinds, said: "Enough sleep, good food and regular exercise are all essential to stay emotionally healthy.

"Nearly 80,000 children and young people suffer with depression, yet we are still failing to provide our young people with the help and support to cope with it and prevent it.

"Providing parents with information about how to look after your body, for example by getting enough sleep, and how to get help if they are worried about their teenager, will ensure problems are tackled early and prevent serious mental health conditions such as depression."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8435955.stm

Published: 2010/01/02 00:00:02 GMT

Unreliable evidence? Time to open up DNA databases

- 06 January 2010 by **Linda Geddes**
- Magazine issue 2742.

How do we know what they've found? (Image: Peter Menzal/SPL)

Editorial: *Time for full and frank data disclosure*

WHEN a defendant's DNA appears to match DNA found at a crime scene, the probability that this is an unfortunate coincidence can be central to whether the suspect is found guilty. The assumptions used to calculate the likelihood of such a fluke - the "random match probability" - are now being questioned by a group of 41 scientists and lawyers based in the US and the UK.

These assumptions have never been independently verified on a large sample of DNA profiles, says the group. What's more, whether some RMPs are truly as vanishingly small as assumed has been called into question by recent insights into DNA databases in the US and Australia.

The group, led by Dan Krane of Wright State University in Dayton, Ohio, is demanding access to CODIS - the US national DNA database, which contains over 7 million profiles - so that they can test the assumptions behind RMPs. They have outlined their arguments in a letter, which was published in *Science* in December (vol 326, p 5960). "The national US database is a truly enormous source of data," says signatory Larry Mueller of the University of California, Irvine (UCI).

Such research could reveal if incorrect RMPs are prompting jurors and judges to attach undue weight to DNA evidence, possibly leading to miscarriages of justice. Even if these fears are not borne out, independent checks on the DNA held in large databases like CODIS are vital to maintaining confidence in DNA evidence presented in courts all over the world, the group says. Access would also allow the number of errors in CODIS to be measured.

DNA evidence, considered the gold standard in forensic science, is typically used in two ways: to link a known suspect to a crime, or to find new suspects - known as a "cold hit" - by searching for a match in a DNA database of known criminals.

Before a match can be sought, a profile is generated from a DNA sample by analysing specific locations on the chromosomes, called loci, and looking at short sections of non-coding DNA, known as short tandem repeats (STRs), which vary between individuals. An RMP is then arrived at using the estimated frequencies of these STRs, or alleles, at all the loci investigated. The more loci that are analysed at once,

the more comprehensive the profile and the smaller the RMP. Labs in the US typically look at 13 loci, while UK labs tend to look at 10.

One thing that researchers would like to use CODIS to verify is whether the allele frequency estimates are correct. Most of these estimates are based on data from small studies conducted during the early years of DNA forensics. But there are signs that these studies did not capture the true frequencies of certain alleles in some populations, which could mean that the RMPs presented in court are wrong. "When you look at real offender databases you see that there are shocking differences between what you actually see and what you would expect to see," says Krane.

Offender databases reveal shocking differences between what you see and what you would expect

The first clue that something might be amiss came in 2005, when limited data was released from the Arizona state database, a small part of CODIS. An analyst who compared every profile with every other profile in the database found that, of 65,493 profiles, 122 pairs of profiles matched at nine out of 13 loci and 20 pairs matched at 10 loci, while one pair matched at 11 loci and one more pair matched at 12 loci. "It surprised a lot of people," says signatory Bill Thompson of UCI. "It had been common for experts to testify that a nine-locus match is tantamount to a unique identification."

Unexpected matches

Similar tests have since been conducted on the Illinois state database (of 220,000 profiles, 903 pairs matched at nine or more loci) and the Maryland state database (of the 30,000 profiles, 32 pairs matched at nine loci, and three matched on all 13 loci).

One possibility is that some are duplications of the same profile in the databases - although this is not the case with the Arizona matches. Alternatively, assumptions about the frequency of alleles in populations, such as how independent these variations are of each other, might be wrong. If this is the case, access to the database is vital if these assumptions are to be corrected. "We need to learn how DNA profiles cluster by race, ethnicity and even geography," says Krane.

We need to learn how DNA profiles cluster by race, ethnicity and even geography

A third possibility is that the surprisingly high number of matches found in these databases is the result of large numbers of relatives in the database, who are more likely to have similar DNA profiles than non-relatives. This could mean that in areas of the US and other parts of the world with more closely related populations, the RMPS may need to be tweaked.

So if CODIS provided new knowledge of the frequency of certain alleles in related or unrelated people, what would the subsequent adjustments of RMPs lead to? Even with such tweaks, in cases where all 13 loci are matched, the chances of it being a coincidence will still be vanishingly small. But a 13-loci match is not always possible.

If only small amounts of DNA are recovered from crime scenes, or if samples are degraded or mixed with other people's DNA, the number of loci available for comparison is often much lower than 13. This means that the statistical weight attached to a match is lower - and the probability of a coincidental match higher. "I would say 5 to 10 per cent of database searches involve evidence profiles with fewer than 10 loci and/or that are mixtures," says Mueller.

For such cases, RMPs will be much higher, so tweaks to these estimates could make a big difference to how a jury interprets them. "I've been involved in cases where these are 1-in-67 or 1-in-83," says signatory Bill Shields of the State University of New York at Syracuse. "If those numbers are off by 50 per cent, then that could make a big difference to a jury."

Bruce Budowle, former senior scientist at the FBI, which controls CODIS, argues that fears sparked by the Arizona database are overblown. Selecting a known suspect's profile and comparing it against a crime scene profile is a bit like taking a person whose birthday is 9 January and calculating the chance that a specific other person shares that birthday, which is about 1 in 365. The comparisons made within the Arizona database were the equivalent of asking how many people in a room share any birthday - a different statistic altogether. With just 23 people, for example, the probability that any two share any birthday exceeds 50 per cent. With 60 people, it is nearly 100 per cent.

The signatories insist that this "birthday problem" can't explain all the matches, however. In 2008, Mueller developed a computer model of the Arizona database that showed that the birthday problem could account for a few, but not all of the matches (*Journal of Genetics*, vol 87, p 101).

Access to DNA databases is not just about preventing potential miscarriages of justice. In 2003, when Krane was given limited access to the DNA database for the Australian state of Victoria as part of the inquest into the death of a toddler, he noticed a cluster of 32 profiles that seemed to match at 17 of the 18 alleles tested for. This was odd because far fewer matched at just 16 alleles - you would expect the opposite to be the case. Krane says the most likely cause is mistakes made when the samples were entered into the database, which he estimates may be present in as many as 1 in 1000 samples.

Access to CODIS would reveal if it contains errors, too, which could be causing investigators searching for a cold hit to miss potential suspects. "If you have mistyped an allele or a locus, then you have a person in a database whose profile would not match his own DNA," says signatory Bicka Barlow at the San Francisco Public Defender's Office.

Will the FBI grant scientists access to CODIS? Director of the FBI Laboratory, Christian Hassell, says he appreciates the concerns the *Science* letter raises. "We are exploring ways to investigate some of the topics," he adds. But he has turned down the request for access, citing concerns about genetic privacy.

The letter's signatories point out that medical researchers who work with DNA overcome privacy issues regularly, for example by signing an agreement promising not to divulge the data and taking certain security measures.

Without external scrutiny of the databases, doubts will remain, Mueller argues. "All of this... can be resolved by letting scientists have access to the data to do what they need to do."

http://www.newscientist.com/article/mg20527424.700-unreliable-evidence-time-to-open-up-dna-databases.html?DCMP=NLC-nletter&nsref=mg20527424.700

Chimp's dance suggests a mental grasp of fire

- 10:50 06 January 2010 by **Fergal MacErlean**

Can chimps understand approaching fire? (Image: James Balog/Aurora/Getty)

Chimps have been reported dancing in rainstorms – and now it seems our closest relation has a "fire dance", too. A dominant male chimp performed such a dance in the face of a raging savannah fire in Senegal.

Anthropologist Jill Pruetz of Iowa State University in Ames recounts that the male faced the fire with "a really exaggerated slow-motion display" before redirecting his display at chimps sheltering in a nearby baobab tree. Barking vocalisations from the male, never heard in more than 2000 hours of monitoring the group, were also heard.

Pruetz and co-author Thomas LaDuke at the East Stroudsburg University of Pennsylvania suggest that the chimps were cognisant enough to predict the fire's movement, retreating short distances at a time while staying calm. Other animals, in contrast, panic when fire approaches.

"If chimps with their small brain size can conceptually deal with fire, then maybe we should rethink some of the earliest evidence for fire usage," Pruetz says. The earliest confirmed evidence of controlled fire use dates to several thousand years ago but some palaeoanthropologists argue control began as far back as 1 to 2 million years ago. The chimps' responses to two fires – set for land clearance – were seen in 2006.

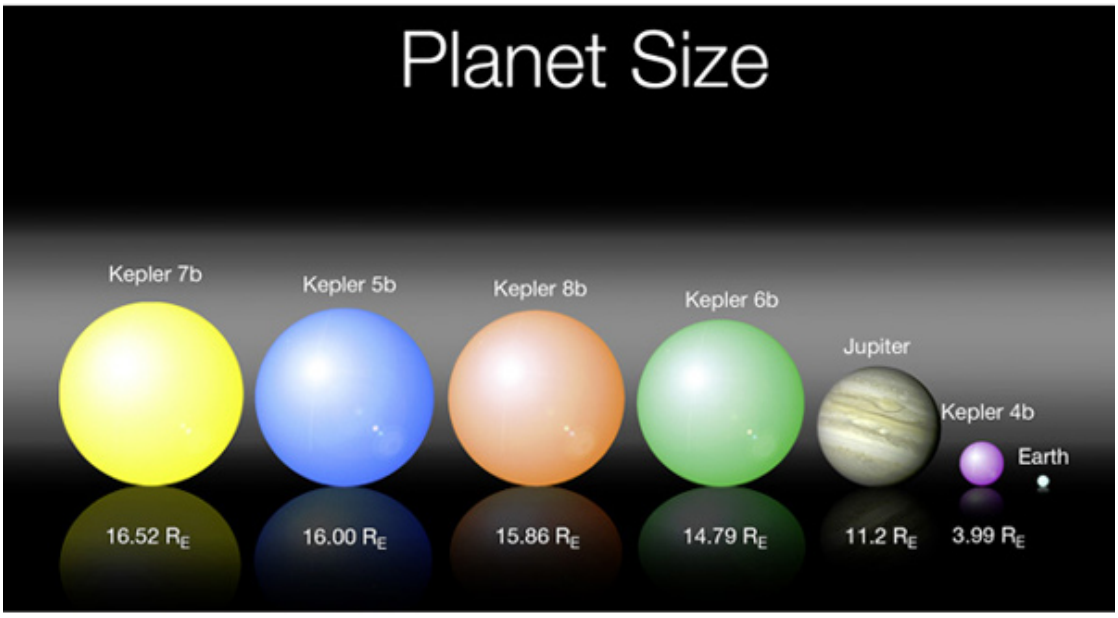
Primatologist William McGrew at the University of Cambridge is wary of granting chimps a "conceptualisation of fire", but further work could yield interesting results, he says.

Journal reference: *American Journal of Physical Anthropology*, DOI: 10.1002/ajpa.21245

http://www.newscientist.com/article/dn18342-chimps-dance-suggests-a-mental-grasp-of-fire.html?DCMP=NLC-nletter&nsref=dn18342

Kepler telescope spots 'Styrofoam' planet

- 23:21 04 January 2010 by **Rachel Courtland**, Washington DC



NASA's Kepler telescope has discovered five giant planets that whip around their stars on tight orbits (Illustration: NASA/JPL)

A giant planet with the density of Styrofoam is one of a clutch of new exoplanets discovered by NASA's Kepler telescope. The planets are too hot to support life as we know it, but the discoveries, made during the telescope's first few weeks of operation, suggest Kepler is on the right track to find Earth's twins, researchers say.

More than 400 planets have now been found orbiting other stars, but Earth-sized planets – which may be the best habitats for life – have remained elusive.

NASA's orbiting Kepler telescope is designed to find them. It has been scrutinising 100,000 stars since April 2009, searching for telltale dips in starlight created when planets pass in front of their host stars.

During its first six weeks of observations, it found five new planets. All are giants – four are heavier than Jupiter and one is about as massive as Neptune. They all orbit their host stars so closely that their surfaces are hotter than molten lava. "Looking at them might be like looking at a blast furnace," says lead scientist William Borucki, who presented the results on Monday at a meeting of the American Astronomical Society in Washington, DC.

Puffed up

The newly found planets are all less dense than expected based on models of how giant planets coalesce from gas.

One, called Kepler 7b, is about as dense as polystyrene. It is about 1.5 times as wide as Jupiter, but only about a tenth as dense, making it one of the most diffuse planets yet found.

Heat is thought to have caused this bloating, but the heating mechanism is not yet understood – it might be stellar radiation, gravitational tugs from the star, or something else.

"We think this has something to do with the fact that they are all very close to their host stars ... but we haven't found the smoking gun," says team member Dimitar Sasselov of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts.

Hotter than their hosts

Kepler's images also revealed two objects that are curiously hotter than their host stars, with temperatures of roughly 10,000 °C. These temperatures suggest the objects are diminutive stars called white dwarfs.

White dwarfs are typically about as large as Earth, but Kepler's observations suggest the objects are much larger – on the order of Jupiter's size.

One possible explanation is that the objects are white dwarfs that lost much of their mass early on, lowering the tug of gravity that keeps the stars compact, says Ronald Gilliland of the Space Telescope Science Institute in Baltimore, Maryland.

Even though the new planets are inhospitably hot, mission members say finding them bodes well for Kepler's ability to detect Earth's twins. "[They are] certainly no place to look for life. That will all come later," says Borucki.

Definitive detections of exoplanets require at least four dimming events, which means that detections of Earth-like planets on year-long orbits are still years away.

http://www.newscientist.com/article/dn18335-kepler-telescope-spots-styrofoam-planet.html?DCMP=NLC-nletter&nsref=dn18335

When men shouldn't be in want of a wife

- 06 January 2010 by **Ewen Callaway**

SOME couples come together for love, others for money, pregnancy or because they're told to. Whatever the reason, socially prescribed monogamy and its ultimate cultural expression, marriage, may have emerged because of the evolutionary benefits that both offer.

By providing men with increased assurance that their wives' children are their true heirs and women with the confidence that their kids will benefit from a decent inheritance, monogamous marriage is a win-win situation, argue Laura Fortunato at University College London and Marco Archetti at Harvard University.

Their view challenges theories of marriage that emphasise the role of religion and the societal benefits of keeping men from fighting over women. Such theories also contend that by giving up multiple wives or partners, men sacrifice their interests for those of the group.

"But there are actually some situations where monogamous marriage is a better strategy for men as well as for women," says Fortunato, who created a mathematical model to find out how such scenarios might work.

The emergence of social monogamy - where monogamyis socially enforced and polygamy is forbidden - is a mystery. The Babylonian king Hammurabi prescribed it in his ancient law code around 1790 BC, though the practice probably stretches back thousands of years further. Fortunato distinguishes this from pair bonding and sexual monogamy, which was practiced by early humans and their ancient ancestors. She says the fact that many populations around the world practice some form of polygyny is a clear indication that social monogamy is not inevitable and therefore needs explaining.

Fortunato and Archetti conclude that men and women will tend to form socially monogamous pairs when land is scarce and its cultivation intense, because men would risk diluting the value of their propertyby dividing it up among too many offspring and heirs. "Having a plot of land that is not big enough to support your family is not clever," says Fortunato.Men and women will tend to form exclusive pairs when land is scarce and its cultivation intense The pair modelled the behaviour of populations incorporating monogamous and polygynous men over two generations. They made the assumption that women in early agrarian cultures did not provide much in the way of material resources. Monogamy won out over polygyny, in terms of reliably passing resources to the most genetically related family members, so long as property remained precious, women mostly faithful and men shrewd - that is, they transferred property exclusively to the children of faithful wives (*Journal of Evolution Biology*, vol 23, p 149). So far, real-world support for this model is anecdotal.

Fortunato suggests that the advent and spread of agriculture about 10,000 years ago played an integral role in the emergence of monogamy, since until then owning specific land was largely pointless. Population growth and technological advances allowed farmers to grow crops more effectively, increasing the value of land to future generations.

Fortunato also reckons that cultures adopt religions that fit their monogamous or polygamous values, rather than the other way around. "I think the evidence must come from archaeology and changes in marriage systems," she says.

Anthropologist Sarah Blaffer Hrdy at the University of California, Davis, says humans are flexible and opportunistic in other aspects of their lives, "so why shouldn't their marriage customs reflect this?"

http://www.newscientist.com/article/mg20527425.300-when-men-shouldnt-be-in-want-of-a-wife.html?DCMP=NLC-nletter&nsref=mg20527425.300

You won't find consciousness in the brain

- 07 January 2010 by **Ray Tallis**

Magazine issue 2742.

Consciousness in action? It is tempting to think that's what is going on - but wrong (Image: Hans Neleman/Getty)

MOST neuroscientists, philosophers of the mind and science journalists feel the time is near when we will be able to explain the mystery of human consciousness in terms of the activity of the brain. There is, however, a vocal minority of neurosceptics who contest this orthodoxy. Among them are those who focus on claims neuroscience makes about the preciseness of correlations between indirectly observed neural activity and different mental functions, states or experiences.

This was well captured in a 2009 article in *Perspectives on Psychological Science* by Harold Pashler from the University of California, San Diego, and colleagues, that argued: "...these correlations are higher than should be expected given the (evidently limited) reliability of both fMRI and personality measures. The high correlations are all the more puzzling because method sections rarely contain much detail about how the correlations were obtained."

Believers will counter that this is irrelevant: as our means of capturing and analysing neural activity become more powerful, so we will be able to make more precise correlations between the quantity, pattern and location of neural activity and aspects of consciousness.

This may well happen, but my argument is not about technical, probably temporary, limitations. It is about the deep philosophical confusion embedded in the assumption that if you can correlate neural activity with consciousness, then you have demonstrated they are one and the same thing, and that a physical science such as neurophysiology is able to show what consciousness truly is.

Many neurosceptics have argued that neural activity is nothing like experience, and that the least one might expect if A and B are the same is that they be indistinguishable from each other. Countering that objection by claiming that, say, activity in the occipital cortex and the sensation of light are two aspects of the same thing does not hold up because the existence of "aspects" depends on the prior existence of consciousness and cannot be used to explain the relationship between neural activity and consciousness.

This disposes of the famous claim by John Searle, Slusser Professor of Philosophy at the University of California, Berkeley: that neural activity and conscious experience stand in the same relationship as molecules of H_2O to water, with its properties of wetness, coldness, shininess and so on. The analogy fails

as the level at which water can be seen as molecules, on the one hand, and as wet, shiny, cold stuff on the other, are intended to correspond to different "levels" at which we are conscious of it. But the existence of levels of experience or of description presupposes consciousness. Water does not intrinsically have these levels.

We cannot therefore conclude that when we see what seem to be neural correlates of consciousness that we are seeing consciousness itself. While neural activity of a certain kind is a necessary condition for every manifestation of consciousness, from the lightest sensation to the most exquisitely constructed sense of self, it is neither a sufficient condition of it, nor, still less, is it identical with it. If it were identical, then we would be left with the insuperable problem of explaining how intracranial nerve impulses, which are material events, could "reach out" to extracranial objects in order to be "of" or "about" them. Straightforward physical causation explains how light from an object brings about events in the occipital cortex. No such explanation is available as to how those neural events are "about" the physical object. Biophysical science explains how the light gets in but not how the gaze looks out.

Many features of ordinary consciousness also resist neurological explanation. Take the unity of consciousness. I can relate things I experience at a given time (the pressure of the seat on my bottom, the sound of traffic, my thoughts) to one another as elements of a single moment. Researchers have attempted to explain this unity, invoking quantum coherence (the cytoskeletal micro-tubules of Stuart Hameroff at the University of Arizona, and Roger Penrose at the University of Oxford), electromagnetic fields (Johnjoe McFadden, University of Surrey), or rhythmic discharges in the brain (the late Francis Crick).

These fail because they assume that an objective unity or uniformity of nerve impulses would be subjectively available, which, of course, it won't be. Even less would this explain the unification of entities that are, at the same time, experienced as distinct. My sensory field is a many-layered whole that also maintains its multiplicity. There is nothing in the convergence or coherence of neural pathways that gives us this "merging without mushing", this ability to see things as both whole and separate.

And there is an insuperable problem with a sense of past and future. Take memory. It is typically seen as being "stored" as the effects of experience which leave enduring changes in, for example, the properties of synapses and consequently in circuitry in the nervous system. But when I "remember", I explicitly reach out of the present to something that is explicitly past. A synapse, being a physical structure, does not have anything other than its present state. It does not, as you and I do, reach temporally upstream from the effects of experience to the experience that brought about the effects. In other words, the sense of the past cannot exist in a physical system. This is consistent with the fact that the physics of time does not allow for tenses: Einstein called the distinction between past, present and future a "stubbornly persistent illusion".

There are also problems with notions of the self, with the initiation of action, and with free will. Some neurophilosophers deal with these by denying their existence, but an account of consciousness that cannot find a basis for voluntary activity or the sense of self should conclude not that these things are unreal but that neuroscience provides at the very least an incomplete explanation of consciousness.

I believe there is a fundamental, but not obvious, reason why that explanation will always remain incomplete - or unrealisable. This concerns the disjunction between the objects of science and the contents of consciousness. Science begins when we escape our subjective, first-person experiences into objective measurement, and reach towards a vantage point the philosopher Thomas Nagel called "the view from nowhere". You think the table over there is large, I may think it is small. We measure it and find that it is 0.66 metres square. We now characterise the table in a way that is less beholden to personal experience.

Science begins when we escape our first-person subjective experience

Thus measurement takes us further from experience and the phenomena of subjective consciousness to a realm where things are described in abstract but quantitative terms. To do its work, physical science has to discard "secondary qualities", such as colour, warmth or cold, taste - in short, the basic contents of consciousness. For the physicist then, light is not in itself bright or colourful, it is a mixture of vibrations in an electromagnetic field of different frequencies. The material world, far from being the noisy, colourful, smelly place we live in, is colourless, silent, full of odourless molecules, atoms, particles, whose nature and behaviour is best described mathematically. In short, physical science is about the marginalisation, or even the disappearance, of phenomenal appearance/qualia, the redness of red wine or the smell of a smelly dog.

Consciousness, on the other hand, is all about phenomenal appearances/qualia. As science moves from appearances/qualia and toward quantities that do not themselves have the kinds of manifestation that make up our experiences, an account of consciousness in terms of nerve impulses must be a contradiction in terms. There is nothing in physical science that can explain why a physical object such as a brain should ascribe appearances/qualia to material objects that do not intrinsically have them.

Material objects require consciousness in order to "appear". Then their "appearings" will depend on the viewpoint of the conscious observer. This must not be taken to imply that there are no constraints on the appearance of objects once they are objects of consciousness.

Our failure to explain consciousness in terms of neural activity inside the brain inside the skull is not due to technical limitations which can be overcome. It is due to the self-contradictory nature of the task, of which the failure to explain "aboutness", the unity and multiplicity of our awareness, the explicit presence of the past, the initiation of actions, the construction of self are just symptoms. We cannot explain "appearings" using an objective approach that has set aside appearings as unreal and which seeks a reality in mass/energy that neither appears in itself nor has the means to make other items appear. The brain, seen as a physical object, no more has a world of things appearing to it than does any other physical object.

Profile

Ray Tallis trained as a doctor, ultimately becoming professor of geriatric medicine at the University of Manchester, UK, where he oversaw a major neuroscience project. He is a Fellow of the Academy of Medical Sciences and a writer on areas ranging from consciousness to medical ethics

http://www.newscientist.com/article/mg20527427.100-you-wont-find-consciousness-in-the-brain.html

Chilling out in the coldest place on Earth

- 06 January 2010
- Magazine issue 2742.

Just when you think it can't get any colder (Image: Michael Studinger/Lamont Doherty Earth Observatory/Columbia University)

VOSTOK Station in Antarctica currently holds the crown for the coldest place on the planet. It recorded -89.2 °C on 21 July 1983. But it could get even colder, with temperatures dropping to about -96 °C, if "perfect" cold-weather conditions prevail.

John Turner of the British Antarctic Survey and colleagues analysed the weather conditions that brought about the record chill and found it was caused by an unusual, near-stationary atmospheric vortex. "This isolated Vostok and prevented the waves of warm air that normally come up from the ocean," says Turner. After that big chill, the temperature bounced up by over 20 °C in one day (*Journal of Geophysical Research - Atmospheres*, DOI: 10.1029/2009JD012104).

If the wind speed were lower and a similar vortex centred on Vostok, Turner reckons that the temperature could drop by a further 6 °C or so. But the researchers say that the coldest place of all might be nearby Dome Argus, where a higher elevation could mean temperatures fall beyond -100 °C. Understanding temperature swings is important for interpreting Antarctic ice-core records, says Turner.

http://www.newscientist.com/article/mg20527426.200-chilling-out-in-the-coldest-place-on-earth.html

Cellphone radiation is good for Alzheimer's mice

- 12:16 07 January 2010 by **Jessica Hamzelou**

Not so bad after all (Image: DAJ/Getty)

Despite years of demonisation, mobile phones might actually do us more good than harm. Regular exposure to an electromagnetic field identical to the ones produced by mobile phones seems to improve memory in mice with symptoms of Alzheimer's disease.

Mobile phones have long been vilified by those who claim the gadgets give off radiation that harms the brain. Alzheimer's disease researcher Gary Arendash, a neuroscientist at the University of South Florida in Tampa, was gazing out of his window at people nattering on their phones when it occurred to him the radiation might have a specific, negative effect on the brains of people with Alzheimer's.

To investigate further, he and his colleagues turned to two-month-old mice that had been genetically engineered to develop symptoms similar to those caused by Alzheimer's as they aged, and similarly transgenic four-month-old mice that had already developed the symptoms.

Maze learning

The team placed an antenna that generated electromagnetic waves of the same wavelength as those produced by mobile phones in the centre of a room, and the mice in cages around it. This was designed to give the mice a similar dose of radiation as a person talking on a mobile phone. The group also placed normal, healthy mice in cages in the same room.

To mimic human phone use, the researchers turned on the antenna for 1 hour twice a day for nine months. Over this period, they regularly tested the mice's memory using a maze task in which the mice had to remember an escape route.

To the researchers' surprise, the memory of both normal and transgenic mice exposed to the electromagnetic field (EMF) seemed better by the end of the experiment than that of a control group of mice that were not irradiated.

Arendash speculates that radiation might increase the electrical activity of neurons, which could in turn improve the brain's ability to form memories. An experiment in 2000 found that if people were exposed to an EMF equivalent to mobile-phone radiation before they went to bed, their brain activity during sleep increased.

Plaque reduction

But the EMF also seemed to have a unique effect on the mice with Alzheimer's symptoms. At the end of the experiment, Arendash's team examined the brains of the mice for plaques made of beta-amyloid protein, which are characteristic of the disease.

They found that the brains of transgenic mice that had been exposed to the EMF from two months old did not contain as many plaques as transgenic control mice of the same age that had not been exposed to the EMF.

What's more, in the older transgenic mice, which had already developed brain plaques before the experiment began, the EMF exposure seemed to have broken up and shrunken the plaques. Arendash say he doesn't know how the EMF could do this.

Aside from the brain benefits, Arendash's group couldn't find any other effects of the EMF on the mice. "There was no effect on their behaviour, no damage to their DNA and no sign of any tumours or organ damage," says Arendash.

Replication required

John Hardy, a neuroscientist at University College London, agrees that it's difficult to work out what could be causing the effect. He says that the results must be replicated before firm conclusions are drawn.

Arendash says he expects to see positive effects in people with Alzheimer's disease who use mobile phones over a long period. Because people tend to use the same ear whenever they listen to their phone, he reckons we might even see differences in plaque formation in different sides of the brain in people with Alzheimer's who also use mobile phones. "No one's ever looked before," he says.

Susan Sorensen, head of research at the Alzheimer's Society in London, thinks it may be too soon to translate the findings to humans. "A lot more work is needed before we can say anything about the possible preventative or treatment effects of this type of radiation on people with Alzheimer's disease," she says. But she admits that the results are "exciting".

The group now hope to fine-tune the exact wavelength and duration of the EMF in order to squeeze out the maximum benefit to the brain.

Arendash says that exposure to an EMF might become part of treatments given to people with Alzheimer's or other types of brain problem. "It might also be useful in traumatic brain injury, which is also characterised by plaques, or just to improve cognitive performance," he says.

Journal reference: *Journal of Alzheimer's Disease*, DOI: 10.3233/jad-2009-1228

http://www.newscientist.com/article/dn18351-cellphone-radiation-is-good-for-alzheimers-mice.html

Supermassive black holes – the fathers of galaxies

- 06 January 2010 by **Marcus Chown**

Magazine issue 2742.

Supermassive black holes may have fathered our galaxy (Image: Arthur Kwiatkowski)

ONCE upon a time, a vast cloud of cold gas was floating in the void of space, a patch of inert blackness against the even deeper blackness behind. Then, as if from nowhere, a thin jet of matter streaked towards it at ultra-high speed. It slammed into the cloud, compressing its matter and triggering a firestorm of star formation. What had once been a dormant gas cloud was now a full-blown galaxy.

Is this how a galaxy is born? David Elbaz's team of astrophysicists is convinced of it. Their idea that galaxies were zapped into existence affects our story of how the universe unfolded and puts supermassive black holes, objects that were once considered esoteric cosmic curiosities, at the very heart of the picture. Supermassive black holes power objects called quasars that are capable of unleashing jets of matter at very high speeds, and it's these jets that Elbaz believes trigger galaxy formation.

If he is right, our accepted notion of galaxy formation will be turned on its head. It also has a startling implication for our ultimate origins. "It may be that none of us would be here but for the supermassive black hole whose jet created the proto-galaxy that in time became our own Milky Way," says Elbaz, at the French Atomic Energy Commission (CEA) in Saclay.

Elbaz and his team didn't plan to rewrite cosmic history. They set out to study the link between supermassive black holes and galaxies, a connection that has baffled researchers trying to understand galaxy formation. The problem first came to light, literally, in the mid-1960s, when quasars were discovered. These very bright, compact objects can release up to 100 times more light than a galaxy like the Milky Way. Such prodigious light output from so small an object can only be explained if this energy is springing from the brilliant core of a galaxy containing a supermassive black hole: the black hole's gravity pulls in surrounding gas and dust, which swirls into a disc and heats up to release enough radiation to outshine everything else.

Back then, many researchers thought that supermassive black holes were only found in quasars, and that as quasars are very rare in the universe, they were inconsequential cosmic anomalies. That view changed, however, with the discovery that at the heart of most, if not all, galaxies there lurks a supermassive black hole. They had remained hidden because in most galaxies, including our own, the "central engine" is starved of fuel and therefore lies dormant.

What is so surprising is the extent to which supermassive black holes influence their parent galaxies. Despite their name, supermassive black holes are very compact objects so you wouldn't expect one to hold much sway over its parent galaxy. Take the Milky Way, for example. We know it is a dense disc of stars and gas 150,000 light years wide, whereas the black hole lurking at its heart would fit inside the orbit of Mercury.

Naked quasar

Yet nearby galaxies all seem to follow an elegant but unexplained relationship: all seem to have central bulges of stars about 700 times as massive as the black holes at their hearts. This relationship between galaxies and supermassive black holes suggests that the growth of one influenced the other. Further evidence of a link comes from the fact that star formation and quasar activity both peaked around the same time, 8 to 10 billion years ago.

So how could something so small affect a galaxy? Elbaz and his colleagues knew one way a supermassive black hole could punch above its weight: when it squirts out matter in two oppositely directed, thread-like jets. This is because the jets of matter can travel within a whisker of the speed of light for the first few light years, allowing them to break out of the surrounding galaxy and travel millions of light years into intergalactic space.

To find out more about the influence of these jets, Elbaz's team began studying an unusual quasar called HE0450-2958 and its jets. Located 5 billion light years away, HE0450-2958 is the only known "naked quasar" - a supermassive black hole without a surrounding galaxy (*Nature*, vol 437, p 381).

Some astronomers have speculated that HE0450-2958 does have a surrounding galaxy, but that it is hidden from view by large amounts of dust. As dust glows at infrared wavelengths, Elbaz's team used the infrared instruments on the Very Large Telescope in Chile to investigate. That's when they made a startling discovery.

As they looked more closely, they noticed that the quasar's jets stabbed like a laser beam into a galaxy 23,000 light years away. That galaxy is rich in bright, young stars and is forming them at a rate equivalent to 350 suns per year, a hundred times more than you would expect for galaxies in that area. Elbaz reckons this frantic pace of star formation is no coincidence. "We think this indicates that the quasar jet actually gave birth to the galaxy," he says.

This is a radical shift from the standard view of galaxy formation, in which galaxies came first and supermassive black holes follow (see diagram). Elbaz and his colleagues think the opposite is true: supermassive black holes trigger galaxy formation.

In the case of HE0450-2958, they think it started off as a supermassive black hole that sucked in gas from intergalactic space until it became a quasar. It kept growing until a critical moment about 200 million years ago when its jets switched on. One of the jets slammed into a gas cloud 23,000 light years away, sending shock waves through the gas. This triggered star formation, resulting in the galaxy we now see.

The team knew how controversial their idea would be. So before they announced their theory, they checked there was no other explanation for the association between the quasar and the galaxy that its jet points towards. First they considered the idea that HE0450-2958 had been kicked out of the galaxy. Simulations have shown that when two galaxies merge, their central black holes can ricochet off each other, with one ejected into intergalactic space.

However, Elbaz points out that it would be an odd coincidence if the quasar was ejected in the same direction as one of its jets. What's more, to escape a galaxy as big as the one in question - which is about the mass of our Milky Way - it would have to be kicked out at about 500 kilometres per second. Not only

is there no evidence of a galaxy merger within the past few hundred million years, but the velocity of the quasar is only about 200 kilometres per second, making it too slow to be a galactic escapee.

In fact, the slow speed of the quasar means that, over time, it will fall into the galaxy it apparently created. "Rather than the supermassive black hole growing in the centre of a galaxy after the galaxy has formed, a supermassive black hole creates a galaxy from outside, then later takes its place at the heart of the galaxy," says Elbaz.

Astrophysicist Joseph Silk of the University of Oxford is impressed with the work. "It's definitely a new and important advance," he says. Others agree. "HE0450-2958 certainly fits the scenario for quasar-induced galaxy formation and that's what makes it so exciting," says Kevin Schawinski of Yale University. However, he cautions that it is only one example from recent cosmic history. "The epoch of massive galaxy formation and quasar activity occurs at early times," he says, "so it will be interesting to see if other systems like HE0450-2958 will be found in the early universe."

For others, it's a leap too far. David Merritt at the Rochester Institute of Technology in New York state has made detailed studies of HE0450-2958. "Elbaz's team does a good job of showing that the quasar is affecting conditions in the companion galaxy," he says. "However, it is a leap from there to the idea that the quasar is basically responsible for the companion galaxy."

Undeterred, Elbaz and his team have already begun looking for other, earlier examples. The beauty of their scenario is that it does not rely on finding more naked quasars like HE0450-2958. "By virtue of their jets, supermassive black holes have the power to transform gas clouds into galaxies whether they are naked or deep in the heart of a galaxy," he says.

He thinks it's even possible for a single quasar to trigger the formation of not just one, but many galaxies. Some quasars have jets that sweep around the heavens like a lighthouse beam - this is thought to happen when another supermassive black hole is in the process of merging with the quasar. As the jets sweep around they could awaken one sleeping gas cloud after another, says Elbaz. That would certainly explain why normal galaxies are often seen clustered near quasars.

It's even possible for a single quasar to trigger the formation of not just one, but many galaxies Astronomers, most notably Halton Arp at the Max Planck Institute for Astrophysics in Garching, Germany, and Geoffrey Burbidge of the University of California, San Diego, have claimed that this clustering is evidence that galaxies give birth to quasars, then eject them. "We're suggesting the exact opposite," says Elbaz. "It's quasars that give birth to galaxies."

One intriguing possibility is that galaxy formation may not even require the presence of a sleeping gas cloud to be brought to life by a quasar jet. That's because such jets can eject up to 100 million solar masses of matter per year and stay switched on for a few hundred million years. This means that, in their lifetime, they may eject enough material to build a large galaxy from scratch.

Look to the clouds

So how can the theory of quasar-induced galaxy formation be proved? Elbaz says we should be looking for objects at an earlier stage of evolution than HE0450-2958 and its nearby galaxy, in particular quasars that are offset from clouds of cold molecular gas - the stage prior to star formation.

In fact, Elbaz thinks some such systems have already been found. "Astronomers have been puzzled to find quasars offset by clouds of carbon monoxide," he says. "In our scenario, there is no puzzle. It makes perfect sense."

Further support for Elbaz's theory comes in the form of evidence showing that supermassive black holes had reached their maximum mass early on in cosmic history. This suggests that there was an epoch

preceding galaxy formation when supermassive black holes grew and ruled the universe - the opposite to what the standard view posits. "This supports our idea," he says.

Of course, if supermassive black holes did form first and then gave birth to galaxies, the $64,000 question is: where did the supermassive black holes come from? "This is the one missing jigsaw piece," admits Elbaz.

While no one knows for sure, there are some ideas on the table. Observations of quasars show that monster black holes weighing 10 billion solar masses formed within a billion years of the big bang. For years, various teams have been puzzling over how they could have grown into such behemoths so quickly.One idea is that they grew from the much smaller black holes which form when a star reaches the end of its life and collapses. In a superdense cluster of stars, several of these black holes might merge to create a huge one that continues to grow by feeding on gas. But critics of this idea point out that there was simply not enough time in the first billion years after the big bang for stellar-mass black holes to merge into something big enough.

An alternative idea involves the formation of single, supermassive stars, a scenario first envisaged by the astronomers Fred Hoyle and Willy Fowler in 1963. If a star like this ever formed, it would be so massive that the heat generated by nuclear burning at its core would not be enough to oppose the gravity trying to crush it. The whole thing would collapse at once, creating a supermassive black hole.

Mitchell Begelman at the University of Colorado in Boulder has studied this scenario in detail and believes that something even stranger happened (*New Scientist*, 16 May 2008, p 30). According to his calculations, the seeds of supermassive black holes formed inside the supermassive stars, growing at a faster rate than they could support in the void of space. Eventually, the outer layers of these curious stars explode to reveal the black hole hidden within. To test the idea, we'll have to wait for the next generation of telescopes.

Hoyle famously showed that we are all made of stardust. We may soon want to add that we all come from black holes, too.

Bibliography

1. "Quasar induced galaxy formation: a new paradigm?" by David Elbaz, Knud Jahnke, Eric Pantin, Damien Le Borgne and Géraldine Letawe (*Astronomy and Astrophysics*, vol 507, p 1359)

Supermassive black hole basics

Every galaxy is thought to harbour a supermassive black hole, ranging from millions of times the mass of the sun to many billion solar masses. The black hole sucks in gas to form a swirling disc of hot matter around it. How bright the core of a galaxy shines depends on the amount of gas it contains. Some galaxies, like the Milky Way, appear dormant because their diet is gas poor. In other active galaxies, the amounts of gas are so vast that the core outshines the stars in the galaxy. Quasars are the most extreme examples of active galaxies and can produce up to 100 times as much light as the whole galaxy from a volume not much bigger than the solar system.

Marcus Chown's latest book is We Need to Talk About Kelvin (Faber & Faber, 2009)

http://www.newscientist.com/article/mg20527421.000-supermassive-black-holes--the-fathers-of-galaxies.html

Get ready for China's domination of science

- 06 January 2010 by **Jonathan Adams**

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Science goes east (Image: Guang Niu/Getty)

SINCE its economic reform began in 1978, China has gone from being a poor developing country to the second-largest economy in the world. China has also emerged from isolation to become a political superpower. Its meteoric rise has been one of the most important global changes of recent years: the rise of China was the most-read news story of the decade, surpassing even 9/11 and the Iraq war.

Yet when it comes to science and technology, most people still think of China as being stuck in the past and only visualise a country with massive steelworks and vast smoking factories.

That may have been true a few years ago, but it is no longer the case. Very quietly, China has become the world's second-largest producer of scientific knowledge, surpassed only by the US, a status it has achieved at an awe-inspiring rate. If it continues on its current trajectory China will overtake the US before 2020 and the world will look very different as a result. The historical scientific dominance of North America and Europe will have to adjust to a new world order.

In the west, we are largely familiar with research systems in which money, people and output stay roughly the same from year to year. Research spending in Europe and North America has outpaced economic growth since 1945, but not by a dramatic amount.

Not so with China. Data from the Organisation for Economic Cooperation and Development shows that between 1995 and 2006, China's gross expenditure on R&D (GERD) grew at an annual rate of 18 per cent. China now ranks third on GERD, just behind the US and Japan and ahead of any individual European Union state.

Universities have experienced similar growth. China's student population has reportedly reached 25 million, up from just 5 million nine years ago. China now has 1700 higher education institutions, around 100 of which make up the "Project 211" group. These elite institutions train four-fifths of PhD students, two-thirds of graduate students and one-third of undergraduates. They are home to 96 per cent of the country's key laboratories and consume 70 per cent of scientific research funding.

China's student population has reached 25 million, up from just 5 million nine years ago

What impact has this had? I recently authored a report analysing China's research strengths and its patterns of international collaboration. The data was drawn from Thomson Reuters, which indexes scientific papers from around 10,500 journals worldwide.

In 1998, China's research output was around 20,000 articles per year. In 2006 it reached 83,000, overtaking the traditional science powerhouses of Japan, Germany and the UK. Last year it exceeded 120,000 articles, second only to the US's 350,000.

Compare that rate of growth with the US, where research output increased by about 30 per cent over the past decade, and it is clear that normal ideas about science management simply do not apply to China.

China is also diversifying its research base. A traditional industrial economy would focus its research on physical sciences and engineering, and our findings confirm that this is where China has been concentrating. But it is also rapidly shifting out of the old economy into new areas.

China produces 10 per cent of the world's publications in engineering, computer sciences and earth sciences, including minerals. It now also produces 20 per cent of global output in materials sciences, with a leading position in composites, ceramics and polymer science and a strong presence in crystallography and metallurgical engineering. The implications for future industrial development are enormous, as China makes the transition from a manufacturing economy to a knowledge economy based on research coming out of its own institutions.

Agricultural research is also expanding as China takes a scientific approach to its vast food demand and supply. Its relatively small share of molecular biology and related areas - around 5 per cent - has suddenly become an investment focus too. If growth in biomedical sciences is as rapid and substantial as it has been elsewhere then China's impact on gene and protein research will be profound.

An obvious word of warning needs to be made here: quantity is not the same as quality. Measuring the volume of China's scientific output is clearly both valuable and surprising but it doesn't tell us whether that research was any good. For that we turn to a useful proxy: China's scientific collaboration with other countries better known for the high quality of their science. The results here, too, are eye-opening.

China is not doing science behind closed doors; its international collaborations are growing. Nearly 9 per cent of papers originating from Chinese institutions have a US-based co-author. Japanese and British co-authorship is also growing. Collaboration with South Korea and Singapore almost trebled between 2004 and 2008 and collaboration with Australia expanded too - signs, perhaps, of an emerging Asia-Pacific regional network.

So what does this all mean? Firstly, China's emergence as a scientific superpower can no longer be denied, and it is a question of when rather than if it will become the world's most prolific producer of scientific knowledge. Perhaps more importantly, China's expanding regional collaborations show that Asia-Pacific nations no longer rely on links to the European and American institutions that have traditionally led the science world.

The question for the EU and the US as we enter the new decade is no longer about whether we should collaborate with China, but what we can bring to the table to ensure that China wants to collaborate with us.

Jonathan Adams is director of research evaluation at Thomson Reuters in London. He is co-author of Global Research Report: China

http://www.newscientist.com/article/mg20527426.900-get-ready-for-chinas-domination-of-science.html

Gene rice on its way in China

- 09:30 04 January 2010 by **Andy Coghlan**

GM crops have been cleared for commercial cultivation (Image: Jeff Hutchens/Getty)

Genetically modified rice cleared for commercial sale could be growing on Chinese farms as early as next year, making China the first country to allow commercial cultivation of GM strains. The field trials required for any new variety are now under way, following official safety clearance November.

Two varieties, called Huahui 1 and Bt Shanyou 63, received clearance and should be launched within the next two years. Both contain "Bt" proteins from the *Bacillus thuringiensis* bacterium to protect them against the rice stem borer, the most serious rice pest in China.

"I expect that large-scale production of these two insect-resistant rices will occur in 2011 in Hubei province, one of the major rice production regions in China," says Jikun Huang, director of the Center for Chinese Agricultural Policy of the Chinese Academy of Sciences in Beijing.

If all goes well in Hubei, Huang expects rapid commercial approval elsewhere in China. He brushes aside the idea that the GM varieties may damage trade by contaminating exports, pointing out that exports account for less than 1 per cent of the country's total rice production.

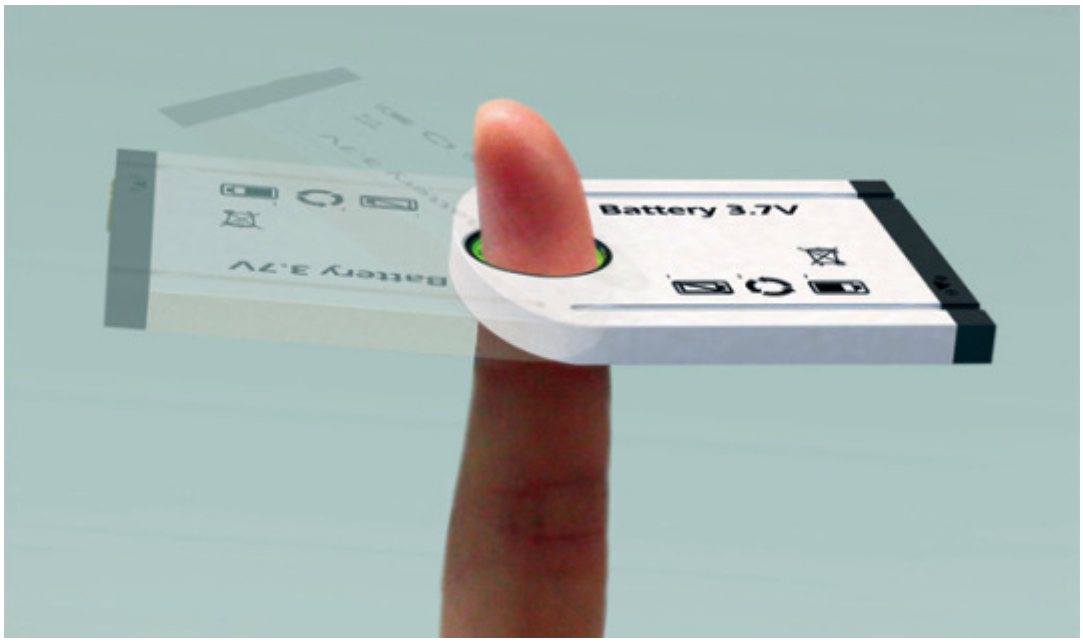
Previous experimental field trials of GM rice varieties in China, including the two now poised for commercialisation, showed that they benefited poor farmers and decreased their exposure to harmful pesticides.

Bob Zeigler, director of the non-profit International Rice Research Institute (IRRI) in Los Baños, the Philippines, is optimistic about the future of GM rice, saying that GM technology can deliver unique traits that are otherwise unobtainable. This year, farmers in India and the Philippines have begun receiving a flood-tolerant rice developed at the IRRI which is non-GM but was developed using knowledge from GM studies.

http://www.newscientist.com/article/dn18328-gene-rice-on-its-way-in-china.html

Twirling Battery Provides Instant Energy for a Dead Cellphone

by Bridgette Meinhold, 01/06/10



This spinning kinetic cellphone battery is a smart solution for times when your phone is dangerously low on juice. With a simple twirl of your finger, you can charge your battery with enough energy to provide a couple more minutes of talk time or a number of minutes of standby. As we gear up for the 2010 Greener Gadgets Design Competition we're thrilled to see innovative ideas like this, so if you have a great idea for a green gadget submit it today!

Designed by Song Teaho & Hyejin Lee, the cell phone battery is recharged by simply placing it on your finger and twirling. As the diagrams indicate, twirling the battery 130 times will generate enough power to provide you 2 more minutes of talk time or 25 minutes of standby power. If a cell phone battery like this ever gets manufactured and becomes popular, expect to see the next dance craze centered around twirling your finger.

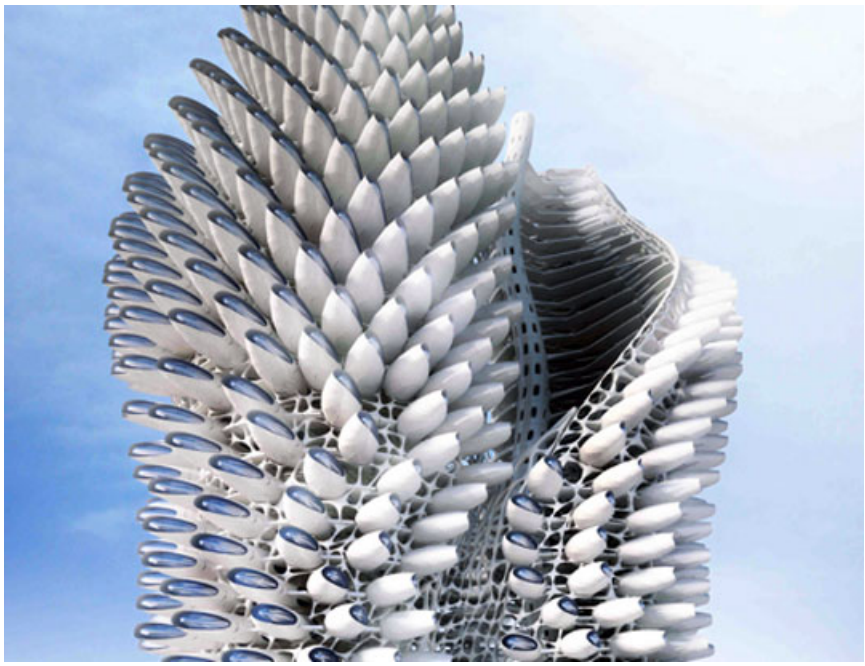
With extra research and development, clean energy charging technologies like this one, will advance even further. But until we design and manufacture greener gadgets powered by the with photovoltaics or kinetic energy, we can't stray too far from outlet.

Via Yanko Design

http://www.inhabitat.com/2010/01/06/twirling-battery-provides-instant-fix-for-dead-battery/?utm_source=Inhabitat+Weekly&utm_campaign=bceda98ac8-Inhabitat_Weekly_November_19th11_12_2009&utm_medium=email

Spiraling Skyscraper Pod City For a Future London

by Mike Chino, 01/05/10



Design team Chimera has conceived of an incredible series of spiraling skyscrapers for London modeled after the complex ecosystems created by the mangrove tree. Dubbed Mangal City, the project is an "urban ecological system" composed of modular pod capsules that shift to adapt to environmental and contextual conditions. A beautiful example of biomimicry and certainly a flight of fancy, the plan proposes a futuristic building system based upon flexibility.

Featuring a twisting latticed frame reminiscent of Eric Vergne's Manhattan skyscraper farms, Mangal City harnesses biomimetic principles borrowed from a range of sources. The skyscraper's structure is modeled after mangrove trees, spiraling plant growth patterns, and the interaction of natural ecosystems.

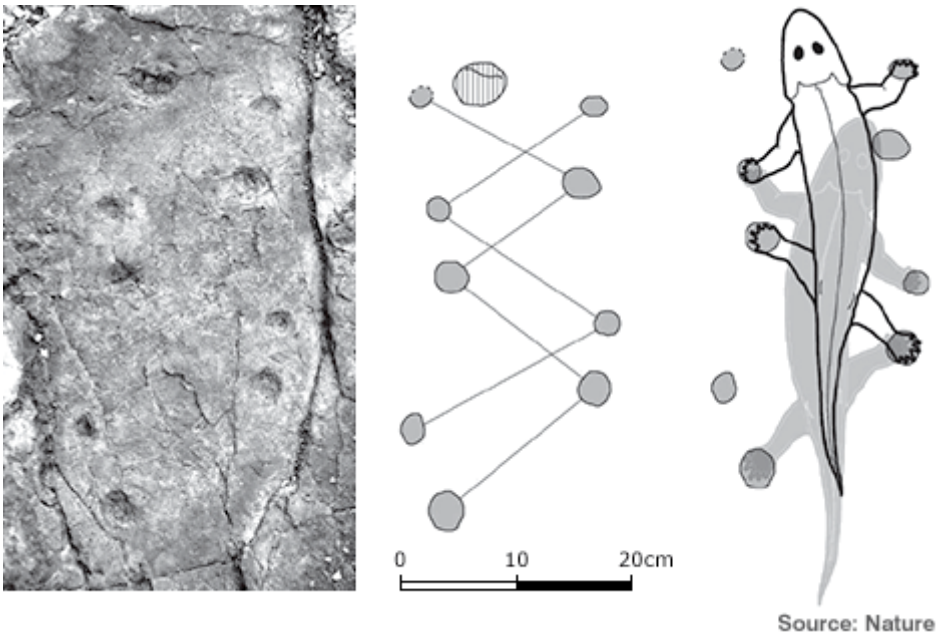
According to Chimera, "our vision is to define an urban ecosystem which supports housing and cultural programs and has the ability to adapt, transform, mutate and adjust according to the specific urban and social character of the site".

Via Warren Ellis and Sucker Punch

http://www.inhabitat.com/2010/01/05/spiraling-skyscraper-pod-city-for-a-future-london/?utm_source=Inhabitat+Weekly&utm_campaign=bceda98ac8-Inhabitat_Weekly_November_19th11_12_2009&utm_medium=email

Tracks record oldest land-walkers
By Jonathan Amos
Science correspondent, BBC News

The oldest evidence of four-legged animals walking on land has been discovered in southeast Poland.



Rocks from a disused quarry record the "footprints" of unknown creatures that lived about 397 million years ago.

Scientists tell the journal Nature that the fossil trackways even retain the impressions left by the "toes" on the animals' feet.

The team says the find means that land vertebrates appeared millions of years earlier than previously supposed.

"This place has yielded what I consider to be some of the most exciting fossils I've ever encountered in my career as a palaeontologist," said team member Per Ahlberg from Uppsala University, Sweden.

"[They are] fossil of footprints that give us the earliest record of how our very distant ancestors moved out of the water and moved on to the land and took their first steps."

Numerous trackways have been identified in the Zachelmie Quarry in the Holy Cross Mountains.

They represent the movements of many animals as they scurried around what would have been a tropical muddy shoreline in the Middle Devonian Period of Earth history.

Slabs of carbonate rock are dappled with prints that range in size and detail.

Some indentations are obscured where successive animals have trampled over the same patch of ground; but others retain exquisite features of the pads and digits that made them.

The animals were probably crocodile-like in appearance and lived an amphibian-like existence (although those specific animal forms did not appear until many millions of years later).

The dimensions of the prints suggest some individuals were more than two metres long.

The Polish and Swedish scientific team analysed the trackway patterns to reconstruct how the ancient creatures would have moved their "hips", "elbows" and "knees".

This confirms that only true four-legged animals, or tetrapods, could have left the marks.

Theory holds that the first land creatures evolved from fish that had pairs of lobed fins. The precise timing of this transition has been a dynamic field of study in recent years.

The assumption of palaeontologists had been that there was a swift but stepwise transition between water and land.

Perhaps the most notable fossil in this story is an organism called *Tikaalik roseae* , an animal that had features intermediate between fish and tetrapods.

But *Tiktaalik* lived about 375 million years ago; and although there are slightly older transition fossils, the Zachelmie Quarry tetrapods break the neat and simple timeline.

"The discovery of undoubted trackways from the earliest period of the Eifelian - that is 379 million years ago - pushes back the divergence between fishes and the four-legged vertebrates by about 18 million years, if not probably more," commented Dr Philippe Janvier from the National Museum of Natural History, Paris, France.

"I suspect that now we can push the divergence back to the Emsian stage, maybe 400 million years ago. That's surprising, but this is what the fossil evidence tells us," the independent researcher told BBC News.

Another key surprise from the research is the recognition that these tetrapods lived in a marine environment, perhaps a coral lagoon.

The favoured origin before now for the emergence of tetrapods had been marshy environments, such as deltas or lakes where freshwater dominated.

The team behind the latest research said the new explanation made sense because it would have allowed marine ancestors of tetrapods gradually to acquire terrestrial competence while accessing a new and essentially untouched resource of food washed up with the tides.

"In the intertidal setting, you've got a smorgasbord laid out twice a day," said Dr Ahlberg.

"Every time the tide goes out, it leaves behind this drift-line of dead and moribund animals. All this was just left there for vertebrates - our ancestors - to emerge on to land and pick them off."

Jonathan.Amos-INTERNET@bbc.co.uk

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8443879.stm

Published: 2010/01/06 18:05:46 GMT

Elegant Solutions in Eco Dream Home

By: Ben Preston

Located on a thin slice of land between the Santa Ynez Mountains and the Pacific Ocean, California's Montecito is home to a few movie star mansions. However, most of the homes in the area are a modest mixture of closely spaced coastal homes and more remote — and as it turned out, flammable — mountain homes, some not much more than improved-upon cabins.

That used to be the case for Ken Radtkey and his wife, Susan Van Atta, who for 10 years lived in an un-insulated 800-square-foot cottage on a wooded mountain lot. Just before last year's Tea Fire burned a 2,000-acre swath of Montecito and adjacent Santa Barbara (the home of Miller-McCune), ravaging the homes of many of their neighbors, they demolished and recycled the rustic house to make way for what has become the first residence in the area to be certified by the U.S. Green Building Council's Leadership in Energy and Environmental Design program as LEED Platinum, the organization's highest level of certification.

The couple are the founders and principal architects of Blackbird Architects Inc. and Van Atta Associates — an award-winning landscape architecture firm — respectively, and have used the combined forces of their talented design teams, as well as their own creativity, to conceive a replacement for their tiny old home.

The implications of their project run much deeper than merely building a new house for the couple and their 9-year-old son. According to Radtkey, the design process has served as a living laboratory for innovation, combining cutting-edge green building techniques with interactive site design that he hopes will not only make the house a pleasant place to live, but will also serve as an example of how a building can be designed with a strong connection to the land on which it stands.

"It's an example of what we wish more people would do, and that's why we've done it," he said, noting that a back-to-basics approach was used in order to keep costs reasonable and to avoid relying upon

expensive mechanical solutions to design problems. "The project is a research avenue for us. We see it as a functional set of cycles, and the more of those you can get to work together, the more interesting the project."

Far different from the nearby mansions of billionaires Oprah Winfrey and Beanie Baby creator Ty Warner, Coyote House, appearing large at first, is a modest affair achieving the effect of having a cavernous interior while maintaining a bag of energy efficiency tricks designed to be monitored from a home computer. During the design process, the bottom line has been "keep it simple," Radtkey said.

Nearly complete, the modern-looking home is called Coyote House, after the long, winding mountain road that leads to it. Ensconced among coast live oaks, the house is situated about halfway up the mountain slope, offering a dramatic view of the coastal plain below, as well as the vast expanse of the Pacific Ocean and the Channel Islands. Many of the neighbors, living in recreational vehicles and trailers, are still rebuilding homes lost in the fire.

Considering the benefits that can be had by including useful aesthetic elements — such as onsite fruit trees, natural lighting and fire-resistant native vegetation, Radtkey and Van Atta have come up with a space that is open, flexible and comfortable. "The visual identity may be forward-looking, but the function and performance of the building relies upon basic principles that people have been using for thousands of years," Radtkey said.

At a time when many Americans live in mass-produced homes that were, in some cases, arbitrarily placed upon a grid pattern devised to fit a certain number of homes on an equally arbitrary tract of land, situating a home on a lot based upon the site's characteristics isn't something that most people are familiar with. For Radtkey and Van Atta, a property's natural components are, literally and figuratively, the foundation upon which each building they design is configured.

"A connection to land and outside is essential. The more complex the interaction between a site's systems, the more rich the experience, and the more potentially sustainable and appropriate the project. Good design has a lot of performance benefits, but it's also experiential," Radtkey said.

Coyote was designed with the same big-picture view, but since the timetable hasn't been rushed by customer demand, more time could be taken to assess the site and experiment with different ways to work with its characteristics. "We're having an opportunity to see firsthand how these things work," said Van Atta, adding that they used drip irrigation on one part of the roof garden, and overhead spray irrigation on another to see what results they come up with.

Beginning with a detailed study of the site's natural processes — water, sunlight and plant growth cycles (they were also fortunate enough to observe the fire cycle before construction began) — the design process undertaken by Blackbird's and Van Atta's architects was a team effort that culminated in a stout list of innovative features. Most of the lot is sloped, so the house is built into the hillside, addressing most of its insulation needs as well as providing a way to blend roofline — which is planted with a variety of native plant species — into the landscape.

Large windows on the south-facing exposure of the house provide a versatile sunlight collection area — the main room on the ground floor has a large area that can be isolated with sliding glass doors in order to trap the sun's heat in the winter, or increase circulation during the summer, as well as keep out insects during summer — while its configuration allows for a natural thermal stacking effect to create ventilation.

Radiant hot water heating elements in the floor are heated by a solar electric power, but also have 96 percent efficient auxiliary gas-powered flash boilers, eliminating the dry, allergy-exacerbating air created by conventional forced-air heating systems. "People also like the comfort of it because it gives you warm feet," said Radtkey.

Photovoltaics, with a battery backup, provide electric power, and a distributed onsite cistern system has a 10,100 gallon capacity, including a 5,000-gallon, aquifer-mimicking sand bed beneath the lawn and bocce court in the front yard. The hope is that the water in the sand bed will irrigate the lawn more efficiently than conventional sprinklers, but it can also be pumped for immediate access to water to fight fires.

The actual structure of the house — the non-combustible concrete shell, steel cross beams, and wooden stairs and cabinetry — is made largely of recycled materials. The concrete is 50 percent fly ash, eliminating much of the carbon-intensive Portland cement usually needed for material strength. The steel comes from mills in Southern California that get 90 to 95 percent of their steel from recyclers. With the exception of the doors, which are made from wood certified by the Forest Stewardship Council, wood used in the house comes from eucalyptus trees felled on the property to allow more direct sunlight for the photovoltaic array and to create a defensible fire protection space around the house.

While the LEED certification is an obvious selling point for the project's positive qualities, Radtkey said that the design elements they considered for Coyote House went beyond its requirements.

"LEED, as we see it, is an evolving points/checklist approach, and the first versions were rough guides to increase the projects' performance and make them less toxic. The versions that have come along have been geared toward a whole system approach, and that's where we've tried to be ahead of LEED," he said.

One of the challenges the couple faced was finding appropriate lighting sources, as not much that is all at once efficient, attractive and dimmable is currently available. "When you set out to do this, it's not as easy as it sounds. It will get easier as more people do it and learn from what we and others have done," said Van Atta, comparing the lighting situation to her initial foray into using native plant species in landscape design years ago. Back then, they were very difficult to find, but she said using native plants has become much more mainstream.

A recent visit to the property showed Coyote House very close to completion. The photovoltaic panels are already functioning and producing power, with the electric meter running backwards as proof. Complete building systems monitoring has, until now, been a phenomenon reserved largely to commercial and institutional setups, but Radtkey hopes that his design team will be able to find a cost-effective approach that can be more universally used by people looking to make their homes more efficient and comfortable.

While the house is very different from what most of us have come to expect from home design, it has been a trial-and-error process the couple said will pave the way toward more ergonomic, more sustainable living.

"We want to make these solutions beautiful, because that's a way to popularize them," said Van Atta. "This house isn't about sacrifice, it's all about abundance. We want to build a more beautiful home that's more livable and more pleasing because it works with its environment."

http://www.miller-mccune.com/science_environment/elegant-solutions-in-eco-dream-home-1723?utm_source=Newsletter91&utm_medium=email&utm_content=0112&utm_campaign=newsletters

Are American Kids Crazy or What?

By: Jill Porter

Many American teenagers are rebellious thrill-seekers who revel in immediate gratification and relinquish autonomy to peer pressure. But is it just the devil of biology that makes them do it? Or is American culture an accessory to the fact?

That's what renowned adolescent psychologist Laurence Steinberg wants to know — and now he has a $1 million research grant to help him find out.

Steinberg, distinguished professor of psychology at Temple University, recently received the first Klaus J. Jacobs Research Prize, one of the largest prizes ever awarded to a social scientist; it rivals the $1.4 million that comes with the Nobel Prize. The foundation called Steinberg "a trailblazer in the field of developmental psychology" in selecting him from 19 nominees. He accepted the award from the Jacobs Foundation of Switzerland on Dec. 3 at a ceremony in Zurich.

With the rare bounty of buckets of money, Steinberg plans to research adolescents in other countries to determine whether they're different from American teens — and, if so, why.

"There are some changes in the brain during adolescence that are, we believe, very strongly linked to the pubertal hormones," Steinberg said. "To the extent that those hormones are universal, we might expect to find that their impact on brain development is pretty much universal.

"But some aspects of brain development during adolescence are probably more influenced by experience."For instance, do children raised in a society where stricter parenting is normal — and therefore less opportunity for experimentation exists — turn into more grounded adolescents? Do children who don't switch school environments in mid-puberty, as many Americans do, become more stable teens?

If so, those differences may provide clues to the way American culture shapes teens as we know them — and what to do about it.

"A question I get asked a lot is if some of the immature judgment that adolescents demonstrate is due to immaturity in the development of certain brain systems; is there anything we can do as adults to facilitate

this process? So if we did the research and we found you have countries where kids at the age of 16 or 17 are not very impulsive, are much more planful, are more future-oriented in the way they think about things, we could ask what are they doing in this culture that seems to be related to this?"

Steinberg is exploring the possibility of expanding an ongoing study of 1,000 children in 10 countries — from Europe to Africa to Asia — to include his own research.

Steinberg's expertise in adolescent behavior and brain biology has taken him from the elaborate halls of Congress, where he briefed staff members of the Senate Judiciary Committee on proposed juvenile justice legislation, to a spare cell in Guantanamo Bay, where, as a potential defense witness, he interviewed Omar Khadr, the youngest detainee accused of being a terrorist. He's also written or co-written 11 books, from scholarly tomes like *Handbook of Adolescent Psychology* to popular titles like *The Ten Basic Principles of Good Parenting*.

His research has helped reform American juvenile justice policy, as reflected in the U.S. Supreme Court's 2005 ruling in *Roper v. Simmons* abolishing the death penalty for juveniles. Steinberg's argument that brain systems that control "self-regulation and the coordination of emotion and thinking" aren't fully developed in teens also underpins the American Psychological Association's amicus curiae brief in the current Supreme Court case seeking to eliminate life sentences for juveniles.

And, yes, he's had practical experience: he and his wife raised a son, Ben, who's now 25 and works at Random House.

Steinberg said his professional research helped him keep his son's adolescent antics in perspective, and one incident actually influenced his work in turn. "He and some friends went to the window of a girl they knew and inadvertently set off a burglar alarm," Steinberg told *The New York Times*. "When a police squad car came, they panicked and fled. When I found out, I said: 'Do you realize that you were running from armed police officers who thought they were interrupting a break-in. What were you thinking?' He said: 'Well, that's the problem. I wasn't.' I wondered: 'What goes on when kids are in a peer group that pushes them to make bad decisions?'"

And while Steinberg's proposed international research might help American teenagers navigate the treacherous shoals of adolescence more safely, he wants to make one thing clear: They aren't crazy.

"I think that in the way that my work on this gets presented, it's that there's something the matter with adolescents because they behave this way," Steinberg said. To the contrary, he said, adolescence is the time when children become capable of reproduction and risk-taking propels them to reach maturity.

"One of the features you see across all mammals is that before they start reproducing, they leave their parents, they leave their natal environment and go out in the world and that's a dangerous thing to do in most species. So evolutionarily, you want people to be at a point where they're going to feel able and confident enough to take risks and leave home and do these things.

"If the underlying thing that's causing kids to take risks is this drive toward novelty and reward, which is what we believe is driving it, then they're going to do that in many different ways, some of which are healthy and some of which are dangerous," Steinberg said.

"So our job as adults is to think about how do we create a world in which kids can satisfy those inclinations and not be tempted to engage in dangerous risk-taking."

That's the million-dollar question Steinberg hopes to answer.

http://www.miller-mccune.com/culture_society/are-american-kids-crazy-or-what-1673?utm_source=Newsletter91&utm_medium=email&utm_content=0112&utm_campaign=newsletters

Arctic tern's epic journey mapped
By Jonathan Amos
Science correspondent, BBC News

The Arctic tern's extraordinary pole-to-pole migration has been detailed by an international team of scientists.

The researchers fitted the birds with tiny tracking devices to see precisely which routes the animals took on their 70,000km (43,000 miles) round trip.

The study reveals they fly down either the African or Brazilian coasts but then return in an "S"-shaped path up the middle of the Atlantic Ocean.

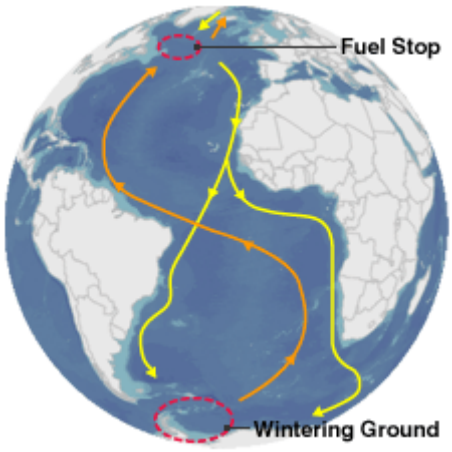
The long-distance adventure is described in the US journal PNAS.

"From ringing, we knew where the Arctic tern travelled," said Carsten Egevang of the Greenland Institute of Natural Resources.

"The new thing is that we've now been able to track the bird during a full year of migration, all the way from the breeding grounds to the wintering grounds and back again."

The avian world is known for its great migrations.

Albatrosses, godwits, and sooty shearwaters all undertake epic journeys. But none can quite match the Arctic tern's colossal trip.



After setting out (yellow line) the birds pause in the North Atlantic (red circle) to feed. Going home (orange line), they follow the winds

- Total distance travelled 70,900km
- On southbound leg: 34,600km
- Daily progress south: 330km
- On northbound leg: 25,700km
- Daily progress north: 520km
- Within Winter grounds: 10,900km

Starting in August and September, this small bird - which weighs little more than 100g (3.5oz) - will head away from Greenland with the intention of getting to the Weddell Sea, on the shores of Antarctica.

It will spend about four or five months in the deep south before heading back to the far north, arriving home in May or June.

A team from Greenland, Denmark, the US, the UK and Iceland attached small (1.4g/0.05oz) "geolocators" to the animals to find out exactly where they went on this polar round trip.

The devices record light intensity. This gives an estimate of the local day length, and the times of sunrise and sunset; and from this information it is possible to work out a geographical position of the birds.

The geolocators were provided by the British Antarctic Survey (BAS).

"The use of these devices on seabirds is not only revolutionising our understanding of migration patterns, but the resulting data on distribution also help address the requirement to identify important biological hotspots," said Richard Phillips from BAS, a co-author of the PNAS paper.

The first surprise is that the terns do not make straight for the Antarctic when they leave the Arctic, but make a lengthy stop-over in the middle of the North Atlantic, about 1,000km (620 miles) north of the Azores.

Here, they feed on zooplankton and fish to fuel themselves for the long journey ahead.

"We were able to compare biological productivity in the ocean from satellite imagery and we could see a high productive area that the birds will spend time in," said Mr Egevang.

"Even more importantly, it's the last high productive area before they enter tropical waters where we know productivity is low."

THE LONG DISTANCE FLIER
Scientific name: *Sterna paradisaea*
Average wingspan of 75-85cm
Breeds in Arctic and sub-Arctic
Lays eggs in small ground scrape
Feeds on fish and crustaceans
Birds live more than 30 years

The birds then head south along the coast of western Europe and western Africa before making a choice, either to continue hugging Africa or sweep across the Atlantic from the Cape Verde Islands to continue the journey along the Brazilian coast.

About half the birds that were tracked decided to take the South American path. It is not clear why, but the researchers believe wind might make either route seem favourable to the terns.

After spending their northern winter months in Antarctic waters, the terns then fly back towards the Arctic.

But rather than retracing their southward flight paths, the birds follow a gigantic "S" pattern up the middle of the Atlantic Ocean.

"This is completely new knowledge," Mr Egevang told BBC News.

"They make a detour of several thousand km but once we start comparing the route to the prevailing wind system, it makes perfect sense - moving in a counter-clockwise direction in the Southern Hemisphere, and clockwise in the Northern Hemisphere.

"It's just more energy-efficient for them to do that even though they are travelling several thousand more km than if they flew in a straight line."

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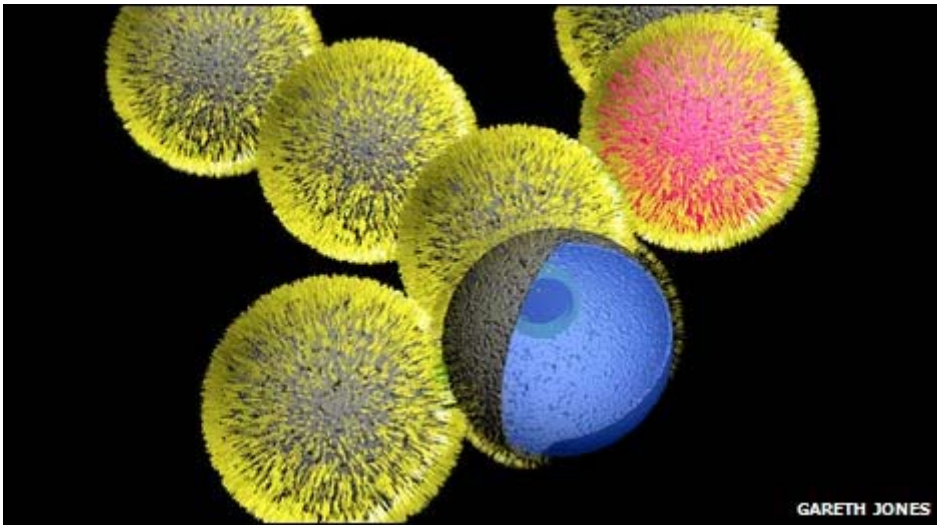
Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8451908.stm

Published: 2010/01/11 23:53:41 GMT

'Wet computer' project kicks off
By Jason Palmer
Science and technology reporter, BBC News

A promising push toward a novel, biologically-inspired "chemical computer" has begun as part of an international collaboration.



The "wet computer" incorporates several recently discovered properties of chemical systems that can be hijacked to engineer computing power.

The team's approach mimics some of the actions of neurons in the brain.

The 1.8m-euro (£1.6m) project will run for three years, funded by an EU emerging technologies programme.

The programme has identified biologically-inspired computing as particularly important, having recently funded several such projects.

What distinguishes the current project is that it will make use of stable "cells" featuring a coating that forms spontaneously, similar to the walls of our own cells, and uses chemistry to accomplish the signal processing similar to that of our own neurons.

The goal is not to make a better computer than conventional ones, said project collaborator Klaus-Peter Zauner of the University of Southampton, but rather to be able to compute in new environments.

" **If one day we want to construct computers of similar power and complexity to the human brain, my bet would be on some form of chemical or molecular computing** "
Frantisek Stepanek, Institute of Chemical Technology, Prague

"The type of wet information technology we are working towards will not find its near-term application in running business software," Dr Zauner told BBC News.

"But it will open up application domains where current IT does not offer any solutions - controlling molecular robots, fine-grained control of chemical assembly, and intelligent drugs that process the chemical signals of the human body and act according to the local biochemical state of the cell."

Lipids and liquids

The group's approach hinges on two critical ideas.

First, individual "cells" are surrounded by a wall made up of so-called lipids that spontaneously encapsulate the liquid innards of the cell.

Recent work has shown that when two such lipid layers encounter each other as the cells come into contact, a protein can form a passage between them, allowing chemical signalling molecules to pass.

Second, the cells' interiors will play host to what is known as a Belousov-Zhabotinsky or B-Z chemical reaction. Simply put, reactions of this type can be initiated by changing the concentration of the element bromine by a certain threshold amount. The reactions are unusual for a number of reasons.

But for the computing application, what is important is that after the arrival of a chemical signal to start it, the cell enters a "refractory period" during which further chemical signals do not influence the reaction.

That keeps a signal from propagating unchecked through any connected cells.

Such self-contained systems that react under their own chemical power to a stimulus above a threshold have an analogue in nature: neurons. "Every neuron is like a molecular computer; ours is a very crude abstraction of what neurons do," said Dr Zauner.

"But the essence of neurons is the capability to get 'excited'; it can re-form an input signal and has its own energy supply so it can fire out a new signal."

This propagation of a chemical signal - along with the "refractory period" that keeps it contained within a given cell - means the cells can form networks that function like the brain.

'**Real chance**'

Frantisek Stepanek, a chemical computing researcher at the Institute of Chemical Technology Prague in the Czech Republic, said the pairing of the two ideas was promising.

"If one day we want to construct computers of similar power and complexity to the human brain, my bet would be on some form of chemical or molecular computing," he told BBC News.

"I think this project stands a real chance of bringing chemical computing from the concept stage to a practical demonstration of a functional prototype."

For its part, the team is already hard at work proving the idea will work.

"Officially the project doesn't start until the first of February," said Dr Zauner, "but we were so curious about it we already sent some lipids to our collaborators in Poland - they've already shown the lipid layers are stable."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8452196.stm

Published: 2010/01/11 16:57:57 GMT

Big bum and thighs 'are healthy'

Carrying extra weight on your hips, bum and thighs is good for your health, protecting against heart and metabolic problems, UK experts have said.

Hip fat mops up harmful fatty acids and contains an anti-inflammatory agent that stops arteries clogging, they say.

Big behinds are preferable to extra fat around the waistline, which gives no such protection, the Oxford team said.

Science could look to deliberately increase hip fat, they told the International Journal of Obesity.

And in the future, doctors might prescribe ways to redistribute body fat to the hips to protect against cardiovascular and metabolic diseases such as diabetes.

The researchers said having too little fat around the hips can lead to serious metabolic problems, as occurs in Cushing's syndrome.

Shape not weight

Evidence shows that fat around the thighs and backside is harder to shift than fat around the waist.

Although this may sound undesirable, it is actually beneficial because when fat is broken down quickly it releases a lot of cytokines which trigger inflammation in the body, say experts.

These cytokines have been linked to cardiovascular disease, insulin resistance and diabetes.

" **Fat around the hips and thighs is good for you but around the tummy is bad** "
Lead researcher Dr Konstantinos Manolopoulos

The slower burning hip fat also makes more of the hormone adiponectin that protects the arteries and promotes better blood sugar control and fat burning.

In comparison, carrying excess fat around the stomach, being "apple shaped", raises the risk of diabetes and heart disease.

Lead researcher Dr Konstantinos Manolopoulos, of Oxford University, said: "It is shape that matters and where the fat gathers.

"Fat around the hips and thighs is good for you but around the tummy is bad."

He said in an ideal world, the more fat around the thighs the better - as long as the tummy stays slim.

"Unfortunately, you tend not to get one without the other," he said.

Fotini Rozakeas of the British Heart Foundation said: "This research helps us better to understand how fat acts in the body in order to develop new approaches in reducing heart and circulatory disease.

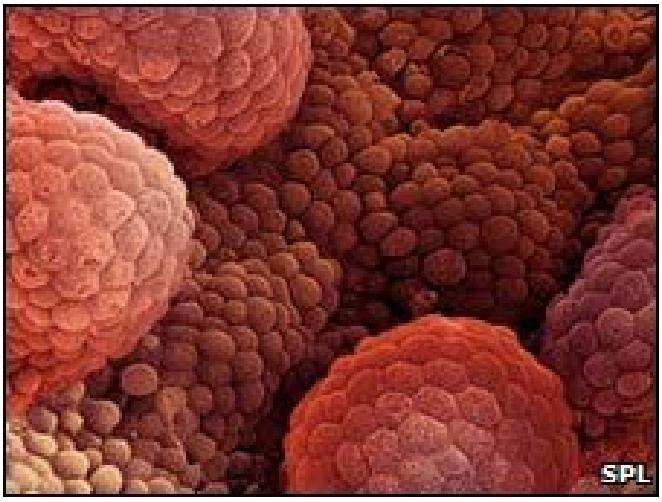
"If you are overweight, obese, or if you have a waist size that is increased, it is important to make changes to your lifestyle, such as eating a healthy diet and doing regular physical activity, to reduce your risk of heart health problems."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8451674.stm

Published: 2010/01/12 11:32:20 GMT

Concern over prostate cancer test

One in eight men screened for prostate cancer will test positive when they do not have the disease, a major European trial has shown.



A positive result can mean undergoing invasive tests such as biopsy as well as potentially unnecessary treatment.

Screening with prostate specific antigen (PSA) is not routinely offered in the UK but government experts are reviewing evidence from the study.

Cancer Research UK said men should talk about the pros and cons with their GP.

Early data from the European Randomised Study of Screening for Prostate Cancer, which is being conducted in seven countries, showed in March 2009 that deaths could be cut by 20%.

" **It is important that men in their 50s and 60s can talk to their doctor about the pros and cons of having a PSA test and only have the test if they feel it is right for them** "
Professor Peter Johnson Cancer Research UK

But other recent evidence has cast doubt on the long-term benefits of screening, suggesting some men may end up being "over-treated" for slow-growing disease that would never cause a problem in their lifetime.

Now data from the Finnish part of the European trial has shown that for every eight men screened - tests are being done on a four-yearly basis - one ended up with a false positive result, even with a fairly high PSA threshold.

Those men who tested positive but were later found not to have cancer were twice as likely not to agree to screening in the future even though they were at risk of developing the disease later, the British Journal of Cancer reported.

'Adverse effects'

The researchers have said more research is needed to make screening more accurate and to help pick out those who are most likely to have a true positive result.

SIGNS OF PROSTATE CANCER
- Having to rush to the toilet to pass urine
- Difficulty in passing urine
- Passing urine more often than usual
- Pain on passing urine
- Blood in the urine or semen

Study leader, Dr Tuomas Kilpelainen, said: "I don't think routine screening should be advised until more is known on the adverse effects and costs of screening.

"If a man has urinary tract symptoms and is concerned he could have prostate cancer, the most important thing is to consult a GP or a urologist."

There is currently no organised screening programme for prostate cancer in the UK but men can request a PSA test if they want and demand is increasing.

Professor Julietta Patnick, director of the NHS Cancer Screening Programmes, said: "While the European trial, of which this Finnish study is a part, showed for the first time that prostate screening with PSA can save lives, it also suggested that 48 men would have to be treated in order to save one life.

"False positives are an issue for any screening programme, and this Finnish paper is very helpful at gaining an understanding of how they might figure in the context of prostate screening."

Results from both the European trial and a large study being carried out in the US are due this year, Cancer Research UK said.

Professor Peter Johnson, Cancer Research UK's chief clinician, said the paper showed there were "two sides" to using PSA for prostate cancer screening.

"Although for some men detecting prostate cancer early through screening can be life-saving, on the other hand the test will be abnormal for around one man in eight without cancer being detectable at that time.

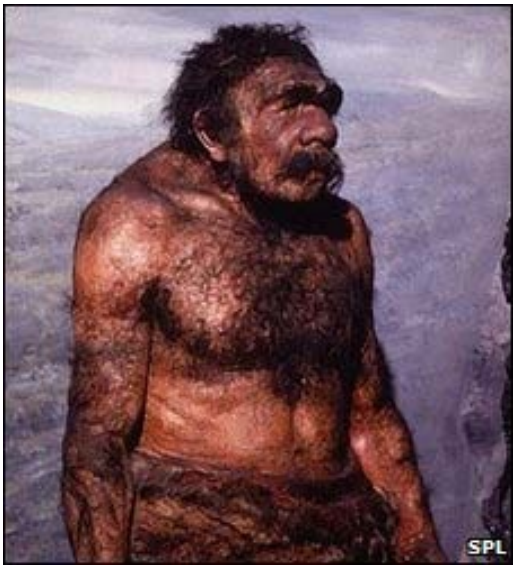
"For this reason, it is important that men in their 50s and 60s can to talk to their doctor about the pros and cons of having a PSA test and only have the test if they feel it is right for them."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8448147.stm

Published: 2010/01/11 00:03:25 GMT

Neanderthal 'make-up' discovered

Scientists claim to have the first persuasive evidence that Neanderthals wore "body paint" 50,000 years ago.



The team report in Proceedings of the National Academy of Sciences (PNAS) that shells containing pigment residues were Neanderthal make-up containers.

Scientists unearthed the shells at two archaeological sites in the Murcia province of southern Spain.

The team says its find buries "the view of Neanderthals as half-wits" and shows they were capable of symbolic thinking.

Professor Joao Zilhao, the archaeologist from Bristol University in the UK, who led the study, said that he and his team had examined shells that were used as containers to mix and store pigments.

Black sticks of the pigment manganese, which may have been used as body paint by Neanderthals, have previously been discovered in Africa.

"[But] this is the first secure evidence for their use of cosmetics," he told BBC News. "The use of these complex recipes is new. It's more than body painting."

The scientists found lumps of a yellow pigment, that they say was possibly used as a foundation.

They also found red powder mixed up with flecks of a reflective brilliant black mineral.

Some of the sculpted, brightly coloured shells may also have been worn by Neanderthals as jewellery.

Until now it had been thought by many researchers that only modern humans wore make-up for decoration and ritual purposes.

There was a time in the Upper Palaeolithic period when Neanderthals and humans may have co-existed. But Professor Zilhao explained that the findings were dated at 10,000 years before this "contact".

"To me, it's the smoking gun that kills the argument once and for all," he told BBC News.

"The association of these findings with Neanderthals is rock-solid and people have to draw the associations and bury this view of Neanderthals as half-wits."

Professor Chris Stringer, a palaeontologist from the Natural History Museum in London, UK, said: "I agree that these findings help to disprove the view that Neanderthals were dim-witted.

But, he added that evidence to that effect had been growing for at least the last decade.

"It's very difficult to dislodge the brutish image from popular thinking," Professor Stringer told BBC News. "When football fans behave badly, or politicians advocate reactionary views, they are invariably called 'Neanderthal', and I can't see the tabloids changing their headlines any time soon."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8448660.stm

Published: 2010/01/09 01:47:15 GMT

Coloured lasers may curb epilepsy

Coloured lights could be used to find treatments for brain disorders such as epilepsy, a study has suggested.

A Massachusetts Institute of Technology team discovered a way to shut down brain activity using flashes of yellow and blue lasers.

They hope to adjust this to switch off neurons that generate an electrical impulse abnormally, causing seizures.

This could help experts understand how the brain works and, ultimately, offer treatment targets, Nature reports.

The work relies on two genes found in natural organisms like algae that need light to make energy.

Illuminating

These genes, known as Arch and Mac, contain the genetic code for light-activated proteins.

The MIT team engineered brain neurons to express Arch and Mac.

" **These tools will help us understand how to control neural circuits, leading to new treatments for brain disorders** "
Ed Boyden Lead researcher

By doing this, they were able to control the brain cells of mice and monkeys using light.

Light activates proteins which, in turn, lowers the voltage in the neurons and prevents them from generating an electrical signal, known as firing.

Arch responds to blue light, Mac to yellow, and both recover afterwards.

Now the researchers plan to closely examine the neural circuits of the brain in the lab to find targets that, when shut down, could treat epilepsy as well as other conditions including Parkinson's disease and chronic pain.

Ed Boyden, who led the research, said: "Silencing different sets of neurons with different colours of light allows us to understand how they work together to implement brain functions.

"These tools will help us understand how to control neural circuits, leading to new understandings and treatments for brain disorders."

Although the work has involved animals, it should shed light on what is happening in humans, he said.

Professor Gero Miesenbock of Oxford University has been using the same technology in his research, which has included studying memory formation in fruit flies.

He has said the technology is "beginning to yield previously unattainable insight" into the organisation and regulation of the neural circuits of the brain, and the link between patterns of cellular activity and behaviour.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8441983.stm

Published: 2010/01/09 00:24:03 GMT

Food industry is 'too secretive'
By Pallab Ghosh
Science correspondent, BBC News

The food industry has been criticised for being secretive about its use of nanotechnology by the UK's House of Lords Science and Technology Committee.

Lord Krebs, chairman of the inquiry, said the industry "wants to keep a low profile" to avoid controversy.

While there were no clear dangers, he said, there were "gaps in knowledge".

In its report Nanotechnologies and Food, the committee suggests a public register of foods or packaging that make use of nanotechnology.

Nanotechnology is the use of very small particles - measured in the billionths of a metre. At these sizes, particles have novel properties and there is active investigation into how those properties arise.

While nanotechnology is already widely employed - in applications ranging from odour-free socks to novel cancer therapeutic methods - they have long been regarded as a subject requiring further study to ensure their safety.

In the food sector, nanotechnology can be employed to enhance flavour and even to make processed foods healthier by reducing the amount of fat and salt needed in production.

Open standards

Peers said in the report that they found it "regrettable that the food industry was refusing to talk about its work in the area".

" **We are not clear what is out there in use at the moment** "
Lord Krebs

They added that it was exactly this behaviour that could prompt public backlash against the use of a technology that could bring many benefits to the public.

Lord Krebs said that the industry was "very reluctant to put its head above the parapet and be open about research on nanotechnology".

"They got their fingers burnt over the use of GM crops and so they want to keep a low profile on this issue. We believe that they should adopt exactly the opposite approach. If you want to build confidence you should be open rather than secretive."

As part of this process, the committee recommends that the Food Standards Agency should have a publicly available register listing food and packaging that use nano-materials.

Julian Hunt, director of communications for the Food and Drink Federation, said he was "surprised" by the criticism.

"Understandably, there are many questions and unknowns about the potential future uses of nanotechnologies in our sector, and there is much work still to be done, by scientists, governments and regulators, as well as the food and drink industry," Mr Hunt said.

"We support the report's recommendation for the formation of an open discussion group to bring more transparency that we know is important to consumers, and indeed we are already engaged in such initiatives, both at UK and EU level."

The Project on Emerging Nanotechnologies, run by the Washington-based Woodrow Wilson International Center for Scholars, has found that there are currently 84 foods or food-related products that use nanotechnology.

The Food and Drink Federation says that none are currently manufactured in the UK.

'No clear danger'

However, Lord Krebs says he and his colleagues are concerned that because of industry secrecy, it is hard to really know the true extent of the use of nanotechnology in food.

"We are not clear what is out there in use at the moment," he said.

The report says that there is likely to be an "explosive growth" in the use of the technology.

Currently the market is valued at $410m (£260m), but the report estimates it will increase more than ten-fold in the next two years.

The report also says insufficient research has been carried out into the safety of the use of nanotechnology in foods. It urges the government to commission more research on the behaviour of nanomaterials, particularly in the gut.

"There is currently no clear and present danger from nanotechnology," according to Lord Krebs.

"But there are significant gaps in our knowledge for regulators to adequately assess the risk of nanomaterials in food."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8446704.stm

Published: 2010/01/08 00:16:18 GMT

Coral reefs are evolution hotspot
By Victoria Gill
Science reporter, BBC News

Coral reefs give rise to many more new species than other tropical marine habitats, according to a new study.

Scientists used fossil records stretching back 540 million years to work out the evolution rate at reefs.

They report in the journal Science that new species originate 50% faster in coral reefs than in other habitats.

The team says its findings show that the loss of these evolution hotspots could mean "losing an opportunity to create new species" in the future.

Coral reefs harbour a huge number of marine species - they are often likened to rainforests in terms of their biodiversity.

" **If we lose reefs we lose an opportunity to create new species by evolutionary processes** "
Wolfgang Kiessling Humboldt University, Berlin

But they also provide a "pump of new marine species", according to Wolfgang Kiessling the scientist from Humboldt University in Berlin, Germany, who led this study.

He and his colleagues examined the fossil record to find the earliest evidence of benthic creatures - animals that live on the seafloor.

These creatures provide a good record of evolution. They remain on the seafloor once they die, and are often fossilised along with some of the remains of their original habitats.

This team of scientists looked for the earliest fossils from each benthic genus, or group of species, in the fossil record.

"We checked when and where each genus first occurred, explained Dr Kiessling. "So for example, if the earliest fossils were 300 million years, we asked: 'Did it occur in a reef or outside'."

He and his colleagues had access to a record stretching back to the Cambrian explosion - when the vast majority of complex organisms are believed to have emerged more than 540 million years ago.

This huge data set was compiled by an international project called the Paleobiology Database, which was started in 2000.

"We had the best documentation of the fossil record at our fingertips," Dr Kiessling told BBC News. "And there was also the geological context there, so we knew where each species occurred.

"Our study shows that reefs are even more important than currently assumed. They are not only ecologically important for the marine environment, but also in an evolutionary sense."

But Dr Brian Rosen, a zoologist at the Natural History Museum in London, UK, warned that the accuracy of fossil records alone was "notoriously difficult to gauge from the literature".

He added that it could be useful for independent experts to re-examine some of the fossilised creatures.

Data "generated by direct examination of the specimens themselves by the relevant taxonomic specialists" is more reliable when it comes to working out important evolutionary patterns, he said.

Carl-Gustaf Lundin, head of the marine programme at the International Union for Conservation of Nature (IUCN) said that this was a "very welcome paper".

"Studies like this provide conclusive evidence that reefs are centres of marine biodiversity," he told BBC News. "And now we see their importance in the evolutionary history of the planet."

He added that currently the planet was losing 2% of its reefs each year, mainly because of increasing ocean temperature bleaching and stunting the coral's growth. And ocean acidification making it more difficult for corals to build their skeletons.

Dr Kiessling said: "If we lose reefs we lose [an] opportunity to create new species by evolutionary processes."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8446002.stm

Published: 2010/01/07 19:43:29 GMT

Mind chemical 'controls choice'

Dopamine, a chemical with a key role in setting people's moods, could have a much wider-ranging impact on their everyday lives, research suggests.

Experiments show that altering levels of the chemical in the brain influences the decisions people make.

One expert said the results showed the relative importance of "gut feeling" over analytical decision making.

The Current Biology study could help understand how expectation of pleasure can go awry, for example in addiction.

It follows previous research by the University College London team, which, using imaging techniques, detected a signal in the brain linked to how much someone enjoyed an experience. They found that signal could in turn predict the choices a person made.

With the suspicion that the signal was dopamine, the researchers set up a study to test how people make complex decisions when their dopamine system has been tampered with.

The 61 participants were given a list of 80 holiday destinations, from Greece to Thailand, and asked to rate them on a scale of one to six.

" **Dopamine has a role in signalling the expected pleasure from those possible future events** "
Tali Sharot Wellcome Trust Centre for Neuro-imaging

They were then given a sugar pill and asked to imagine themselves in each of 40 of the destinations.

Researchers then administered L-Dopa, a drug used in Parkinson's disease to increase dopamine concentrations in the brain, before asking them to imagine the other holidays.

They rated all the destinations again, and a day later they were asked where they would prefer to go, out of paired lists of holidays.

The extra dopamine gave people higher expectations when rating holiday options.

And that translated into the choice of trip they made a day later.

Study leader Dr Tali Sharot, from the Wellcome Trust Centre for Neuro-imaging at UCL, said humans made far more complex decisions than other animals, such as what job to take and whether to start a family, and it seemed dopamine played an important part in that.

" **It is a sort of shortcut in our thinking** "
Professor John Maule Leeds University

She said they had been surprised at the strength of the effect they had seen.

"Our results indicate that when we consider alternative options when making real-life decisions, dopamine has a role in signalling the expected pleasure from those possible future events.

"We then use that signal to make our choices."

Dr Sharot added that addicts overestimated the pleasure they would gain from something, be it heroin or gambling, because their dopamine system was dysfunctional, and the latest research underpinned that the choices they made would be influenced by that.

Gut instinct

She added: "For many conditions we have medication which changes dopamine function, so knowing we may be changing people's expectations and their decision making might change how we think about giving these types of medications."

Professor John Maule, an expert in decision making, at Leeds University Business School, said that in recent years people had begun to realise emotional or "gut instinct" decision making was just as important in human choices as analytical decision making.

"At any one time you will have both these processes going on, so it's not surprising to see these results, especially when it comes to emotionally based decisions, such as holidays.

"It is a sort of shortcut in our thinking."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8357739.stm

Published: 2010/01/08 17:16:11 GMT

Respect for elders 'may be universal' in primates

- 18:05 06 January 2010 by **Shanta Barley**

It was all jungle round here when I was young (Image: Patricio Robles Gil/Minden Pictures/FLPA)

Respect for elders may be universal in primates. Monkeys – just like humans – pay their elders special attention during conversation, apparently in order to garner some of the older animals' wisdom.

Alban Lemasson at the University of Rennes in Paimpont, France, and colleagues recorded 823 vocal exchanges between eight female Campbell's monkeys, each of which was observed for 6 hours.

The calls by older monkeys elicited more vocal responses than those by younger monkeys, regardless of their status within the group. Seven-year-olds got twice as many responses from the rest of the group as 2-year olds.

Audio: Listen to a "conversation" between a group of monkeys

"This is the first time scientists have shown systematically that primates other than humans pay special attention to the voices of their elders, and it suggests that respect for elders is part of our primate heritage," says Klaus Zuberbühler of the School of Psychology at the University of St Andrews, UK, who was not involved in the study.

Forging friendship

Why should younger monkeys pay more attention to what their elders have to say? For one thing, being taken under the wing of a senior monkey may help younger animals forge friendships and climb the social ladder. "Older monkeys play a key role in regulating the social network," says Lemasson.

Older monkeys also know more, Zuberbühler points out. "Elders know the forest better, they're better at spotting predators, and they're better at finding new food," he says. "The calls made by elders may play a key role in group cohesion and survival."

In addition, the calls made by elders should carry more weight than those made by juveniles, as elders are better versed in the "rules" of conversation, Lemasson says. Juveniles are more likely to break the rules and give misleading signals.

False alarm

"For example, vervet monkeys send out an alarm call when they see an eagle fly overhead, but youngsters will send it out simply in response to a leaf falling from the sky," Lemasson says. "The elders' calls are more trustworthy."

Respect for our elders may well be a universal trait in primates, Zuberbühler concludes, though he points out that the group of female monkeys in Lemasson's experiment – only one of which was a mother – was not typical of wild groups.

"Seven of the eight females had no offspring, and that's unusual," says Zuberbühler. "The next thing to do is to do a comparable study in the wild with natural populations and see if the effect holds."

Journal reference: *Biology Letters*, DOI: 10.1098/rsbl.2009.0875

http://www.newscientist.com/article/dn18347-respect-for-elders-may-be-universal-in-primates.html

Brain 'entanglement' could explain memories

- 16:42 12 January 2010 by **David Robson**

Mirror image: neurons in the brain begin to clone after reaching a 'tipping point' of activity (Image: Stone/Getty)

Subatomic particles do it. Now the observation that groups of brain cells seem to have their own version of quantum entanglement, or "spooky action at a distance", could help explain how our minds combine experiences from many different senses into one memory.

Previous experiments have shown that the electrical activity of neurons in separate parts of the brain can oscillate simultaneously at the same frequency – a process known as phase locking. The frequency seems to be a signature that marks out neurons working on the same task, allowing them to identify each other.

Dietmar Plenz and Tara Thiagarajan at the National Institute of Mental Health in Bethesda, Maryland, wondered whether more complicated signatures also link groups of neurons. To investigate, they analysed neuronal activity using arrays of electrodes implanted in the brains of two awake macaque monkeys and embedded in dish-grown neuron cultures.

In both cases, the researchers noticed that the voltage of the electrical signal in groups of neurons separated by up to 10 millimetres sometimes rose and fell with exactly the same rhythm. These patterns of activity, dubbed "coherence potentials", often started in one set of neurons, only to be mimicked or "cloned" by others milliseconds later. They were also much more complicated than the simple phase-locked oscillations and always matched each other in amplitude as well as in frequency.

Perfect clones

"The precision with which these new sites pick up on the activity of the initiating group is quite astounding – they are perfect clones," says Plenz.

Importantly, cloned signals only appeared after one region had reached a threshold level of activity. Plenz likens this to the "tipping point" in human societies when a trend becomes adopted by large numbers of people. This threshold might ensure that our attention is only captured by significant stimuli rather than by every single signal.

Since the coherence potentials seemed unique, each one could represent a different memory Plenz suggests. Their purpose may be to trigger activity in the various parts of the brain that store aspects of the same experience. So a smell or taste, say might trigger a coherence potential that then activates the same potential in neurons in the visual part of the brain.

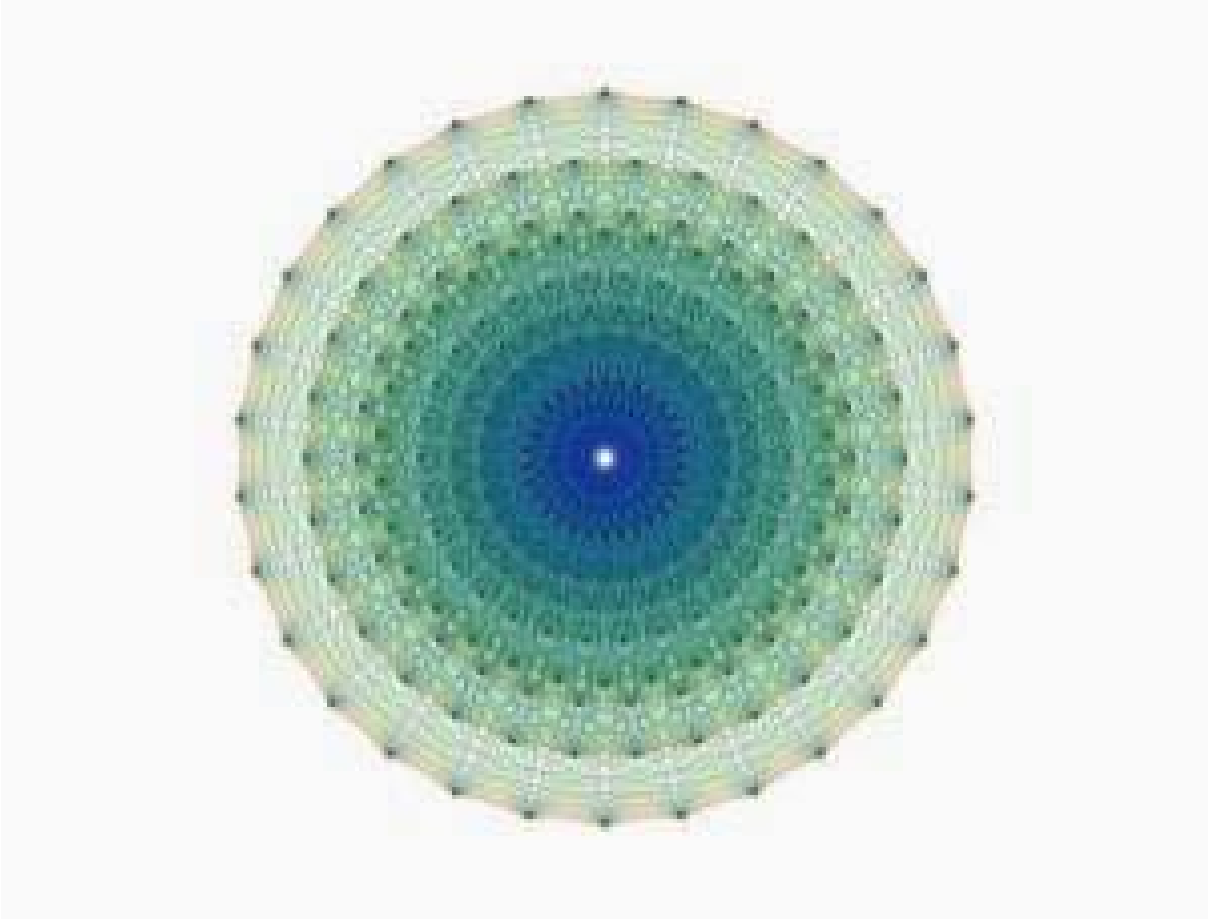
Karl Friston at University College London calls the discovery "a missing piece of the jigsaw puzzle" in terms of brain message transmission.

Journal reference: *PLoS Biology*, DOI: 10.1371/journal.pbio.1000278

http://www.newscientist.com/article/dn18371-brain-entanglement-could-explain-memories.html

'Most beautiful' math structure appears in lab for first time

- 20:49 07 January 2010 by **David Shiga**



The signature of a mathematical structure called E8 has been seen in the real world for the first time (Illustration: Claudio Rocchini under a creative commons 2.5 licence)

A complex form of mathematical symmetry linked to string theory has been glimpsed in the real world for the first time, in laboratory experiments on exotic crystals.

Mathematicians discovered a complex 248-dimensional symmetry called E8 in the late 1800s. The dimensions in the structure are not necessarily spatial, like the three dimensions we live in, but they correspond to mathematical degrees of freedom, where each dimension represents a different variable.

In the 1970s, the symmetrical form turned up in calculations related to string theory, a candidate for the "theory of everything" that might explain all the forces in the universe. But string theory still awaits experimental proof.

The structure is also the basis for another proposed theory of everything advanced in 2007 by surfer-physicist Garrett Lisi, who refers to E8 as "perhaps the most beautiful structure in mathematics".

Now, physicists have detected the signature of E8 in a very different realm – experiments on super-chilled crystals.

Up or down

Radu Coldea of the University of Oxford and his colleagues chilled a crystal made of cobalt and niobium to 0.04 °C above absolute zero. Atoms in the crystal are arranged in long, parallel chains. Because of a quantum property called spin, electrons attached to the atom chains act like tiny bar magnets, each of which can only point up or down.

Strange things occurred when the experimenters applied a powerful 5.5-Tesla magnetic field perpendicular to the direction of these electron "magnets". Patterns appeared spontaneously in the electron spins in the chains – in a simplified example with three electrons, the spins could read up-up-down or down-up-down, among other possibilities. Each distinct pattern has a different energy associated with it.

The ratio of these different energy levels showed that the electron spins were ordering themselves according to mathematical relationships in E8 symmetry.

Complex symmetry

Alexander Zamolodchikov, currently at Rutgers University in Piscataway, New Jersey, pointed out in 1989 that the theoretically predicted energies of such systems match expectations from E8 symmetry.

But the underlying reason why is still mysterious. Robert Konik of Brookhaven National Laboratory in Upton, New York, who was not involved in the experiment, says the fact that such a simple system – essentially consisting of one-dimensional chains of magnets – should display such complex symmetry is surprising.

"Just sort of looking at the system, you wouldn't necessarily expect it to occur," he told *New Scientist*. It is "remarkable" to see this rather exotic piece of mathematics appear in the real world, he adds.

No link

Although E8 does show up in string theory calculations, observing the symmetry in magnetic crystal experiments does not provide any evidence for string theory itself, Konik says.

"The fact that you see this particular symmetry in this spin chain doesn't say anything about string theory per se," he says. "The existence of this symmetry in a sense is sort of separate from any [particular] physical phenomenon."

For the same reason, the experiments also provide no backing for Lisi's proposed theory of everything, which is based on E8, he adds.

Journal reference: *Science* (DOI: 10.1126/science.1180085)

http://www.newscientist.com/article/dn18356-most-beautiful-math-structure-appears-in-lab-for-first-time.html

How to make a liquid invisibility cloak

- 14:51 08 January 2010 by **Kate McAlpine**

Hiding behind water (Image: Dimitar Dilkoff/AFP/Getty)

When J. K. Rowling described Harry Potter's invisibility cloak as "fluid and silvery", she probably wasn't thinking specifically about silver-plated nanoparticles suspended in water. But a team of theorists believe that using such a set-up would make the first soft, tunable metamaterial – the "active ingredient" in an invisibility device.

The fluid proposed by Ji-Ping Huang of Fudan University in Shanghai, China, and colleagues, contains magnetite balls 10 nanometres in diameter, coated with a 5-nanometre-thick layer of silver, possibly with polymer chains attached to keep them from clumping.

In the absence of a magnetic field, such nanoparticles would simply float around in the water, but if a field were introduced, the particles would self-assemble into chains whose lengths depend on the strength of the field, and which can also attract one another to form thicker columns.

The chains and columns would lie along the direction of the magnetic field. If they were oriented vertically in a pool of water, light striking the surface would refract negatively – bent in way that no natural material can manage.

This property could be exploited for invisibility devices, directing light around an object so that it appears as if nothing is there, or be put to use in lenses that could capture finer details than any optical microscope.

Dark spots

The team simulated three wavelengths to confirm negative refraction for much of the red portion of the visible spectrum and into infrared wavelengths.

Ulf Leonhardt at the University of St Andrews in the UK finds the work fascinating and the analysis sound. "There are a few caveats," he says. "I doubt whether the useful frequency band of the material can be extended to the entire visible spectrum", because it would be difficult to prevent some light being absorbed or sent elsewhere, resulting in dark spots.

A solid metamaterial that negatively refracts the long wavelengths of red light has already been developed, but it has proven tricky to get further into the visible spectrum: the smaller the wavelengths, the smaller the structures needed to control them, and the more difficult they are to build.

Convincing simulations

Huang holds that in principle the fluid could negatively refract all wavelengths in the visible spectrum, provided the nanoparticles had the right coating.

"One can reduce the thickness of the [fluid] sample in order to reduce the loss," he says. "As a result, the dark spots can disappear."

"The simulations look convincing," says Igor Smolyaninov of the University of Maryland in College Park, but he stresses that the set-up is still only theoretical. Huang says one of his co-authors, Xiang Zhang of the University of California, Berkeley, currently has a team at work creating a fluid metamaterial.

Journal reference: *Physical Review Letters* (in press)

http://www.newscientist.com/article/dn18359-how-to-make-a-liquid-invisibility-cloak.html

Electron-spotting could explain warm superconductors

- 19:00 07 January 2010 by **Colin Barras**

How can some materials become superconductors, allowing electricity to flow through them with zero resistance? The answer to this mystery may lie in a phenomenon best known from LCD televisions.

Admittedly, not all superconduction is a mystery: it is well established why some materials can become superconductors at temperatures close to absolute zero. But in the 1980s some materials based on copper oxide were found to superconduct at temperatures above 30 Kelvin, or -243 °C – still very cold, but warm enough to raise hopes that the technology could be exploited for practical purposes closer to room temperature.Decades later, there are still no room-temperature superconductors, and no explanation of how the existing so-called high-temperature superconductors work. The discovery in 2008 of a second class of high-temperature superconductors containing iron simply added to the mystery.

A new microscopy technique has now suggested a possible solution. Spectroscopic imaging-scanning tunnelling microscopy can image the electronic states inside a material by passing an atomically sharp electrode over its surface and measuring the changing probability that an electron of a given energy will move from the electrode into the material.

Electron watching

"For 50 years people imagined that we could see where atoms are in electronic materials, but not the electrons," explains Séamus Davis at Cornell University in Ithaca, New York. "[The new technique] turns that paradigm on its head – we ignore the atoms and look at the electrons."His team used that approach to examine the surface of an iron-based material that acts as a high-temperature superconductor. At temperatures just above absolute zero they found faint striped patterns of electrons. The distinct stripes are regions in which electrons are "frozen in one direction of motion but can move freely in the other", says Davis. Quantum effects are responsible for this behaviour.

The stripy structures look like the microscopic patterns made by liquid crystal molecules, well known because of their use in LCD televisions and other flat panel displays. In 2007, Davis's team found evidence for such electronic liquid crystals, as they are known, in some copper oxide superconductors. He says the fact that they exist in the iron-based material too could suggest they are a prerequisite for high-temperature superconductivity."Some would say this provides evidence that electronic liquid crystals are a key component of the physics of high-temperature superconductivity," says Davis. Other theoreticians in the field will probably disagree, he concedes, adding, "I'm an empiricist, not a theorist, and what I know is that there are common characteristics in these two classes of high-temperature superconductor."

Spectacular finding

The "spectacular" data "show beautiful electronic structures", says Robert Cava at Princeton University, New Jersey. But those patterns are "both delicious and daunting", he adds, raising the question of whether they are critical for superconductivity or simply found in all complex materials of that type.Andy Mackenzie at St Andrews University, UK, points out that similar electronic liquid crystals are found in ruthenate metals, which are not high-temperature superconductors. But with explanations for superconductivity thin on the ground, the liquid crystal link will be examined carefully. "If that leads to an improved understanding of the mechanism of high-temperature superconductivity, it could well advance research into applications."

Journal reference: *Science*, DOI: 10.1126/science.1181083

http://www.newscientist.com/article/dn18354-electronspotting-could-explain-warm-superconductors.html

World's communications network due an energy diet

- 17:30 12 January 2010 by **Paul Marks**

Working smarter to save energy across the communication networks (Image: ChuckSchug Photography/iStock)

The internet and other communications networks could use one-ten-thousandth of the energy that they do today if smarter data-coding techniques were used to move information around. That's the conclusion of Bell Labs, the research centre in Murray Hill, New Jersey, where both the laser and transistor were invented.

The lab has launched a consortium of networking and computing firms called Green Touch that is committed to developing new power-saving technologies. The initial goal is to cut power use in the global telecoms network by 99.9 per cent by 2015.

At issue, says Gee Rittenhouse, head of research at Bell Labs, is the 300 million tonnes of carbon dioxide belched into the atmosphere to power today's global telephone, internet and cellphone networks. "That's equivalent to the emissions from 50 million automobiles, or 20 per cent of the cars registered in the US," he says. The explosion in internet traffic taking place as mobiles go online and video viewing grows, plus future changes such as the arrival of 3D TV, will push those emissions even higher.

Back to basics

One way Bell Labs plans to develop low-power networks is by harnessing the theories of its late alumnus Claude Shannon that underlie all electronic communication, wired or wireless.

Shannon worked out that in a low-power channel, where unwanted "noise" is loud compared with the intended signal, a code can always be devised to extract the messages being transmitted. Today's fibre-optic and cellphone networks avoid having to take that approach by using high power levels. "But by using smarter codes we can extract those signals and reconstruct them accurately even in the presence of high noise," Rittenhouse says.

Other members of the Green Touch consortium include US mobile network AT&T, China Mobile – the world's largest cellphone operator – European mobile operator Telefonica, hardware manufacturers Samsung and Freescale Semiconductor, the Massachusetts Institute of Technology, Stanford University, California, the University of Melbourne, Australia and the French national computing lab INRIA.

Consolidated data

MIT engineer Muriel Médard says she will be looking for ways to bundle together internet data taking similar routes through the network to reduce the traffic on power-hungry trunk routes. "A lot of energy is dissipated in vain," she says.

At the University of Melbourne, Rod Tucker will focus on the power consumed by broadband modems, phones and cellphones when not in use.

"If you have broadband your modem is probably switched on all the time, consuming a few watts," he explains. "We'll be looking at ways to make modems and phones go into a sleep mode when not in use – but from which they can wake up quickly."

Samsung of South Korea is still firming up its ideas. "But memory and displays in communications systems are areas where we can particularly innovate," says engineer Young Mo Kim.

It's not just hardware that will be getting attention – changing user behaviour can also cut power use. For example by making cellphone battery life indicators more accurate or power-saving settings easier to change, users could be encouraged to use their cellphone batteries more efficiently. "The user aspects of communications energy-saving will be a clear focus," says Bell Labs president Jeong Kim.

http://www.newscientist.com/article/dn18377-worlds-communications-network-due-an-energy-diet.html

Artificial leaf could make green hydrogen

- 10 January 2010 by **Mason Inman**

Magazine issue 2742.

Harnessing plant power (Image: Pasieka/SPL)

1 more image

HIDDEN detail in the natural world could hold the key to future sources of clean energy. So say materials scientists who have created an artificial leaf that can harness light to split water and generate hydrogen.

Plant leaves have evolved over millions of years to catch the energy in the sun's rays very efficiently. They use the energy to produce food, and the central step in the process involves splitting water molecules and creating hydrogen ions.

By mimicking the machinery plants use to do this, it is possible to create a miniature hydrogen factory, says Tongxiang Fan of The State Key Laboratory of Metal Matrix Composites at Shanghai Jiao Tong University, China. "Using sunlight to split water molecules and form hydrogen fuel is one of the most promising tactics for kicking our carbon habit," he says.

Mimicking the machinery plants use to capture sunlight can create a mini hydrogen factory

The idea is not new, but until now researchers have focused on trying to modify or mimic the molecules directly involved in splitting hydrogen. "We'd like to adopt an entirely different concept, to mimic photosynthesis by copying the elaborate architectures of green leaves," Fan says.

Fan and his colleagues used several types of leaves as a template, including the grape-leaved anemone (*Anemone vitifolia*). First, they treated the leaves with dilute hydrochloric acid, allowing them to replace magnesium atoms - which form a crucial part of plants' photosynthetic machinery - with titanium (see illustration).

Then they dried the leaves and heated them to 500 °C to burn away most of the remaining plant material. This left a crystallised titanium dioxide framework plus many of the leaves' natural structures. Titanium

dioxide is commonly used in solar cells to enhance their efficiency, and in the leaf it catalyses the splitting of water molecules.

The leaf retained features such as the lens-like cells at its surface, which catch light coming from any angle, and veins that help guide light deeper into the leaf. The replicas also captured very fine detail, including structures called thykaloids, which increase the surface area available for photosynthesis and are just 10 nanometres thick.

It is these features which make the artificial leaves so efficient at generating hydrogen, Fan says. The team immersed the artificial leaves in a solution containing 20 per cent methanol - which acts as a catalyst - and zapped them with near-ultraviolet visible light. Compared with a commercially available form of titanium dioxide called P25 that can be used to create hydrogen, the artificial leaves absorbed more than twice as much light, and gave off more than three times as much hydrogen, Fan reports (*Advanced Materials*, DOI: 10.1002/adma.200902039).

The work is a "good beginning", says Chinnakonda Gopinath of the National Chemical Laboratory in Pune, India. "Complex structures found in leaves should be utilised further for enhancement in light harvesting."

http://www.newscientist.com/article/mg20527426.700-artificial-leaf-could-make-green-hydrogen.html

2010 preview: Tooth-mounted hearing aid for the masses

- 19 December 2009 by **Linda Geddes**
- Magazine issue 2739.

Learning to hear again (Image: Barnaby Hall/Photonica/Getty)

Beethoven is said to have overcome his deafness by attaching a rod to his piano and clenching it between his teeth, enabling the musical vibrations to travel through his jawbone to his inner ear. Next year, a similar but less unwieldy approach might restore hearing to people with a common form of deafness.

Single-sided deafness (SSD) affects around 9 million people in the US, and makes it difficult for them to pinpoint the exact source of sounds. This can make crossing roads extremely hazardous, and also makes it hard to hear conversations in noisy rooms.

Sonitus Medical of San Mateo in California has created a small device that wraps around the teeth. It picks up the sounds detected from a tiny microphone in the deaf ear and transforms them into vibrations. These then travel through the teeth and down the jawbone to the cochlea in the working ear, where they are transmitted to the brain providing stereo sound. The same process of "bone conduction" explains how we hear our own voices, and why they sound different when they are recorded and played back to us.

Some existing hearing aids also use bone conduction to transmit sounds to the cochlea, but these either require a titanium post to be drilled into the skull, or rely on cumbersome headsets. It also differs from conventional hearing aids, which employ air conduction to simply turn up the volume of sound travelling into the ear. The Cleveland Clinic in Ohio voted Sonitus's device its top medical innovation for 2010.

Sonitus is testing the device in people with SSD. One study suggests the device is comfortable and doesn't damage the teeth, and that it improved speech intelligibility in noisy surroundings (*Otology and Neurotology*, DOI: 10.1097/mao.0b013e3181be6741). The firm may start testing the device in people with other forms of deafness and at least one functioning cochlea.

The company plans to submit its results to the US Food and Drug Administration for approval in early 2010, and if all goes to plan, the device should become available later in the year. It will lend an ear to millions.

http://www.newscientist.com/article/mg20427396.100-2010-preview-toothmounted-hearing-aid-for-the-masses.html?full=true&print=true

Egg white provides a puncture repair kit for fetuses

- 07 January 2010
- Magazine issue 2742.

Patch this (Image: F1 Online/Rex Features)

BETTER known for giving meringues and soufflés their texture, egg white is being tested as a sealant for the amnion, a membrane that surrounds developing fetuses.

The amnion can rupture spontaneously, but can also tear after amniocentesis - in which a needle is used to extract amniotic fluid to test for genetic diseases - or fetal surgery. Such a breach can cause the mother's waters to break prematurely, resulting in miscarriage.

Noting its stickiness and its role in protecting a developing chick, Ken Moise and his colleagues at the Baylor College of Medicine in Houston, Texas, turned to purified, treated white from chicken eggs, which they had already used to repair holes in balloons and condoms.

They took discarded human amnions and stretched each across the bottom of an open-ended glass tube, which they then filled with human amniotic fluid. Next they ruptured the membrane with a needle, and after 30 seconds applied purified egg white. Of 21 tubes, 19 stopped leaking immediately. The others stopped after a second application (*American Journal of Obstetrics & Gynecology*, DOI: 10.1016/j.ajog.2009.10.862).

Moise had to use antibiotics to quell microbial infections caused by the procedure, which would complicate using it in the body. But as other attempts to seal or patch amnions have been disappointing, the development is a positive step, he says.

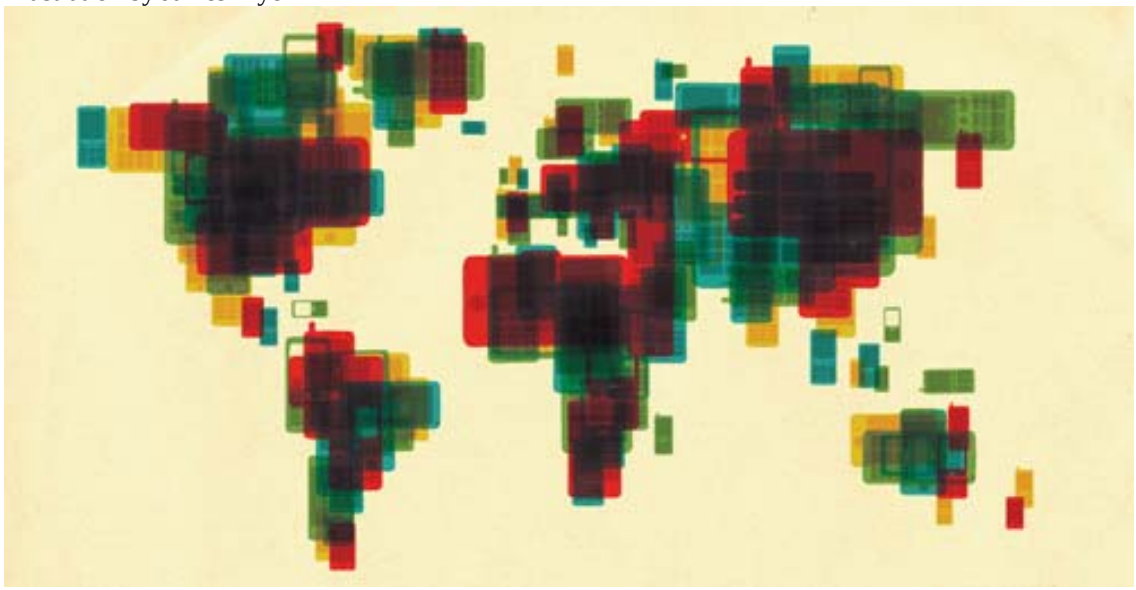
http://www.newscientist.com/article/mg20527425.500-egg-white-provides-a-puncture-repair-kit-for-fetuses.html

The Apparatgeist calls

Dec 30th 2009
From *The Economist* print edition

How you use your mobile phone has long reflected where you live. But the spirit of the machines may be wiping away cultural differences

Illustration by James Fryer



TECHNOLOGIES tend to be global, both by nature and by name. Say “television”, “computer” or “internet” anywhere and chances are you will be understood. But hand-held phones? For this ubiquitous technology, mankind suffers from a Tower of Babel syndrome. Under millions of Christmas trees North and South Americans have been unwrapping cell phones or *celulares*. Yet to Britons and Spaniards they are mobiles or *móviles*. Germans and Finns refer to them as *Handys* and *kännykät*, respectively, because they fit in your hand. The Chinese, too, make calls on a *sho ji*, or “hand machine”. And in Japan the term of art is *keitai*, which roughly means “something you can carry with you”.

This disjunction is revealing for an object that, in the space of a decade, has become as essential to human functioning as a pair of shoes. Mobile phones do not share a single global moniker because the origins of their names are deeply cultural. “Cellular” refers to how modern wireless networks are built, pointing to a technological worldview in America. “Mobile” emphasises that the device is untethered, which fits the roaming, once-imperial British style. *Handy* highlights the importance of functionality, much appreciated in Germany. But are such differences more than cosmetic? And will they persist or give way to a global mobile culture?

Such questions bear asking. It is easy to forget how rapidly mobile phones have taken over. A decade ago, there were fewer than 500m mobile subscriptions, according to the International Telecommunication Union (ITU). Now there are about 4.6 billion (see chart). Penetration rates have risen steeply everywhere. In rich countries subscriptions outnumber the population. Even in poor countries more than half the inhabitants have gone mobile. Dial a number and the odds are three to one that it will cause a mobile phone, rather than a fixed-line one, to ring somewhere on the planet.

As airtime gets cheaper, the untethered masses tend to use their mobiles more. In early 2000 an average user spoke for 174 minutes a month, according to the GSM Association (GSMA), an industry group. By early 2009 that had risen to 261 minutes, which suggests that humanity spends over 1 trillion minutes a month on mobiles, or nearly 2m years. Nobody can keep track of the flood of text messages. One estimate

suggests that American subscribers alone sent over 1 trillion texts in 2008, almost treble the number sent the previous year.

Now a further mobile-phone revolution is under way, driven by the iPhone and other "smart" handsets which let users gain access to the internet and download mobile applications, including games, social-networking programs, productivity tools and much else besides. Smart-phones accounted for over 13% of the 309m handsets shipped in the third quarter of 2009. Some analysts estimate that by 2015 almost all shipped handsets will be smart. Mobile operators have started building networks which will allow for faster connection speeds for an even wider variety of applications and services.

All alike, all different

Yet these global trends hide starkly different national and regional stories. Vittorio Colao, the boss of Vodafone, which operates or partially owns networks in 31 countries, argues that the farther south you go, the more people use their phones, even past the equator: where life is less organised people need a tool, for example to rejig appointments. "Culture influences the lifestyle, and the lifestyle influences the way we communicate," he says. "If you don't leave your phone on in a meeting in Italy, you are likely to miss the next one."

Other mundane factors also affect how phones are used. For instance, in countries where many people have holiday homes they are more likely to give out a mobile number, which then becomes the default where they can be reached, thus undermining the use of fixed-line phones. Technologies are always "both constructive and constructed by historical, social, and cultural contexts," writes Mizuko Ito, an anthropologist at the University of California in Irvine, who has co-edited a book on Japan's mobile-phone subculture.

Indeed, Japan is good example of how such subcultures come about. In the 1990s Americans and Scandinavians were early adopters of mobile phones. But in the next decade Japan was widely seen as the model for the mobile future, given its early embrace of the mobile internet. For some time *Wired*, a magazine for technology lovers, ran a column called "Japanese schoolgirl watch", serving readers with a stream of *keitai* oddities. The implication was that what Japanese schoolgirls did one day, everyone else would do the next.

The country's mobile boom was arguably encouraged by underlying social conditions. Most teenagers had long used pagers to keep in touch. In 1999 NTT, Japan's dominant operator, launched i-mode, a platform for mobile-internet services. It allowed cheap e-mails between networks and the Japanese promptly signed up in droves for mobile internet. Ms Ito also points out that Japan is a crowded place with lots of rules. Harried teenagers, in particular, have few chances for private conversations and talking on the phone in public is frowned upon, if not outlawed. Hence the appeal of mobile data services.

The best way to grasp Japan's mobile culture is to take a crowded commuter train. There are plenty of signs advising you not to use your phone. Every few minutes announcements are made to the same effect. If you do take a call, you risk more than disapproving gazes. Passengers may appeal to a guard who will quietly but firmly explain: "*dame desu*"—it's not allowed. Some studies suggest that talking on a mobile phone on a train is seen as worse than in a theatre. Instead, hushed passengers type away on their handsets or read mobile-phone novels (written Japanese allows more information to be displayed on a small screen than languages that use the Roman alphabet).

Might the Japanese stop talking entirely on their mobiles? They seem less and less keen on the phone's original purpose. In 2002 the average Japanese mobile user spoke on it for 181 minutes each month, about the global norm. By early 2009 that had fallen to 133 minutes, then only half the world average. Nobody knows how many e-mails are sent, but the Japanese are probably even more prolific than text-crazy Indonesians, who average more than 1,000 messages per month on some operators. No wonder that Tokyo's teenagers have been called the "thumb generation".

Others are quiet, too. On average Germans—who are fond of saying that "talk is silver, silence is golden"—spend only 89 minutes each month calling others for *Handy*-based conversation. This may be a result of national telephone companies on both sides of the Berlin Wall having exhorted subscribers for years to "keep it short" because of underinvestment in the East and rapid economic growth that overtaxed the network in the West. Germans are also thrifty, suggests Anastassia Lauterbach of Deutsche Telekom. For longer calls, she says, consumers resort to much cheaper landlines.

In contrast, Americans won't shut up. Their average monthly talk-time is a whopping 788 minutes, though some of this is a statistical illusion because subscribers also pay for incoming calls. Yet talk is cheap: there is no roaming charge within the United States. Americans are often in their cars, an ideal spot for phone calls, especially in the many states where driving and talking without headsets is still legal.

The chattiest of all are Puerto Ricans, who have by far the highest monthly average in the world of 1,875 minutes, probably because operators on the American island offer all-you-can-talk plans for only $40, which include calls to the mainland. This allows Puerto Ricans to chat endlessly with their friends in New York, but may also have arbitrageurs routing cheap international phone calls through the island.

Just how people behave when talking on a mobile phone is a question of culture, at least at first, according to Amapro Lasén, a sociologist at Universidad Complutense in Madrid. In the early 2000s she studied phone users in the Spanish capital, in Paris and in London. Mobiles were a common sight, but Parisians and Madrileniens felt freer to talk in the street, even in the middle of the pavement. Londoners, by contrast, tended to gather in certain zones, for instance at the entrances of tube stations—the sort of place Ms Lasén calls an "improvised open-air wireless phone booth".

In Paris people openly complained when bothered by others talking loudly about intimate matters, but complaints were rare in London. In both places, people tended to separate phone and face-to-face conversations, for instance by retreating to a quiet corner. But subscribers in Madrid often mixed them and even allowed others to take part in their phone conversations. The Spanish almost always take a call and most turn off voicemail.

For Ms Lasén, who has lived in all three cities, such variations reflect how people traditionally use urban space. In London, she says, the streets are mainly for walking, "like the bed where the river flows". Paris, however, is a place to stroll, the home of the *flâneur*. In Madrid people inhabit the streets to talk together. As for their aversion to voicemail, the Spanish consider it rude to leave a call unanswered, even if it is inconvenient. This may be the result of a strong sense of social obligation towards friends and family.

Elsewhere, too, culture and history may help determine whether people talk in public or take a call. The Chinese often let themselves be interrupted, fearing that otherwise they could miss a business opportunity. Uzbeks use their mobiles only rarely in public, because the police might be listening. And Germans can get quite aggressive if people disobey the rules, even unwritten ones. In 1999 a German man died in a fight triggered by his ill-mannered *Handy* use.

Economics and other hard factors also shape habits. Olaf Swantee, the head of Orange's mobile business, notes that pricey handsets are less popular in Belgium than in Britain because Belgian operators have long been barred from subsidising phones, a strategy widely used on the other side of the Channel. Italy, however, exhibits both low subsidies and many high-end handsets. Subscribers there do not want to spend much on airtime, but are keen to buy a flashy phone.

China is distinct because of economics and relatively lax regulation. Many consumers use *shanzhai* ("bandit") phones, produced by hundreds of small handset-makers based on chips and software from Mediatek, a Taiwanese firm. Knock-offs are common, with labels such as "Nckia" and "Sumsung". Other innovative manufacturers have developed specialised phones, for instance handsets that can respond to two phone numbers, or models with giant speakers for farmers on noisy tractors.

Elsewhere the physical environment determines which kinds of handsets prevail, says Younghee Jung, a design expert at Nokia, the world's largest maker of handsets. In hot India, for instance, men rarely wear jackets, but their shirts have pockets to hold phones—which therefore cannot be large. Indian women keep phones in colourful pouches, less as a fashion statement than as a way to protect the devices and preserve their resale value. It also makes for a noteworthy contrast with Japan, says Ms Jung. If women there keep phones in a pouch and decorate them with stickers and straps, that has nothing to do with economics, but reflects the urge to personalise the handset. Phones are highly subsidised in Japan and the resale value is essentially nil, so it is not unusual to see lost units lying in the gutter.

In some countries it is a common habit to carry around more than one phone. Japanese workers often have two: a private one and a work one (which they often turn off so bosses cannot get them at any hour). "I have one phone for work, one for family, one for pleasure and one for the car," says a Middle Eastern salesman quoted in a study for Motorola, a handset-maker. Having several phones is often meant to signal importance. Latin American managers, for instance, like to show how well connected they are: some even have a dedicated one for the boss.

As this example suggests, softer factors may influence the choice and design of hardware, even for networks. If coverage in America tends to be patchy, it is not least because consumers seem willing to endure a lot and changing operators is a hassle. Elsewhere the reverse is true. Italians demand good reception on the ski slopes, the Greeks on their many islands and Finns in road tunnels, however remote. If coverage is poor, subscribers will switch.

Paradoxically, however, it is in Italy and Greece that people are especially worried about the supposed health risks of electromagnetic fields. A 2007 survey commissioned by the European Commission found that 86% of Greeks and 69% of Italians were "very" or "fairly" concerned about them, compared with 51% in Britain, 35% in Germany and only 27% in Sweden. It may be that people fret when they lack reliable information—or that in some countries local politicians stir up fears.

Whatever the reasons, the public reaction explains why phone masts in Italy are often disguised, for instance as the arches of a hamburger restaurant, as a palm tree or even as the cross on a famous cathedral. In Moldova, by contrast, such masts are monuments to prosperity. "Every time we put up a mast, they had a party. It connected them," says Orange's Mr Swantee.

Yet digital technologies change quickly, and so do attitudes towards them. Will such differences between cultures persist and grow larger, or will they diminish over time? Companies would like to know, because it costs more to provide different handsets and services in different parts of the world than it would do to offer the same things everywhere.

A few years ago such questions provoked academic controversy. Not everybody agrees with Ms Ito's argument that technology is always socially constructed. James Katz, a professor of communication at Rutgers University in New Jersey, argues that there is an *Apparatgeist* (German for "spirit of the machine"). For personal communication technologies, he argues, people react in pretty much the same way, a few national variations notwithstanding. "Regardless of culture," he suggests, "when people interact with personal communication technologies, they tend to standardise infrastructure and gravitate towards consistent tastes and universal features."

Recent developments seem to support him. When Ms Lasén went back to London, Paris and Madrid a few years later, phone behaviour had, by and large, become the same in the different cities (although Spaniards still rejected voicemail). Yet it is not just the *Apparatgeist* that explains this, argues Ms Lasén. In all three cities, she says, people lead increasingly complex lives and need their mobiles to manage them. Ms Ito agrees. American teenagers now also text madly, in part because their lives are becoming almost as regulated as those of the Japanese.

This convergence is likely to continue, not least because it is in the interest of the industry's heavyweights. Handsets increasingly come with all kinds of sensors. Nokia's Ms Jung, for instance, is working on a project to develop an "Esperanto of gestures" to control such environmentally aware devices. Her team is trying to find an internationally acceptable gesture to quieten a ringing phone. This is tricky: giving the device the evil eye or shushing it, for instance, will not work. Treating objects as living things might work in East Asia, where almost everything has a soul, but not in the Middle East, where religious tenets make this unacceptable.

In the long run most national differences will disappear, predicts Scott Campbell of the University of Michigan, author of several papers on mobile-phone usage. But he expects some persistence of variations that go back to economics. In poorer countries subscribers will handle their mobile phones differently simply because they lack money. Nearly all airtime in Africa is pre-paid. Practices such as "beeping" are likely to continue for quite a while: when callers lack credit, they hang up after just one ring, a signal that they want to be called back.

A few differences may remain within borders, suggests Kathryn Archibald, who works at Nokia and tries to understand consumers in different parts of the world. Only a few countries, mainly in Africa and Asia, still need special cultural attention when designing a phone (which is why some models in India double as torches). "We see more differences within countries than between them," she says.

Nokia breaks down phone users into various categories, rather than by geography. "Simplicity seekers" barely know how to turn on their phones and use them only in case of trouble. At the other end of the spectrum, "technology leaders" always want the latest devices and feel crippled without their phones. "Life jugglers" need their handsets to co-ordinate the many parts of their lives. Ms Archibald says Nokia's aim is to offer the right handset to each such group.

But when it comes to content—the services offered via the phones and the applications installed on them—Nokia pays considerable attention to local culture. In India and other developing countries the firm has launched a set of services called "Life Tools", which ranges from agricultural information for farmers to educational services such as language tuition. In many rich countries, by contrast, handsets come bundled with a subscription to download music. "We need to operate globally, but be relevant locally," concludes Ms Archibald.

All this raises a question: as differences fade, are people becoming slaves to the *Apparatgeist*? "Because of our evolutionary heritage, we want to be in perpetual contact with others," argues Mr Katz. Just as technology allows people to overeat, it now lets them overcommunicate. If this is a problem now, imagine what would happen if telepathy become possible. The thought is not entirely far-fetched: researchers at Intel, a chipmaker, are devising ways to use brain waves to control computers. A phone that can be implanted in your head may be just a few years away—at which point the Germans will no longer be able to call it a *Handy*.

http://www.economist.com/displayStory.cfm?story_id=15172850

Five emotions you never knew you had

- 13 January 2010 by **Jessica Griggs**
- Magazine issue 2743

Jumping for joy (Image: Olivier Morin/Getty)

Editorial: *Uh-oh, more emotions to worry about*

CAN you name the six basic emotions? Take a straw poll of your friends and we guarantee that you will find no consensus. Yet psychologists are unequivocal: joy, sadness, anger, fear, surprise and disgust. These are the Big Six, quite literally, the in-your-face emotions - the ones that everyone the world over exhibits with the same dramatic and characteristic facial expressions. They have been the subjects of intense research for over half a century, not least because of the role they have played in our survival as a species.

Times have changed, though. Our ancestors may have had daily need of fear to flee predators, anger to conquer foes and disgust to avoid diseases, but we live in a more subtle world in which other emotions have come to the fore. There are many contenders. Avarice, embarrassment, boredom, depression, jealousy and love, for example, might epitomise the modern age. Yet some more obscure emotions may be increasingly relevant today. Here we explore five of them, any one of which could make a case to be promoted to a place alongside the Big Six.

ELEVATION

The uplifting emotion

"Let it be said by our children's children that when we were tested we refused to let this journey end, that we did not turn back nor did we falter; and with eyes fixed on the horizon and God's grace upon us, we carried forth that great gift of freedom and delivered it safely to future generations."

In the midst of last year's economic turmoil President Barack Obama's inauguration speech was powerful, inspiring stuff. Some of his supporters, hanging on his every word, will have had tears in their eyes, a tingling sensation on the back of their necks and a warm feeling in their chest as though it was opening up to let love and hope flood out. This feeling is what Jonathan Haidt at the University of Virginia, Charlottesville, has labelled "elevation".

Elevation seems to be a universal feeling. Although not yet studied in modern-day pre-literate societies, it has been documented in people from Japan, India, the US and the Palestinian territories. That puts it in the same league as the Big Six. But to be considered as a basic emotion it should also have a purpose. If emotions are to fulfil their role as survival aids, they must motivate activities that help us thrive. So what is elevation for? Originally Haidt thought that it makes us nobler towards others. But when he asked volunteers to watch either an uplifting episode of *Oprah* or a non-uplifting scene from the sitcom *Seinfeld*, and then gave them a chance to help a stranger, there was no difference in behaviour between the two groups.

Haidt's next idea was born of the choked feelings that people often report when they describe experiencing elevation. This hints that the vagus nerve is involved because it is responsible for stimulating the throat and neck muscles. Activation of the vagus nerve is also linked to the release of a hormone called oxytocin, which generates warm, calm feelings - just the sort associated with elevation. Could oxytocin be the key? The inspiration for how to test this idea came from his student, Jennifer Silvers, who pointed out that oxytocin makes nursing mothers release milk.

So in a second round of experiments, Haidt and Silvers showed the same videos to breastfeeding mothers. They found that after watching *Oprah* mothers were more likely to leak milk into a nursing pad. They also spent more time nursing and hugging their babies than the mothers who watched the *Seinfeld* video (*Emotion*, vol 8, p 291). "Oxytocin doesn't make people go out and give money to charity, it doesn't make people help strangers jump-start their cars, it makes them want to touch, hug and be more open and trusting with each other," says Haidt.

So elevation has a physiological component and motivational one too. However, unlike the Big Six emotions, it does not have an obvious characteristic facial expression, which may explain why it has slipped under the research radar for so long. If you appreciate the context, you may be able to detect a slight softening of the features, says Haidt. Sometimes the eyebrows are raised as if the person is sad.

Elevation is also relatively rare. People typically experience it less than once a week, although there are wide individual differences. Where it does score, though, is in being highly significant. "If you ask people to remember their most cherished experiences of their whole life, elevatory moments are likely to feature in their top five," says Haidt. What's more, if we can harness elevation to build trust, it could have particular relevance in the modern world for strengthening or repairing personal relationships. Haidt envisages a time, for example, when marital therapists might try to induce it so as to enhance the effectiveness of couples' counselling sessions.

INTEREST

The curious emotion

Your head tilts to one side, your speech quickens and the muscles in your forehead and around your eyes contract as you become engrossed in mastering a bassoon sonata, understanding the thermodynamics of the universe, or perhaps just browsing your stamp collection. Interest may be trickier to pin down than fear or joy but it nevertheless possesses one of the hallmarks of a basic emotion - its own facial expression. Since the 1960s when Paul Ekman pioneered the field, psychologists have looked for universal, characteristic facial expressions to help measure and classify emotions.

Interest also seems to have a purpose. Psychologist Paul Silvia at the University of North Carolina at Greensboro, believes it motivates people to learn - not for money, not for an exam, but for its own sake, to increase their knowledge just because they want to.

This could explain why interest has come into its own in the modern world. It can be seen as a counterbalance to the fear and anxiety that surrounds unfamiliar experiences. Without interest we would shy away from new or complicated things because they tend to make us nervous. "This makes sense if we

think in terms of evolutionary history, as unfamiliar situations could often be dangerous," says Silvia. "But in the modern world, it would be disastrous because we couldn't flourish intellectually."

Another strong argument for interest deserving a status boost is that it can go wrong. One criterion that some psychologists use to define a basic emotion is that it should have associated aberrations or pathologies. Excessive fear, for example, generates panic or chronic anxiety. Likewise, too much interest results in repetitive, consuming and compulsive behaviour.

So how does interest fare in the emotions league? As naturally curious creatures, we experience it daily and devote a lot of time and brainpower to things that interest us. That alone could make it a major emotional player. But the real power of interest, according to Silvia, lies in its ability to keep us engaged in our frenetic lives rather than becoming overwhelmed by information overload. That's also a reason for trying to understand what stimulates interest. "We have to find ways of helping people learn, to keep them from becoming anxious and tuning out in the face of this monstrous amount of information," he says.

GRATITUDE

The relationship-boosting emotion

Gratitude has a way to go before it satisfies the most stringent emotion criteria. The facial expression has yet to be identified, although it is easy to speculate what it might involve - a smile and a dip of the head, perhaps. Furthermore, studies have yet to be carried out in non-western cultures. This could be important, as expressions of gratitude may be culturally ingrained. Expectations of which situations will generate gratitude certainly are: waiters in the US will stand at your elbow until you tip, for example, whereas in Japan they will chase you down the street to return the extra cash you left on the table.

Like all emotions worth their salt, though, gratitude motivates us to act: it makes us want to acknowledge and repay a kindness or thoughtful gesture. So gratitude might simply ensure a quid pro quo repayment mechanism, but new research suggests there may be more to it than that.

Sara Algoe of the University of North Carolina at Chapel Hill has found that gratitude makes cohabiting couples feel more connected. She reasons that truly thoughtful gestures help us find the individuals who really "get us". The grateful feeling is a signal that we should get to know them better as they are the ones likely to be there for us in the future. So, once you are in a romantic relationship, feelings of gratitude serve as a little reminder of how great your partner is. Long term, Algoe says, gratitude is there to help promote a positive cycle of give and take, creating an upward spiral of satisfaction in the relationship.

In a romantic relationship, the feeling of gratitude serves as a reminder of how great your partner is

If Algoe is correct, gratitude has big potential benefits in the modern world. High-quality relationships are good for our health, notes her colleague Barbara Fredrickson. She goes further in her book, *Positivity* (Crown, 2009), suggesting that by cultivating gratitude we might increase social harmony in groups, fostering lower employee turnover, more volunteering in communities, perhaps even less crime, less littering and less wasting of resources.

PRIDE

The emotion with two faces

The conceited, arrogant feeling of pride has been called the deadliest of the seven deadly sins. Yet pride can also be noble. We all know the contented sense of achievement and self-worth that comes with having done well at something, whether it be achieving a promotion, building something, winning a race or figuring out a cryptic crossword clue. That's why Jessica Tracy at the University of British Columbia

(UBC) in Vancouver, Canada, one of the few psychologists focused on pride, makes the distinction between what she calls "hubristic pride" and "authentic pride".

Pride may manifest itself in two different ways, but we cannot tell these apart by their outward appearance, she says (*Emotion*, vol 7, p 789). Both types cause people to tilt their heads back, extend their arms from their body and try to look as large as possible. As Charles Darwin noted in his book *The Expression of Emotions in Man and Animals* (1872), a proud person looks "swollen or puffed up". So there is a characteristic prideful look, but in contrast to the basic emotions, the face only plays a small role, with a slight smile creeping across it.

Pride also differs from the Big Six in being a "self-conscious" emotion. Like shame, guilt and embarrassment, it requires a sense of self and the ability to self-evaluate. "In order to experience pride," Tracy says, "I need to think about who I am, who I want to be and how the event that's just happened reflects on me and my ambitions." Nevertheless, she believes there is a strong case for thinking of pride as a basic emotion. Her research suggests that the physical expression of pride is recognised in pre-literate, isolated tribes (*Journal of Personality and Social Psychology*, vol 94, p 516). She has even found it in people who were born blind, indicating that it is innate rather than learned (*Proceedings of the National Academy of Sciences*, vol 105, p 11655).

So what is the point of pride, and why do we have two prides that feel different but look the same? In general, when people see pride expressed they associate it with high status. So pride motivates us to do well so that we gain respect. There are two distinct ways to do this, which perhaps explains the flip sides of pride.

Status can take two forms, says anthropologist Joe Henrich, also at UBC. The first is based on dominance and commonly seen in non-human primates, whereby bigger and stronger individuals are revered because they could overwhelm or kill others. The human equivalents include the playground bully and officious boss. The second kind of status is prestige. In this case, respect and power is gained through knowledge or skill. "This fits in with the two kinds of pride," says Tracy. "One is associated with aggression and overconfidence, while the other motivates achievement, hard work and altruistic behaviour."

CONFUSION

The time-for-change emotion

It's a feeling we have all experienced, whether in a lecture theatre, an art gallery or wandering around an unfamiliar city, but confusion is tricky to describe. Dacher Keltner at the University of California, Berkeley, suggests that it is the "feeling that the environment is giving insufficient or contradictory information". But is confusion really an emotion?

For some psychologists, the idea is scandalous. Others describe confusion as the fringiest of the fringe. Nevertheless, Silvia thinks there is a good case to be made for considering confusion as a basic emotion, not least because it is so easy to spot. The brow furrows, the eyes narrow, the lip might even get bitten - you know confusion when you see it. In fact, one study found it was the second most recognisable everyday expression, only surpassed by joy (*Emotion*, vol 3, p 68).

What, then, is confusion for? It's a knowledge-based emotion, in the same "family" as interest and surprise, says Silvia. He believes it is our brain's way of telling us that the way we are thinking about things is not working, that our mental model of the world is flawed or inadequate. Sometimes this will make us withdraw, but it can also motivate us to shift our attention or change our learning strategy, he says.

A related idea is that a confused facial expression alerts others to help the confused person. If so, confusion serves to bring new knowledge and encourage social relationships, making it, perhaps, the perfect 21st-century emotion.

I say boredom, you say ennui

Some emotional states only have names in particular languages. Here are some examples; let us know in the comments if you know of more.

Fiero (Italian): contented pride in achieving something just for oneself.

Amae (Japanese): the sweet feeling of being dependent on someone else.

Naches (Yiddish): the glow of proud pleasure that only a child can give to its parents.

Schadenfreude (German): the feeling you experience when you learn that your worst enemy has suffered some misfortune.

Ennui (French): the sophisticated, world-weary boredom most intensely felt by philosophers and intellectuals.

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http://www.newscientist.com/article/mg20527431.300-five-emotions-you-never-knew-you-had.html?DCMP=NLC-nletter&nsref=mg20527431.300

Poor neighbourhoods can kill

- 13 January 2010 by **Peter Aldhous**

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Victim of circumstance? (Image: Sarah Hoskins for New Scientist)

2 more images

Editorial: *US health gaps shame us all*

DEEP down, Diana Garmon-Spears knew something was seriously wrong when she noticed a lump in her right breast, about the size of a peanut. "I ignored it, but then my breast started to deform. I started to form a mass of lumps all around," she recalls.

Two years later, she doesn't expect doctors to cure her cancer, and has been forced to give up her office work. "I don't think there's any employer who's going to understand you having chemo or radiation for 2 hours a day."

As an African American woman living in Chicago, the dice are loaded against Garmon-Spears. Across the US, death rates among black women diagnosed with breast cancer are 37 per cent higher than for whites, but in Chicago the difference is an astonishing 68 per cent (*Cancer Causes & Control*, vol 18, p 323). Something about this heaving metropolis is sending black women to an early grave.

Poor access to screening and therapy is clearly an important factor. But according to a novel collaboration between sociologists and biologists, the strain of living in some of the toughest neighbourhoods in the US may cause biological changes that lead directly to earlier deaths.

Results from the collaboration indicate that social isolation and a fear of crime cause an overload of stress hormones that can change cell biology, sending tumours into overdrive. "We're showing that your social environment can affect your health directly," says Suzanne Conzen of the University of Chicago. "It goes into gene expression. That concept is really new."

Crucially, this insidious influence is felt most by Chicago's African American women, who are far more likely to live in the city's deprived areas than their white counterparts.

The provocative hypothesis highlights the need for new ways of fighting breast cancer in black women in Chicago specifically, including via social interventions. More broadly, other health researchers are hailing

the union of biology and sociology as a model for future studies into a whole range of health disparities. "It's a great example of the kind of direction in which I can see us heading," says Tim Rebbeck, an epidemiologist at the University of Pennsylvania in Philadelphia. There are already hints that stress and social deprivation could have similar effects on diabetes and cardiovascular disease.

To get a handle on how tough life in Chicago can get, a good place to start is the neighbourhood of Englewood in the city's South Side (see diagram). Poverty in Englewood is grinding, crime is endemic and amenities that the mostly white residents of comfortable suburbs like Clearing take for granted are long gone. "Even churches have moved out," says Sarah Gehlert of Washington University in St Louis, Missouri, lead sociologist on the project.

New Scientist got a taste of conditions on a tour of the South Side with members of Gehlert's research team. At vacant lots strewn with beer bottles and other debris, I'm told to watch my step. A previous visitor stumbled on a bag of urine and other medical waste. Along one Englewood street, we pass three burnt-out houses. On this winter morning, the gang activity that blights the area has yet to ramp up for the day. But the grilles on the windows of the Simon Guggenheim Elementary School are a testament to the crime that stalks these streets. You wouldn't want to be here after dark, says Charles Mininger, a graduate student on the project.

Other sociologists have documented the struggle to survive in this grim environment. But in 2003 Gehlert, then at the University of Chicago, took a novel approach when she teamed up with some of the university's leading oncologists and biologists to investigate how social circumstances might influence prospects for women with breast cancer.

From the work of Nigerian-born Funmi Olopade, the researchers knew that women of west African descent are more likely than their white counterparts to develop "triple-negative" tumours. These tumours, which usually strike before menopause, can be particularly deadly because they don't carry large amounts of a surface protein called HER2/neu and also lack receptors for the sex hormones oestrogen and progesterone. As a result, they fail to respond to either of the leading breast cancer drugs: tamoxifen, which blocks the stimulating effect of oestrogen; or Herceptin, which targets HER2/neu.

Tumour type can't fully explain the astonishingly high death rate from breast cancer among black Chicagoan women, however. A clue that social factors might contribute to this tragic trend came from the lab of behavioural biologist Martha McClintock, also at the University of Chicago. When she housed normally gregarious rats alone, she noticed that they tended to die early from a variety of tumours. She has since investigated the phenomenon in detail, revealing last month that isolated female rats become edgy and vigilant, have high levels of the stress hormone cortisol, and are 3.3 times more likely to develop breast cancer than animals living in groups (*Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.0910753106).

Gehlert was struck by the parallels between McClintock's rats and the vigilant, stressed women she knew from the scariest South Side neighbourhoods. She decided to find out if the stress and isolation these women experience has direct biological effects on their health too. Over the past five years, Gehlert's team has recruited some 230 black Chicagoan women, newly diagnosed with breast cancer, for a survey that combines interviews, analyses of crime statistics and other conditions in their neighbourhoods, plus hormonal measurements and molecular studies of biopsies from tumours. Garmon-Spears is one of the volunteers.

In a seminar last month at the National Institutes of Health in Bethesda, Maryland, Gehlert described her team's findings. Most striking is the fact that the women fall into two groups based on the daily patterns of cortisol in their saliva (see graph). One-third of the women had a normal daily cycle, with a peak about 30 minutes after waking up. But the other two-thirds, dubbed "flatliners", had no cortisol cycle at all.

It turned out that the flatliners lived in areas with more homicides and robberies, and scored higher for depression. Women who felt they had strong social networks, and scored low on a psychometric test for loneliness, were more likely to have a normal cycle.

Women with 'flatline' cortisol cycles tended to live in areas with more homicides and robberies

Gehlert suggests that the fear that comes with living in high-crime areas combined with scant social support causes overproduction of cortisol, similar to that seen in McClintock's isolated rats. This eventually erodes the body's ability to release the stress hormone, creating the flatline effect. Similar "burnout" patterns have been seen in patients with post-traumatic stress disorder.

In this respect, Garmon-Spears's prospects may be better than many. While she grew up in a tough South Side housing project, and lost her husband to an overdose of crack cocaine over a decade ago, she feels comfortable in her present home, just north of the city centre. "I'm watchful; I'm careful, but I'm not scared," she says. Between caring for her mother, chatting with her sisters, and attending Jehovah's Witnesses meetings, she has a busy social life.

But among the flatliners, fear of crime and lack of amenities creates severe social isolation. "When they list their five closest ties, it's unlikely they'll be in the vicinity," Gehlert says. "In the worst neighbourhoods, they have no casual ties, because businesses have moved out."

Meanwhile, Conzen and McClintock have come up with a biological mechanism that could explain how high levels of cortisol caused by social isolation might increase women's death rate from breast cancer. In mice that were genetically predisposed to breast cancer, the researchers found that the surge in cortisol caused by social isolation works through receptors on the surface of tumour cells to increase the activity of certain genes. This increase allows the tumour cells to use sugars and fats more efficiently. By 21 weeks of age, isolated mice had tumours that were on average more than 50 per cent larger than those in mice that were also prone to breast cancer, but housed in groups (*Cancer Prevention Research*, vol 2, p 850).

Health disparities

To complete the picture, Olopade is now studying biopsies of the women's tumours to see if the flatliners, in particular, have altered gene activity that is similar to patterns seen in the isolated mice - although she warns that a bigger sample of women may be needed to produce definitive results.

So far, the results from the collaboration have impressed other researchers interested in health disparities. "Loneliness is something that people might not think of immediately as an obvious factor on the pathway to aggressive breast cancer," says Marshall Chin, a diabetes specialist also at the University of Chicago. Other projects are examining whether a fusion of sociology and biology can shed light on why other disadvantaged US populations, both black and white, are disproportionately affected by cancer (see "From city streets to country roads").

The key test of the approach, however, will be whether or not it can improve survival rates. Gehlert is already planning trial interventions for the next phase of the Chicago project. Stress-control techniques are a non-starter. "If we taught a woman relaxation, we'd be helping her biologically but she'd probably be murdered," Gehlert says. "Where there are a lot of crimes and unsafe housing, they really do need to be vigilant."

Relaxation might help a woman biologically but she'd probably be murdered

Instead, she plans to recruit "neighbourhood coordinators" within South Side communities who will help women to negotiate obstacles such as the bureaucracy that frustrates attempts to obtain housing, healthcare and other necessities. The coordinators will also work with free clinics and other community

groups to find spaces where isolated women can meet one another and get the social support that is missing from their lives. "We need places where women can have some social interaction without fearing harm," Gehlert says.

Meanwhile, biologists on the team are thinking about affordable drugs that might help. Given the apparent involvement of genes that affect the metabolism of sugars, Conzen suggests that metformin, which decreases the amount of glucose absorbed from food and released from the liver, might starve the women's tumours of nutrients, making them less aggressive.

Metformin is already used to treat type 2 diabetes, and there is a possibility that similar stress-induced changes in gene activity could contribute to disparities in the incidence of this disease. "There's a lot of interest in cortisol burnout in diabetes," says Graham Colditz, an epidemiologist at Washington University in St Louis. Indeed, related mechanisms might help explain why disadvantaged populations suffer heavily from a whole range of major killers. "They have high cancer, high diabetes, high heart disease, and very high stroke," Colditz says.

Could a combination of social interventions and drug treatments give Gehlert's flatliners a fighting chance? Will it be necessary to intervene earlier to stave off cortisol burnout in younger women before the damage is done? For now, there are more questions than answers. But when answers come, they may resonate in the corridors of power. The young Barack Obama cut his teeth as a community organiser on Chicago's South Side. His wife, Michelle, was on the planning committee for Gehlert's project.

The women of the South Side urgently need a message of hope. But turning hope into improved health outcomes for disadvantaged populations across the US may require political action at the highest level.

From city streets to country roads

At first glance, the rural backwaters of south-east Missouri have little in common with the South Side of Chicago. But they are both examples of social environments that may be causing biological changes in people's bodies that can send them to an early grave.

Sarah Gehlert of the University of Chicago is looking at how the strain and isolation of life in tough neighbourhoods in Chicago might explain the high death rates from breast cancer in black women (see main story).

In Missouri, she is teaming up with Graham Colditz at the University of Washington in St Louis to recruit about 300 black and white women with breast cancer. Here, crime is lower than in Chicago, but the poverty is similar. A sparse population means social isolation is also a serious problem.

Meanwhile, Gehlert's collaborator Electra Paskett of Ohio State University in Columbus is exploring whether social isolation in poor white women in the Appalachian mountains depresses immunity, allowing papillomaviruses to trigger cervical cancer.

And in Philadelphia, Tim Rebbeck of the University of Pennsylvania is looking at the social and biological factors behind the black-white disparity for prostate cancer. He has found that the prognosis is worst for black men in deprived areas who lack a supportive social network through family or church.

http://www.newscientist.com/article/mg20527433.900-poor-neighbourhoods-can-kill.html?DCMP=NLC-nletter&nsref=mg20527433.900

Circumcision: there goes the microbial neighbourhood

- 14:44 08 January 2010 by **Ewen Callaway**

A flap of foreskin isn't the only thing missing after a circumcision. Microbes that call the penis home disappear, too, which could explain why the procedure reduces a man's chance of contracting HIV.

"The microbes change dramatically," says Lance Price, a microbiologist at the Translational Genomics Research Institute in Flagstaff, Arizona, whose team identified thousands of microbes on the penises of 12 HIV-negative men. All had participated in a clinical study in Uganda which showed that circumcision halves the chances of getting the virus.

The team discovered a total of 38 families of bacteria on the men's penises before circumcision, and 36 a year after. But the make-up of these communities had swung. Gone were a diverse population of bacteria intolerant of oxygen and linked with vaginal infection; now there was a more homogenous air-loving lot, more typical of other patches of skin.

Price thinks that some of the expelled bacteria provoke an immune reaction on an uncircumcised penis, causing specialised immune cells to shuttle HIV throughout the body.

Residents of the penis

Even where religion, culture or costs prevent widespread circumcision, Price says the work could be a first step in delivering the benefits of the procedure without surgery. "The really interesting thing about this study is the potential to modify somebody's risk for HIV."

His team next plans to determine which microbes are most common on the penises of men who go onto to acquire HIV. Targeting these bacteria with antibiotics – while leaving harmless or even helpful residents of the penis alone – could stem the spread of HIV, he says.

Martin Blaser, a microbiologist at New York University, says the new study is the most comprehensive look yet at the microbes living on the penis. But given that microbial populations on other parts of the body shift over time, he wonders whether the pre-circumcision bacteria will return. "I expect it will stay changed," he says.

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http://www.newscientist.com/article/dn18358-circumcision-there-goes-the-microbial-neighbourhood.html?DCMP=NLC-nletter&nsref=dn18358

Jim Al-Khalili: Islam's House of Wisdom will rise again

- 13 January 2010 by **Sanjida O'Connell**

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Reminding us of Islam's rich scientific heritage

*Quantum physicist **Jim Al-Khalili** grew up in Iraq and has become an expert on the golden age of Islamic science. He explains to **Sanjida O'Connell** how science in the Muslim world will flourish once more*

Few westerners know about the golden age of Arabic science. How did it come about?

The Arab empire was hugely powerful by late 8th and early 9th century; its rulers were getting taxes from across the empire and had money to spend on translations and patronage of scholarship. About this time the House of Wisdom was set up in Baghdad by one of the Abbasid caliphs, al-Ma'mun. It began as a translation house, translating Greek texts into Arabic and rapidly started to attract the greatest minds in the Islamic world, while Arabic became the international language of science. There was also a strong influence from Persia; an Arab scholar once said, "We Arabs have all the words but you Persians have all the ideas."

In the west there is a widely held misconception that the Islamic world did no more than act as steward of Greek science

In fact, an incredible number of important and original advances were made by Arab scientists, who were the first to undertake real science - theory and experimentation - several hundred years before the scientific revolution in Europe.

Can you give an example of this legendary Arabic science?

An Islamic mathematician, al-Khwarizmi, wrote a book, the title of which gives us the word algebra from the Arabic *al-jabr*, which means "restoration". He is regarded as the father of algebra but I wasn't sure whether this was true. It turns out that no one was really doing proper algebra until he came along. The concept of an equation that you solve to find the unknown quantity, *x*, goes back to this one scholar. There's also a scholar whom I regard as the greatest physicist of the medieval world, Ibn al-Haytham, who used geometry to prove how vision works. It's obvious to us now but at the time no one understood that light travels in straight lines.

Why did Arabic science go into decline?

Some say it went into decline in the 11th century because Islam suddenly took a turn for orthodoxy and conservatism and became anti-scientific. There's also an argument that it went into decline with the Mongol invasion in the 13th century, which destroyed Baghdad, including the House of Wisdom.

The truth is that the decline in Arabic science happened much more slowly than people think: there were great scholars in the Islamic world all the way up to and including the 15th century.

Why is this era of science so little known in the western world?

Europe was flush with money around the time the Islamic empire was fragmenting. When the Renaissance began, Europeans went through the same process that the early Muslims did: they learned Arabic and rediscovered Greek texts that had been translated into Arabic. So we really only know about those scholars whose work was translated from Arabic into Latin. One of the greatest philosophers of Islam, Ibn Sina, is known in Europe as Avicenna. His work was very easy to get hold of and it hugely influenced European philosophers like Thomas Aquinas and Francis Bacon.

Some argue that colonialism played a role. When the British and the French were invading Asia, the Middle East and Africa they didn't want to hear that these places were once wonderful, flourishing civilisations; in order to justify what they were doing, they had to show that these people were ignorant savages.

So do you think there's an element of racism to the suppression of Arabic science?

In a sense, yes. It's tied in with modern-day Islamophobia and the idea that all Muslims have backward attitudes to life, from women to politics; and there's the additional tension because of fundamentalism and terrorism. So there is a natural tendency to think that surely these people couldn't really have been far more civilised and advanced than us.

Is it true that what really concerns you is that the Islamic world itself isn't proud enough of its own heritage?

Yes, it is a shame that there are anti-scientific attitudes in Islam today, almost to the level of - why do you want to go and do science, it's all written in the Qur'an? The Muslim world needs to be reminded where it was 1000 years ago: it was tolerant of other religions, it was enlightened, it was doing curiosity-driven science.

One thousand years ago the Muslim world was doing curiosity-driven science

Many developing countries have poured money into science but only to drive their economy. You won't get real advances in science - real blue-sky thinking - unless you forget about what might come out of it and you do science for the sake of it. That's what the Islamic world was like 1000 years ago and until it gets back to that sort of mindset it will always be trying to catch up with the rest of the world.

The King of Saudi Arabia has created a new university, the King Abdullah University of Science and Technology (KAUST). Could that lead to a renaissance in Islamic science?

The king has specifically said that he wants KAUST to be the new House of Wisdom, so I hope so. A lot of leading western universities are falling over each other to join in collaborations with KAUST hopefully not just because of money, but because they think there's going to be some real, fundamental research carried out there. Billions of dollars of Saudi oil money have gone into building the university in less than three years. KAUST does seem to be genuinely interested in doing pure, curiosity-driven research - not research to support the oil industry or any political or religious agenda. There are other pockets of excellence and we will see it tentatively growing: the Qatar Foundation is trying to transform their

universities into something much more modern and blue-sky research driven. The Royan Institute, a genetics lab in Tehran, Iran, is also doing remarkable work.

Are any of these institutions operating under any constraints?

At the Royan Institute a religious body oversees what research fits into the remit of Islamic teaching. Even KAUST has to be very politically sensitive about what it's doing. After all, Saudi Arabia is an Islamic country and many people are anti-science.

Your own research is into quantum physics. What was your biggest breakthrough?

The "quantum" world of atoms behaves very differently to the everyday world of Newtonian physics. I apply quantum physics to the atomic nucleus: understanding what it looks like, how its constituents - the protons and neutrons - all fit together. For years we've thought of the protons and neutrons as being tightly packed together inside the nucleus. But what we've discovered is that some neutrons can orbit the rest of the nucleus much further away than we'd thought. My most cited paper was one in which I'd calculated the size of this "halo cloud".

Profile

Jim Al-Khalili is a theoretical physicist at the University of Surrey, UK. His book, *The House of Wisdom and the Legacy of Arabic Science*, will be published this year. He is also presenting two science documentary series in the UK, *The Secret Life of Chaos* and *Elements* on BBC4 this spring

http://www.newscientist.com/article/mg20527431.200-jim-alkhalili-islams-house-of-wisdom-can-rise-again.html?DCMP=NLC-nletter&nsref=mg20527431.200