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## CONTENTS

**What if the Earth stopped spinning?**

- 26 January 2011 by **Hazel Muir**
- Magazine issue 2796.

Alternate Earth (Image: Tim Gravestock)

*Or what if our home planet had two moons, or none, or was a moon itself?*

IN THE quirky H. G. Wells tale *The Man Who Could Work Miracles*, a character called George Fotheringay discovers that he has supernatural powers. Egged on by the local vicar, Fotheringay uses his gift to miraculously improve his village by night, mending buildings and reforming drunks. Then he realises there is a way to buy more time for good deeds before sunrise: simply order the Earth to stop spinning.

The moment Fotheringay gives the command, all hell breaks loose. "When Mr Fotheringay had arrested the rotation of the solid globe, he had made no stipulation concerning the trifling movables upon its surface," Wells wrote. "Every human being, every living creature, every house and every tree - all the world as we know it - had been so jerked and smashed and utterly destroyed."

Wells loved to play God with the planets in his fiction, but such fantasies are good for more than entertainment. Implausible scenarios of the sort Wells cooked up are worth exploring because they give

clarity to what makes the real world tick, says Neil Comins, an astrophysicist at the University of Maine in Orono. In his new book *What if the Earth Had Two Moons?* Comins gives the Earth some other-worldly makeovers to see how different our environment could have been. "Thinking through what could happen or might have happened gives a much better perspective on how things actually are," he says.

So what strange scenarios would drastically alter our world, and what would be the upshot?

Toying with the moon is a good place to start. The moon has had an enormous influence on our planet, not least in the cataclysmic events that led to its formation. The consensus is that a Mars-sized body, often called Theia, slammed into the Earth around 4.5 billion years ago, spraying debris into orbit. This eventually clumped together to form the moon at about a tenth of its current distance, roughly the same altitude as most of today's communications satellites. Around this time, the Earth would have rotated on its axis once every 8 hours or so, but gravitational interactions between the Earth and moon, including effects to do with the tides, have since slowed that to the familiar 24-hour day.

So what if the moon had not formed? The only significant tidal forces on Earth would come from the sun, which would have increased the length of a day from 8 to about 12 hours. You would weigh less too, since about 10 per cent of the mass of the Earth is thought to come from the remnants of Theia that it absorbed, so gravity would be that much weaker.

**Unique life forms**

Without the moon, life might not have taken hold as quickly as it did. The newborn moon was so close to the Earth that it would have raised tides 1000 times higher than today's. Those vast tides probably caused the oceans to scour the continents, enriching the sea with minerals and helping to create the "primordial soup" that gave rise to life. Comins suspects life would eventually have emerged even without the moon, but says there would not have been animals adapted to live in tidal pools, or to hunt or navigate by moonlight. What's more, with no lunar gravity to stabilise the Earth's rotation, our planet could have ended up spinning on its side, like Uranus. Over the course of a year, sunlight would drift from one pole to the other, then back again. "Virtually every living thing would have to migrate on such a world," says Comins. "Life would have to follow the sunlight."

The impact of Theia could, in theory, have created more than one moon. Would that have made a difference? Probably not. Even if the debris had formed two lumps, gravitational effects would have made them collide long before complex life forms appeared on Earth some 600 million years ago.

The only way the Earth could support a second moon today - let's call it Moon2 - would be if it had been captured recently from a pair of bodies that wandered into its vicinity. This encounter could have left Moon2 settled into a stable Earth orbit, as long as a large chunk of its kinetic energy was transferred to its companion, which would have zoomed off into space. The gravity of Moon2 and its companion would have caused havoc as they approached Earth, triggering mammoth tidal waves and volcanism. The skies would have been dark with dust, and there would almost certainly have been a mass extinction of life. Things would have calmed down eventually - probably within a few years of the departure of Moon2's companion.

Suppose that Moon2 was the same size as the original moon and that its orbit was in the same plane and direction, but half as far away from Earth. Any surviving land dwellers would be treated to a spectacular second moon twice as wide and four times as bright as the first, circling Earth once every 10 days. When both moons were full, it would be easy to read a book at midnight.

Not that it's all good news: Moon2 would be spitting lava. The ever-changing gravitational forces due to the Earth and our original moon would massage Moon2's interior, keeping it molten and making lava spew out

through volcanoes and cracks in the surface. "How spectacular that would be," says Comins. "You'd also see glowing rivers of lava on this moon." Some would be ejected fast enough to escape and fall to Earth, making clear nights a glittering show of shooting stars.

The two moons would be destined to collide. While tidal interactions make our moon recede from Earth by 3.8 centimetres each year, Moon2 would recede faster, catching up with the original roughly 1.5 billion years after capture. Their catastrophic collision would send debris raining down on Earth, likely causing another mass extinction.

Another of Comins's scenarios has a moon orbiting Earth the "wrong" way, rather than in the same direction as the Earth rotates. Given the manner of our moon's birth, that would be impossible: if Theia had carried enough momentum to splatter a moon into orbit in the opposite direction, it would almost certainly have destroyed Earth in the process, Comins argues.

So a moon orbiting in the opposite direction - called Noom, say - could only exist if it had been captured from a pair of passing bodies. According to Comins, that is unlikely, but not impossible. Let's say Noom has the same mass as our moon and orbits at the same distance with the same period, albeit in the opposite direction. The previously moonless Earth would now have a faster rotation rate, turning once in 12 hours.

The complex gravitational interplay between the two worlds would lead to Noom gradually spiralling towards Earth, its orbit becoming ever faster and possibly more elliptical. Meanwhile, Earth's rotation rate would slow to zero, before eventually spinning in the opposite direction.

As the Earth's rotation ground to a halt, the days would become as long as the planet's year, causing extreme heating on the daylight side and extreme cooling elsewhere. But the slowing would occur over billions of years, so animals would have time to evolve migratory patterns to follow comfortable climates. "There could easily be life on the boundary, where the sun is on the horizon," says Comins.

After that, the sun would rise in the west and set in the east as Earth began to spin in the opposite direction. As Noom got closer, shorelines would be ravaged by tides reaching 3 kilometres high. Eventually, Noom would get so near that it would be torn apart by gravitational tidal forces, disintegrating into a ring of boulders around 4500 kilometres above the Earth. Some of these would give the planet a good pummelling - perhaps severe enough to cause a mass extinction.

So much for monkeying around with the moon. But what if the Earth was not a planet but a moon akin to the Earth-like moon Pandora in the film *Avatar*? Imagine the Earth in orbit above the equator of a clone of Neptune - Neptune2 - and that both bodies rotate about an axis perpendicular to the plane of the solar system. For this satellite Earth to be warm and habitable, the system would have to orbit the sun at roughly the same distance as the real Earth does now.

**Planet shine**

Over a few billion years, the satellite Earth's rotation would become synchronised with its orbit, so that one face would be permanently turned towards Neptune2. If the satellite Earth were orbiting around 300,000 kilometres from the centre of the planet, it would have an orbital period and a day lasting just over 100 hours. The view of Neptune2 from Earth would be spectacular, spanning 9 degrees of sky, or 18 times the angular size of the full moon.

If you lived in the centre of the Neptune2-facing side, the planet would be directly overhead, and half of it would be lit up when the sun rose. It would shrink to a crescent before eclipsing the sun for about 2 hours around noon, the stars appearing in an inky black sky. Then Neptune2 would gradually grow through another

crescent phase as night fell to a "full Neptune2" around midnight, shining about 2800 times brighter than our moon ever gets. Midnight on this side of Earth would be far brighter than noon. "Effectively, there would be two periods of daylight," says Comins. Animals living on the Neptune2 side and the far side would experience different day-night cycles and would have different body clocks.

The long days and nights on the satellite Earth would create daily temperature swings roughly twice as big as those on our Earth so life would have to adapt. Worse, Neptune2's gravity would make it a magnet for asteroids and comets and the captive Earth would be at risk from cosmic crossfire. "Neptune2 would pull debris onto it, and that is also going to potentially threaten the Earth," Comins says.

Now imagine drastically altering conditions on Earth, not by tinkering with the moon or having the Earth orbit another planet, but simply by giving the Earth a thicker crust. The average thickness of the Earth's continental crust is about 40 kilometres, while the oceanic crust is 7 kilometres. What would the world be like if the crust was, say, about 100 kilometres thick on average? That could have come about if the young Earth had been very dry.

Most of the water on Earth is thought to have been delivered by icy comets and asteroids. This water makes the Earth's crust and upper mantle - its lithosphere - flexible enough to be pushed aside when blobs of magma carry heat up from the Earth's interior. "Water provides lubrication for the movement of the crust," says Comins.

Had comets brought water to Earth much later, its crust would have become much thicker. That's because, over time, magma blobs would have stacked up and congealed beneath the lithosphere. Heat would build up in the Earth's interior until, eventually, something would give, causing parts of the lithosphere to melt all the way to the surface every few tens of millions of years. As these tracts of land or seabed turned molten, they would release heat to space over a few hundred years before solidifying again.

These meltdowns would release a cocktail of toxic gases and erase all features in the vicinity. "Perhaps thousands of square kilometres are going to become totally uninhabitable," says Comins, who based his model on the parched crust of Venus, which lacks tectonic plates. "Venus has seen these melts, which is why the planet has so few craters - it has been resurfaced." He adds that any successful species on Earth would need the ability to sense when the land under its feet was about to melt, and flee: "Otherwise it's just going to be plain wiped out."

Finally, back to the miracle worker in H. G. Wells's tale: what would happen if the Earth suddenly stopped spinning? Certainly everything on the surface would continue moving at up to 1667 kilometres per hour, the rotation speed at the equator. "Anything on the surface that is not held down with incredible strength is going to fly off parallel to the surface," Comins says. He calculates that people outdoors would be flung outwards to an altitude of about 11 kilometres, then fall and hit the ground at more than 1000 kilometres per hour. Buildings would be ripped from their foundations, while the oceans would engulf the land. Such a catastrophe could extinguish all life on Earth.

Life would fare better if the Earth stopped spinning over a longer timescale, say two or three decades. There would be a profound effect on the oceans, however. The centrifugal effect of the Earth's rotation makes the solid Earth bulge outwards at the equator, and creates equatorial ocean bulges 8 kilometres high. Were the Earth to stop spinning, the oceans would migrate to the poles, where surface gravity is slightly stronger because the land is closer to the Earth's centre.

Witold Fraczek of the Environmental Systems Research Institute in Redlands, California, has simulated this scenario and shown that once the Earth had lost half its angular momentum, the oceans would split into two parts, one at each pole, with shorelines at roughly 30 degrees north and south. In between, a mega-continent

would emerge, its mountains peaking at up to 10 kilometres above the new sea level (see diagram). The northern ocean would drown most of Canada, Europe and Russia.

Whether people could survive on this new world is unclear. Much of the agricultural land would be lost, and the atmosphere would become too thin above most of the equator for people to survive there. Humans would separate into two populations, living along the shores of the northern and southern oceans, kept apart by rugged terrain in between, Fraczek says.

Add to that the challenge of scorching days and frigid nights, each lasting six months, spring accompanying sunrise, sunset signalling autumn. People might live in the twilight zones, migrating to keep pace with the gradual shift of light around the globe.

While there's no way the Earth could, in reality, stop spinning over just a couple of decades, its rotation is gradually slowing. Many billion years into the future, it's possible that the Earth's day could become as long as its year. Wells pictures a perpetual sunset on the ageing Earth in his classic book *The Time Machine*, but beyond fiction, that future is just too distant to foretell.

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1. *What if the Earth Had Two Moons?* by Neil F. Comins (St Martin's Press, 2010)

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http://www.newscientist.com/article/mg20927960.400-what-if-the-earth-stopped-spinning.html?

**Maser to predict Milky Way's fate**

- 28 January 2011 by **Maggie McKee**
- Magazine issue 2797.

The Andromeda galaxy (shown) may or may not be on a collision course with the Milky Way (Image: T A Rector and B A Wolpa/NOAO/AURA/NSF)

WILL the Milky Way slam into its giant neighbour, Andromeda, in a few billion years? A laser-like spot of light in the galaxy hints at an answer.

The speed at which Andromeda is moving towards the Milky Way can be determined from the Doppler shift of the light it emits. But the galaxy is too spread out for its subtle sideways motion in the sky to be detected. If it moves fast enough in this direction it may miss the Milky Way altogether.

Now Loránt Sjouwerman of the National Radio Astronomy Observatory in Socorro, New Mexico, and colleagues have glimpsed a bright, laser-like spot of microwave radiation, called a maser, in Andromeda that could help determine its sideways motion (see its location).

Detected with the newly upgraded Very Large Array of telescopes in New Mexico, the maser appears when interstellar methanol molecules get heated up by nearby stars. Tracking the motion of this bright spot

precisely should be easier than the galaxy as a whole, say the team. However, they must first find other masers in Andromeda, to confirm that the maser motion reflects Andromeda's path overall.

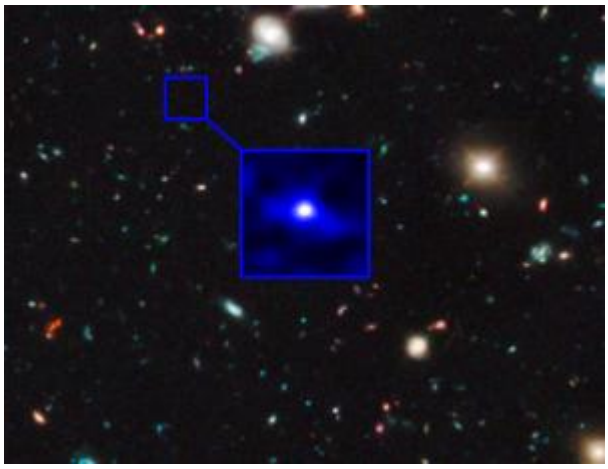
"Measuring the proper motion of Andromeda is key to determining the fate of the Milky Way," says Mark Reid of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts. "Such a measurement is best done with a compact, bright source such as a maser, but until now no maser strong enough for current telescopes to measure has been detected."

Journal reference: *Astrophysical Journal Letters*, DOI: 10.1088/2041-8205/724/2/L158

http://www.newscientist.com/article/mg20927974.100-maser-to-predict-milky-ways-fate.html?full=true&print=true

**Will we ever glimpse the universe's first stars?**

- 01:53 27 January 2011 by **Rachel Courtland**



The most distant galaxy yet found (inset) lies at a "redshift" of about 10. That is so far away that it took more than 13 billion years for the galaxy's light to reach Earth. We are seeing the galaxy as it was just 480 million years after the big bang (Image: NASA/ESA/G Illingworth/UCSC/R Bouwens/Leiden U/HUDF09 team)

The race to see the universe's most distant objects continues. Astronomers reported today the discovery of the farthest galaxy seen to date. Its light, which was captured by the Hubble Space Telescope, was emitted when the universe was less than 500 million years old, making it the oldest galaxy yet observed.

If history is any guide, the galaxy, dubbed UDFj-39546284, is unlikely to hold that title for long. So how far back in time can ultimately we go? *New Scientist* takes a look at the prospects for seeing the very first galaxies and stars.

**What is the oldest light that reaches Earth?**

The very oldest light we can see comes from the cosmic microwave background, a haze of radiation that was emitted when the universe was less than 400,000 years old. After this light was released, the universe entered the cosmic dark ages. It likely took at least 50 million years before the first stars lit up the night sky, and the first galaxies probably formed roughly 200 million years later.

**Why are astronomers interested in these ancient objects?**

Studying the first stars and galaxies could help shed light on an era called 'reionisation', which occurred within the first billion years after the big bang. During that time, neutral hydrogen atoms in the space between stars were broken into protons and electrons, making the universe transparent to ultraviolet light.

Radiation from the first stars and galaxies, and possibly dark matter, is thought to have caused the reionisation, but exactly how the process occurred is still unclear.

Studying early galaxies could also reveal how the colossal black holes inside galaxies, which may have grown up faster than the galaxies themselves, reached maturity.

**Can we see the first stars and galaxies with current telescopes?**

A deep image of a small patch of the night sky, made with the Hubble Space Telescope, was needed to find the new galaxy. But current telescopes are unlikely to probe much farther. That's because the light from ancient stars and galaxies is stretched to longer, and redder, wavelengths by the expansion of space.

To properly see these objects, astronomers need a sensitive telescope that can detect light farther into the infrared part of the spectrum. The best bet for seeing stars and galaxies much beyond the current record-holder is NASA's James Webb Space Telescope (JWST), which could launch as early as 2015.

**Could JWST see the very first stars?**

It depends on how big the first stars, dubbed Population III stars, became and how late they formed. The first stars coalesced from a pure mix of hydrogen, helium, and lithium forged in the big bang, but it is not clear how massive they were. Interactions with dark matter may have allowed these first stars to grow into bloated behemoths dubbed dark stars.

"One thing that really hasn't converged yet is the typical mass of these Population III stars," says Erik Zackrisson of Stockholm University in Sweden. "We don't know whether it's 10 or 100 times the mass of the sun. If the universe can form dark stars, it could be 1000 solar masses."

Since the mass of the star has a strong influence on its brightness and its longevity, "it is an important factor in trying to figure out whether [the first stars] will be observable or not", he says.

Individual Population III stars are likely to be too dim for even JWST to detect, Zackrisson says. He says a better bet would be to look for galaxies that are mostly made of Population III stars or to look for the bright flashes created when those stars explode.

**Will JWST see the first galaxies?**

Maybe. "JWST has been marketed as the 'first light' machine, but if you look at the predictions in the literature, they are pretty bleak," Zackrisson says. "The earliest galaxies may be too distant and dim to see with JWST."

Galaxies that formed hundreds of millions of years after the first ones, in parts of the universe where the density of matter is relatively low, may offer the best chance of spotting stars like those that formed soon after the big bang. That is because in low-density regions, primordial gas clouds would take longer to collapse into stars, so they could be forming their first stars hundreds of millions of years after the first Population III stars were born.

Zackrisson reckons that clusters of galaxies relatively close to Earth could aid in the search for these late-blooming galaxies, since the clusters' gravity could bend and magnify the distant galaxies' light.

http://www.newscientist.com/article/dn20038-will-we-ever-glimpse-the-universes-first-stars.html

**When is a group of stars not a galaxy?**

- 16:22 25 January 2011 by **Rachel Courtland**
- Magazine issue 2797

Identity crisis hits Omega Centauri (Image: Spitzer Space Telescope)

Are there impostors lurking among the many millions of galaxies identified so far? No one can give a clear answer because there is as yet no formal definition of what a galaxy is. But a pair of astronomers are now putting the question of what defines a galaxy to a public vote, in the hope of reaching a consensus and avoiding the sort of controversy that surrounded Pluto being stripped of its status as a planet.

While a typical galaxy contains billions of stars, a number of tiny galaxies have been found in recent years that do not fit the classic picture and instead resemble the groups of stars known as star clusters. So which are they?

"There is no simple definition of what can be a galaxy or a star cluster," says Pavel Kroupa of the University of Bonn in Germany. "Where does one draw the line?"

**Online survey**

To try and settle the matter, Kroupa and Duncan Forbes of Swinburne University of Technology in Hawthorn, Victoria, Australia, have launched an online survey to poll astronomers on what they think the defining features of a galaxy should be.

Star clusters and galaxies both contain stars bound together by gravity, but while the members of a star cluster are thought to form simultaneously from a collapsing ball of gas, galaxies have richer histories. In the most popular cosmological model, they form along swathes of dark matter and contain enough gas to form many generations of stars.

Yet the distinction is not always clear-cut. Take Omega Centauri (pictured), a round swarm of stars that orbits the Milky Way and is visible to the naked eye. It has long been classified as a star cluster, but there is now evidence that it contains multiple generations of stars, suggesting it is actually the remnant of a galaxy.

**Five criteria**

In a paper to appear in *Publications of the Astronomical Society of Australia*, Forbes and Kroupa have offered five possible criteria for determining whether an object is a galaxy: the presence of dark matter, multiple generations of stars, satellite star clusters, a minimum size, and the time it takes for gravitational interactions between stars to slow them all down to roughly the same speed. In galaxies, stars tend to be farther apart, so this smoothing-out process takes longer.

Response to the poll has been mixed. Some say dark matter should be the only defining factor, but this raises practical problems. Looking for dark matter by searching for slight deviations in star motions is tricky in low-mass objects, says Manoj Kaplinghat of the University of California, Irvine. Citing the case of a dim object called Willman 1, he says: "If we could unambiguously say that it is held together by dark matter, nobody would debate if it is a galaxy."

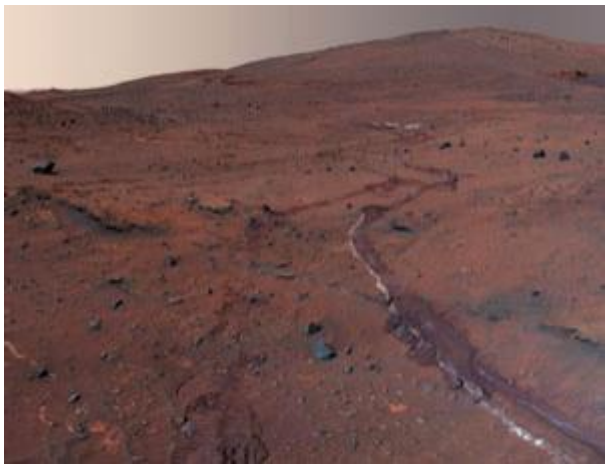
Others say there may never be an unambiguous dividing line. "We don't understand well enough how galaxies and star clusters form to know if any clear division between them actually exists," says Michael Drinkwater of the University of Queensland in Brisbane, Australia. "There may not be any real dividing line out there to find."

http://www.newscientist.com/article/dn20026-when-is-a-group-of-stars-not-a-galaxy.html

**Telltale chemistry could betray ET**

- 21 January 2011 by **Michael Marshall**

Magazine issue 2796



Mars may yet show signs of life (Image: NASA/JPL/Cornell)

ALIEN life might be hard to find for the simple reason that it is fundamentally unlike Earth life. It might not use DNA, or contain protein. But whatever and wherever it is, its tendency to chemically alter its environment might just give it away.

Life has had a radical impact on Earth's chemistry - perhaps most notably leading to soaring atmospheric oxygen concentrations around 2.2 billion years ago. If life has had a comparable impact elsewhere in the solar system, the relative abundances of chemicals key for its survival - whatever they may be - could betray its presence.

On Earth, those key chemicals, such as amino acids, are modestly sized, exist in relatively small numbers and act as building blocks to form all complex life. Identifying the alien equivalents of those chemical building blocks "is our only way to detect life not as we know it", says astrobiologist Chris McKay of NASA's Ames Research Center in Moffett Field, California. He calls this the Lego principle.

To test the idea, Christoph Adami of the Keck Graduate Institute of Applied Life Sciences in Claremont, California, and colleagues pulled together 30 measurements of amino acid abundances from abiotic sources, including meteorites and lab synthesis experiments, and compared them with 125 samples taken from soils, ocean sediments and water.

The lifeless samples were dominated by the simplest amino acids, glycine and alanine. In contrast, the biological sources also had plenty of the more complicated amino acids fundamental to terrestrial life.

Adami found a similar signature for carboxylic acids, which include common substances like formic acid. Lifeless samples were dominated by small acids up to six carbon atoms long, while biological samples contained acids up to 30 carbon atoms long, with a preference for even-numbered chains.

Adami then went a step further. Since 1993 he has worked with Avida, a computer system in which programs called avidians compete for processing power. Each avidian is an artificial organism, built from a set of 29

simple instructions analogous to the 20 amino acids found in terrestrial life and able to evolve through mutation and selection.

If the organisms were absent each of the instructions would be equally abundant. But when Adami ran 350 populations of avidians under a range of conditions, he found that certain instructions always became more abundant at the expense of others, creating an avidian "chemical" signature that indicated their presence (*Journal of Molecular Evolution*, in press).

"That's very important," says McKay. "What we see on Earth is not a quirk of Earth biology but a universal principle."

That may be true, says Dirk Schulze-Makuch of Washington State University in Pullman, but he warns chemical ET hunters that different minerals, temperatures and pressures could allow for chemical reactions that do not occur on Earth. So determining whether the recorded abundances represent abiotic baseline conditions or the presence of life might prove tricky. "There's a lot of uncertainty," he says.

Adami agrees that it is a challenge, but thinks it is not an insuperable one. "You would have to establish the geochemistry well enough to know what the 'alphabet' of molecules was" before hunting for unusual relative abundances, he says.

**The search for alien lego**

No Mars mission has yet tried to detect life using the Lego principle (see main story), but similar methods are being investigated.

The team behind the ExoMars rover, scheduled for launch in 2018, plans to look for amino acids that have the same symmetry as each other. All Earth life is based on amino acids of the same symmetry, so this could be a telltale sign - assuming Martian life uses amino acids at all.

Victor Parro of the Centre for Astrobiology in Madrid, Spain, and his colleagues have a different approach. Rather than staking everything on one type of molecule, their device, SOLID2, can detect a wide range of molecules including DNA and sugars.

In work yet to be published, Parro found that SOLID2 successfully detected life in two largely lifeless environments - Antarctica during winter, and the height of summer in the Atacama desert. He is now exploring ways to get it flown to Mars.

According to Christoph Adami of the Keck Graduate Institute, SOLID2 is too Earth-centric, because it looks for specific sequences of molecules. "They are looking for phrases like 'I think therefore I am', whereas I am looking for the frequencies of individual letters," he says. Still, he thinks the technology could be modified to fit this purpose.

http://www.newscientist.com/article/mg20927962.700-telltale-chemistry-could-betray-et.html

**Online games reveal players' personalities – to who?**

- 25 January 2011 by **Jim Giles**
- Magazine issue 2796

Your personality will show through (Image: Leonard Ortiz/Zuma Press/Corbis)

*Marketers want to divine what makes you tick – and then tailor their online offerings accordingly*

WEBSITES that track your buying and browsing habits can seem to read your mind - but you ain't seen nothing yet. Future sites may attempt to gauge your personality, and tailor what they show you accordingly.

That's the possibility raised by a new study of computer gamers, which has revealed that a player's behaviour within the game mimics their real-world character traits. Using similar information from the internet as a whole, it might one day be possible to profile a web surfer's personality.

Most sites currently present the same content and layout to everyone who visits. Some larger sites tailor content to individuals, but the rules they use to do so are crude. Amazon, for example, displays links to products similar to those the visitor already purchased. Yahoo has software that monitors the news articles that visitors click on, and suggests other stories accordingly. If the user is logged in, the software may also consider their age and sex when displaying links to stories.

Nick Yee and colleagues at the Palo Alto Research Center (PARC) in California reckoned this personalisation could be made far more sophisticated if websites could assess visitors' personalities. He also had a hunch that the real-world traits that define an individual's personality could be gleaned from their online behaviour.

To test this, Yee and his team sent personality surveys to 1000 gamers who like to engage with the monsters, spells and dungeons found in *World of Warcraft* (WoW). They then compared the responses to logs of the players' activity in the game, which are publicly available.

Yee's hunch proved correct. Players rated extrovert by the survey tended to prefer group activities such as banding together with other players to fight rival groups or monsters. Those who scored high on questions designed to measure caring or cooperative traits preferred non-combat activities such as exploring. They also sent more positive messages to other players. The study will be presented in May at the Conference on Human Factors in Computing Systems in Vancouver, Canada.

The PARC team is now thinking about how activity on websites, rather than in games, could be used to gauge personality. They believe a few key factors, such as interactions with other users in forums or time spent exploring parts of a site, could unlock insights into a user's personality. Other studies have shown that people who score higher for neurotic traits log on more often, but for less time, compared to other visitors.

With this information, websites might then tailor content to different personality types. At a retail site, for example, extroverts might be shown user reviews whereas introverts would see a product's technical specifications.

The team will have to tread carefully if it is to avoid unsettling users, who may see personality profiling as an invasion of their privacy. Raghu Ramakrishnan, chief scientist for search at Yahoo in Sunnyvale, California, says that his team has been alert to such concerns when developing its software. "We're very careful not to be intrusive," he says.

**A virtual world but still the real you**

Your avatar can be anything you want: a different size, age, sex - even a different species. But it's a freedom most of us don't exploit. Nick Yee's finding (see main story) that people have similar personalities online and in real life is just the latest in a line of results linking behaviour in the real and virtual worlds. One study found that users who are assigned tall avatars tended to interact more aggressively with other avatars. In another experiment, users reported feeling more satisfaction with avatars the more closely aligned they were with their own personalities. People even maintain conventions of personal space and eye contact in virtual worlds. "We don't really invent ourselves anew," says Yee.

http://www.newscientist.com/article/mg20927964.100-online-games-reveal-players-personalities--to-who.html

**Compact 'eyeball' camera stretches to zoom**

- 27 January 2011 by **James Urquhart**
- Magazine issue 2796.

Stretching to see further (Image: John Rogers)

A CAMERA inspired by the operation of the human eye can "zoom" without the need for bulky lenses, making it more compact than conventional cameras.

The device builds on a non-zooming eyeball camera developed in 2008 by John Rogers of the University of Illinois, Urbana-Champaign. Now he has given the technology a twist by building in a stretchable lens and a flexible photodetector whose shape alters as the magnification of the lens changes. This produces a camera with a 3.5× optical zoom.

Traditional cameras capture their images on a flat surface, formerly photographic film but now usually a digital photodetector. In a conventional camera, extra lenses are required to flatten the image before it hits the detector, otherwise it appears blurry or uneven.

The eyeball camera does away with the need for these extra, movable lenses, and reshapes the sensor instead. Rather than adjusting the image to suit a flat surface, it flexes the sensor to match the curvature of the image and the lens.

To achieve this, Rogers has mounted an array of silicon photodetectors on an elastic membrane, which in turn forms the surface of a fluid-filled chamber (*Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.1015440108). Using hydraulic actuators to adjust the amount of fluid in the chamber, the membrane can be flexed to take up convex or concave shapes.

The lens is formed by fluid held in a gap between a glass window and an elastic membrane whose shape can also be adjusted hydraulically.

The eyeball technology could be used in night-vision cameras that now typically use bulky and expensive lenses to capture infrared images. Another application would be endoscopes, where very tiny cameras with a wide field of view are required, Rogers says.

Corin Gawith, an optoelectronics researcher at the University of Southampton, UK, says the device is an elegant solution to the problem of making lens systems less bulky. "In an endoscope you can see how it would be very useful because you've got a very small lens and what you are trying to do is take an image of quite a wide area," he says. "Same again in the security camera. What they are offering is a very compact way of achieving that."

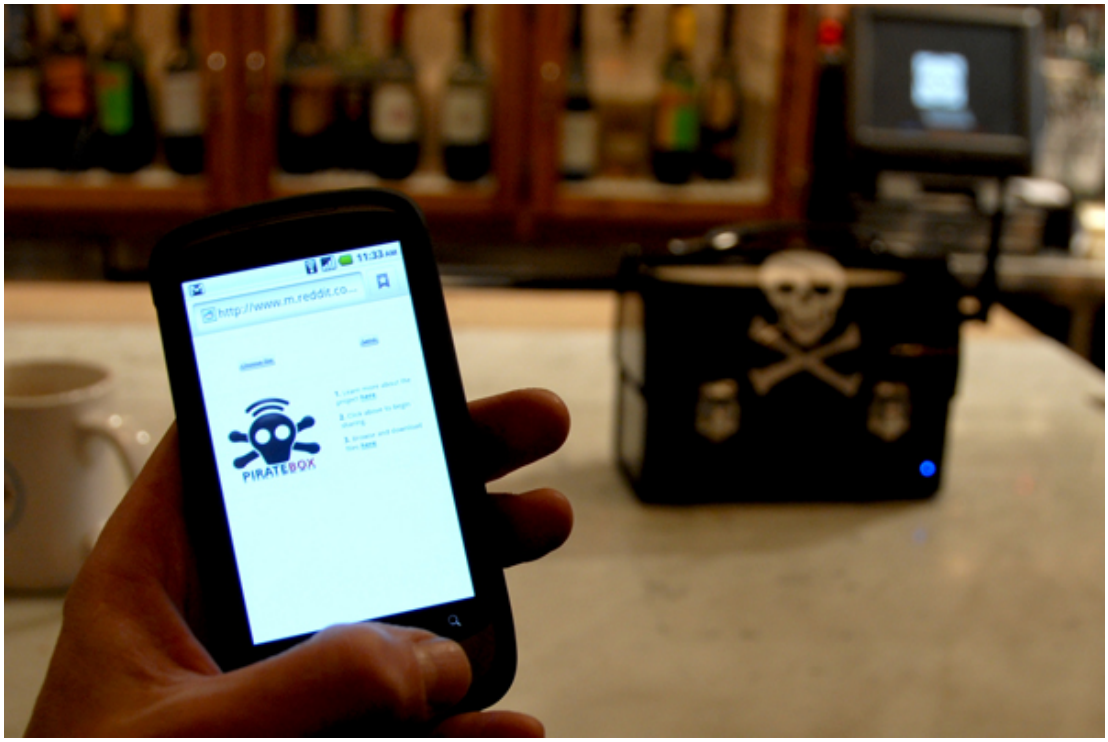
For now, Rogers's camera can only produce images with an effective resolution of a few thousand pixels, but that could be dramatically improved. "There's no law of physics that needs to be broken in order to go from where we are now to a 5-megapixel camera," Rogers says.

http://www.newscientist.com/article/mg20927964.500-compact-eyeball-camera-stretches-to-zoom.html

**PirateBox lets you share files with anyone close by**

18:35 28 January 2011
Technology

*Jacob Aron, technology reporter*



*(Image: David Darts)*

Online file-sharers disheartened at the news that Google has begun censoring peer-to-peer search terms can now take their data into the real world with the PirateBox, a lunchbox-sized device created by David Darts, a professor of art and technology at NYU Steinhardt.
The PirateBox broadcasts an open WiFi network that anyone in the vicinity can anonymously join. Once connected, users can upload and download any files they please - effectively creating a temporary and portable file sharing network. You don't need to log in and no user data is recorded, so file-sharers are free to trade whatever they like.
Darts built the device, originally called Freedrop, as an easy way to share files with his students in class. "I was looking for a device that would allow users in the same physical space to easily share files," he says. It was a hit, but he soon found that his students had other sharing plans. "Students started sharing non-class related materials, their favorite albums and so on."
This alternative use inspired Darts to place the Freedrop inside a pirate-themed lunchbox, inevitably leading to the name PirateBox. But is he encouraging piracy? "Pirate is a strange term," says Darts, who prefers to see the device as a tool for sharing content of any kind. "But calling it the PirateBox is certainly provocative."
If you fancy making your own PirateBox, Darts provides instructions for building one at a cost of around $100. It's not the first time file-sharing has entered the real world though - last year artist Aram Bartholl installed USB sticks in walls and buildings around New York to create a series of digital dead drops.

http://www.newscientist.com/blogs/onepercent/2011/01/piratebox.html

**Spinning seeds inspire single-bladed helicopters**

- 13:09 28 January 2011 by **Jacob Aron**

Naturally better design (Image: Anette Linnea Rasmussen/Getty)

A mini helicopter modelled on flying tree seeds could soon be flying overhead. Evan Ulrich and colleagues at the University of Maryland in College Park turned to the biological world for inspiration to build a scaled-down helicopter that could mimic the properties of full-size aircraft.

The complex design of full-size helicopters gets less efficient when shrunk, meaning that standard mini helicopters expend most of their power simply fighting to stay stable in the air. The researchers realised that a simpler aircraft designed to stay stable passively would use much less power and reduce manufacturing costs to boot.

It turns out that nature had beaten them to it. The seeds of trees such as the maple have a single-blade structure that allows them to fly far away and drift safely to the ground. These seeds, known as samaras, need no engine to spin through the air, thanks to a process called autorotation. By analysing the behaviour of the samara with high-speed cameras, Ulrich and his team were able to copy its design.

The samara copter is not the first single-winged helicopter – one was flown in 1952, and others have been attempted since – but it is the first to take advantage of the samara's autorotation. This allows Ulrich's vehicle to perform some neat tricks, such as falling safely to the ground if its motor fails or using vertical columns of air to stay aloft indefinitely. "We can turn off the motor and autorotate, which requires no power to sustain," says Ulrich.

**Pitch piloting**

The team found that a single-winged chopper is harder to control than a regular helicopter, because its constant spinning makes it impossible to work out which way the craft is orientated relative to its direction of flight using conventional sensors. What allowed Ulrich to take control was his discovery that both natural and robotic samaras travel in a fixed circle whose radius is determined by the pitch of the wing.

"We can change the size of the circle the vehicle is travelling in and pilot the aircraft to any desired destination," explains Ulrich.

Having built around 100 prototypes, Ulrich is ready to seek commercial applications for his artificial samara. Selling it as a toy is obvious appealing, but he has grander plans. "It can potentially compete with satellites," says Ulrich.

"A larger robotic samara would be deployed into the jet stream and be able to use the fast-moving air to stay aloft." A samara-mounted camera could also be used to create 3D maps of terrain below or in a war could relay images to soldiers on the ground.

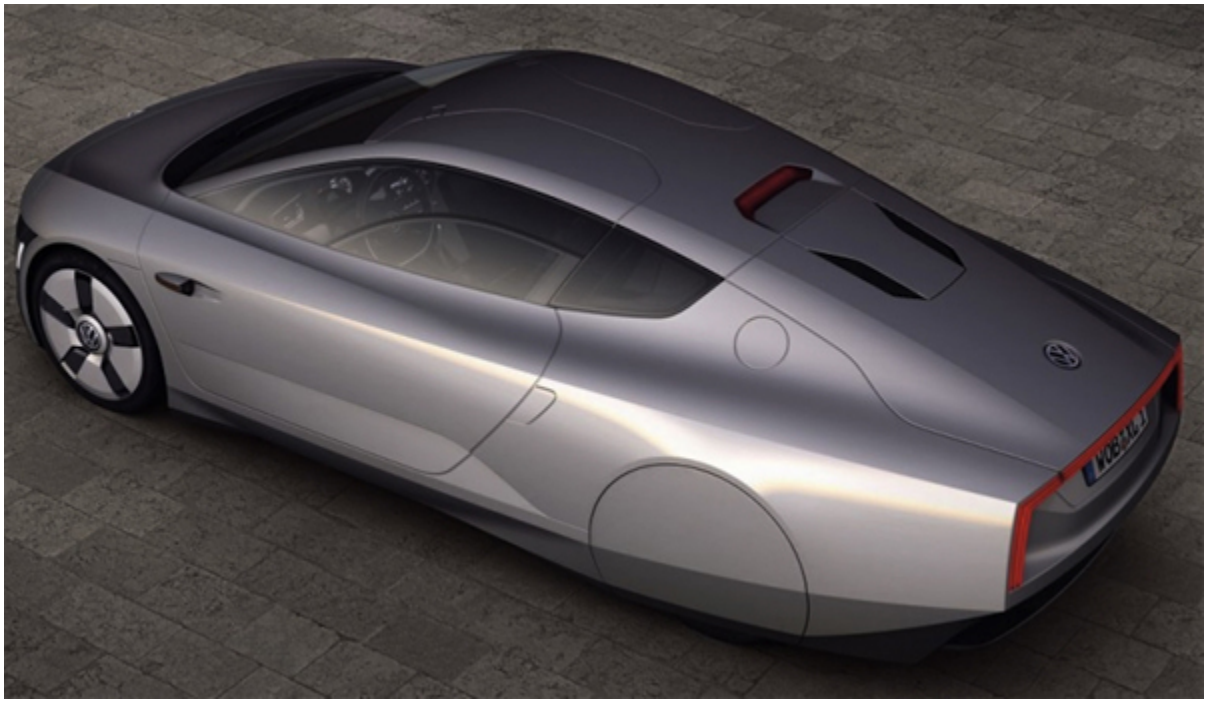
"The samara concept is an interesting one, which has merit in terms of its size and mass," says Stephen Prior, a researcher in autonomous robotic systems at Middlesex University in London who warns that the vehicle's spin might make it difficult to take pictures in flight. "However, like most nano air vehicles it suffers from lack of endurance and the difficulty of getting a stable image off the platform, since it is continuously spinning."

http://www.newscientist.com/article/dn20045-spinning-seeds-inspire-singlebladed-helicopters.html

**VW's diesel hybrid: most efficient car on the planet?**

19:45 27 January 2011
Cars

*Niall Firth, technology editor*



*(Image: VW)*

In a world of soaring fuel prices it's certainly a smart move.

While Volkswagen's new XL1 "Super Efficient Vehicle" might look like a "futuristic" concept car designed sometime in the late 1980s, its figures are undoubtedly impressive.

Unveiled at the Qatar motor show on Tuesday night, the XL1 claims an incredible fuel consumption of just 0.9 litres per 100 kilometres (equivalent to 239 miles per gallon). VW also says it emits just 24 grams of carbon dioxide per kilometre.

The remarkable figures are all down to a combination of a 0.8-litre diesel engine and an electric motor couple with clever weight-saving design and superior aerodynamics.

While these do not produce a huge amount of power, the car's carbon-fiber body means it weighs just 795 kilograms, allowing it to accelerate from 0 to 100 km/h in 11.9 seconds. Not bad going for a hybrid.

The XL1's "unique" stylings mean that it only seats two passengers but its aerodynamic profile has been sculpted so that it can boast an impressive 0.186 drag coefficient. VW says it plans to start production of the

XL1 by 2013, but the German car manufacturer is not the only big gun looking to exploit the resurgence in interest in electric cars.

Electric vehicles dominated proceedings at the recent Detroit car show, scooping most of the top awards, and Audi's R8 E-Tron all-electric supercar wowed the crowds at CES this year.

http://www.newscientist.com/blogs/onepercent/2011/01/xl1-electric-super-car.html

**Parallel parking is better for pedestrians' health**

15:24 27 January 2011
Cars
*Kate McAlpine, contributor*

*(Image: Harri Tahvanainen/Getty)*

Packed bumper to bumper along the street, a long line of parked cars might not strike you as a particularly healthy sight.

But the way those cars are parked could actually be good for you - at least, that's what new simulations of air flow in streets suggest. While parallel parked cars can successfully deflect exhaust from the sidewalk, blocking between 31 and 49 per cent of the pollutants, angled parking could increase exposure by up to 288 per cent, say researchers.

A team of engineers at Trinity College in Dublin, Ireland released carbon dioxide as a pollutant into their computer-generated streets that were 20 to 25 metres wide, with the building heights matching the width. The wind blew across the street, from right to left over the buildings, with some of the fresh air running down the left wall. Much of the air blew across the road and up the face of the opposite buildings, taking pollutants with it.

But when parallel parked cars were parked alongside the left side of the street, the three-metre-wide footpath caught much of the fresh air in an eddy. On the right footpath, the cars served as a wall, directing the air from the road to flow above it while less-polluted air circulated in its own eddy for the pedestrians to breathe.

Parallel parked cars still formed a barrier when winds blew along the length of the street as wake patterns between the cars closed the route from the street to the sidewalk against incoming fumes. However, when cars were parked at an angle there was a nasty increase in pollution as they channelled exhaust from the street to the sidewalk.

"Progressive increases in the fraction of parked cars improves the air quality on the footpaths in most scenarios," says John Gallagher, and since the highest vehicle traffic often coincides with times when most parking spaces are occupied, the team says that pedestrians should get the maximum protection when pollution is worst.

http://www.newscientist.com/blogs/onepercent/2011/01/parallel-parking-is-better-for.html

**Soft-centred fossils reveal dinosaurs' true colours**

- 27 January 2011 by **Jeff Hecht**
- Magazine issue 2796.

*T. rex* has secrets to divulge (Image: Mark Ryan)

*Newly discovered traces of soft tissue provide unprecedented insights into how animals that died millions of years ago looked and lived*

PETE LARSON and Phil Manning mount the dinosaur fossil on a small motorised platform inside the lead-lined chamber. The two palaeontologists make a few final adjustments, then exit the chamber and bolt it tight. At the console, geochemist Roy Wogelius flips a switch, sending a beam of X-rays sweeping over the fossil's surface.

The scene, at the Stanford Synchrotron Radiation Lightsource in California, is reminiscent of Dr Frankenstein animating his monster. And that is essentially what Larson, Manning and Wogelius are trying to do.

Their project is one of several challenges to the conventional wisdom that when animals fossilise, all the original organic material, from the bones to the blood, is lost. Larson, of the Black Hills Institute in South Dakota, and Manning and Wogelius of the University of Manchester, UK, have already detected chemicals in a 145-million-year-old bird fossil that they believe were present in the living creature. Other groups have reported finding proteins and blood vessels inside dinosaur bones, and traces of pigments in 108-million-year-old feathers. The claims are controversial, but if true they promise to breathe new life into our understanding of ancient life.

The research could also help locate new deposits of extraordinarily well preserved fossils, says Patrick Orr of University College Dublin in Ireland - sites like the Burgess shale in Canada and Chinese feathered dinosaurs beds that have given us tremendous insights into evolution. Such deposits are usually found by accident, but the more we understand about the conditions that create them the more chance we have of discovering new ones.

First, however, researchers like Manning must convince other palaeontologists that their fossils really do preserve original material, which won't be easy.

Palaeontologists have long studied the process of fossilisation - a field known as taphonomy - by observing the fate of dead animals and measuring what happens to the organic matter. Most of the time soft tissues are completely consumed by predators, scavengers and decay, leaving just scattered and fragmentary bones and teeth. If these fossilise they become mineralised, with all of the original material turned to rock.

**Pristine preservation**

Occasionally, though, nature is kind and fossilisation preserves details of an animal's soft tissue. For example, the animals of the Burgess shale were buried rapidly in anoxic mud, allowing their soft tissues to be fossilised in amazing detail. Dinosaur "mummies" such as Dakota, a spectacularly well-preserved specimen of the duck-billed dinosaur *Edmontosaurus*, form when thick-skinned animals are buried quickly in fine river-bed sands, capturing impressions of the skin before the tissue decays. Impressions of feathers from *Archaeopteryx* were preserved in fine lime deposits on the bottom of a stagnant lagoon, and China's celebrated feathered dinosaurs were fossilised in fine silts and layers of volcanic ash settling to the bottoms of lakes 125 million years ago.

However, even these exceptional conditions were not thought to preserve original organic material. The Chinese fossils are covered in a thin black film of carbon, but this is believed to be remains of bacteria that consumed the soft tissue before being entombed in rock. Convincing evidence of original soft tissue older than the Ice Age was lacking.

That wasn't for lack of trying. The biggest prize was DNA, because it could reveal so much about extinct animals and their relations to living ones.

The 1993 movie *Jurassic Park* pumped up interest in the search for dinosaur DNA, and a year later Scott Woodward of Brigham Young University in Provo, Utah, claimed to have found dinosaur DNA in 80-million-year-old bone fragments (*New Scientist*, 26 November 1994, p 12). His report in *Science* (vol 266, p 1229) made headlines across the world, but the DNA was soon found to be contamination from humans who had handled the fossil.

Technology has advanced tremendously since then. DNA has now been extracted and sequenced from mammoths, the bones of Neanderthals, and extinct cave bears. But recovering DNA from dinosaurs remains the stuff of fiction. DNA degrades much faster than proteins and other soft tissue components and nobody thinks it is possible to recover DNA that is older than about a million years.

But DNA is not the only game in town. The controversy surrounding the supposed dinosaur DNA made a lasting impression on Mary Schweitzer, who was then a graduate student at Montana State University in Bozeman. Ten years later, she reported recovering soft, flexible tissues from inside the leg bone of a 68-million-year-old *Tyrannosaurus rex* which she claimed were blood vessels (*Science*, vol 307, p 1952).

The *T. rex* was discovered in a remote South Dakota canyon in 2000 by a team from the Museum of the Rockies. Its femur was intact but too heavy for a helicopter to lift in one piece, so they had to break it. To everyone's surprise the interior was hollow - fossilised bones are usually filled with minerals - so the excavation team took samples and sent them to Schweitzer for analysis. She soaked the samples in a solution to dissolve the calcium compounds in the fossil, and was surprised to be left with flexible tissue which she identified as blood vessels.

Schweitzer's claim was met with scepticism, in part because of the immense age of the bone. "The cynics think it's far too old," says Derek Briggs of Yale University. Tom Kaye of the University of Washington in Seattle suggested that what she had found was a biofilm left by bacteria that had feasted on the dead animal (*PLoS One*, vol 3, p e2808).

**Blood from a stone**

However, in 2007, Schweitzer - now at North Carolina State University - and colleagues reported that the *T. rex* bone also contained fragments of the protein collagen, a key component of connective tissue in animals

(*Science*, vol 316, p 277). That was a huge jump from the previous oldest protein found, collagen from a 600,000-year-old mastodon.

The dinosaur protein was not as well preserved, but it offered an important rebuttal to the biofilm critics. "Microbes can't do collagen," says Schweitzer. It must have come from the dinosaur.

She also showed that an antibody to chicken collagen reacted with the samples, which would be expected as birds are descended from dinosaurs. Further evidence comes from her colleague John Asara at Harvard Medical School, who sequenced the protein fragments and found matches to sequences of collagen taken from living species, including birds.

Collagen is an extremely durable protein but it also evolves very slowly, so sequencing its amino acid building blocks - in much the same way that DNA bases can be sequenced - is of little use if you want to identify relationships between extinct and living species. However, in 2009 Schweitzer went one better. Working with the 80-million-year-old leg of a *Brachylophosaurus*, her group extracted not only collagen but also haemoglobin, elastin and laminin, as well as structures that resemble blood and bone cells (*Science*, vol 324, p 626). These proteins vary much more among species, so sequencing them could reveal relationships between dinosaurs and other animals.

Others have begun to report similar findings, and not just from inside bones. Manning and Wogelius have reported finding amino acids in the claw and skin of Dakota, the 66-million-year-old *Edmontosaurus* mummy (*Proceedings of the Royal Society B*, vol 276, p 3429). Meanwhile, Orr's former student Maria McNamara, now splitting her time between Dublin and Yale, claims to have found marrow inside the fossilised bones of 10 million-year old frogs and salamanders preserved in lake-bed deposits from Spain (*Geology*, vol 34, p 641). Marrow is normally among the first tissues to decay, but she found organic residues preserved in three dimensions that retained the original colour and texture of the marrow.

"The fidelity of preservation on a morphological level is remarkable, though it's very unlikely that the biochemistry would be completely original," says Orr. Preservation of very decay-prone soft tissues is probably more common than we realise, he adds.

As technology progresses, new techniques are being developed that can look at fossils in a whole new light, revealing details of preservation that have never been seen before. "The synchrotron is the latest thing out there," says Briggs.

Synchrotrons generate high-energy X-rays which can blast inner-shell electrons from atoms. Outer electrons then fill the holes left behind and in the process emit radiation, the wavelength of which can be used to identify the atom that emitted it.

Larson first heard about Stanford's synchrotron on a radio programme about a project to decipher an ancient manuscript believed to contain lost writings by Archimedes. The book was a palimpsest, written on parchment from which a previous text had been removed. The researchers were using synchrotron radiation to detect iron from the original text, in the hope they could make out the words (*New Scientist*, 6 October 2007, p 43). Larson wondered what the technique could reveal about fossils, so he fixed up a test run.

The results were encouraging. "It looked like a good way to study soft tissue preservation," he recalls. Larson showed Manning some preliminary images. "I said, my gosh, that looks impressive," recalls Manning. So Larson invited him along to the next beam run, along with me.

That run examined part of a dinosaur mummy, a fossil lizard, a 125-million-year-old Chinese bird with feather imprints and some modern samples including a freeze-dried turtle and a duck skull. Unfortunately, the

complex geometry of the dinosaur mummy made it tricky to study. Flat fossils, they found, were much more suited to the technique.

One such flat fossil that looked ripe for the synchrotron was the Thermopolis Archaeopteryx (see a photo here), the only Archaeopteryx specimen in the US, housed at the Wyoming Dinosaur Center in Thermopolis. This turned out to be ideal for the technique, and in 2009 the team published a set of stunning new views (*Proceedings of the National Academy of Sciences*, vol 107, p 9060).

Some of the X-ray images showed that the bones and feather shafts are rich in phosphorus, an important element in these parts of living birds. This suggests that the fossil preserves some original material, the team say. Nobody had expected soft-tissue chemistry to be preserved in such places, Wogelius says, and previous techniques had not been sensitive enough to reveal the phosphorus. "It's amazing that that chemistry is preserved after 150 million years."

That's not all that remains. "Zinc levels in bones are not far from what we expect in modern birds," says Wogelius. Copper, another key nutrient in modern birds, is also higher in the fossilised bones than in the surrounding rock, suggesting that nutritional balances in *Archaeopteryx* were similar to those in modern birds.

Other feathered fossils have revealed more surprises. When Briggs's student Jakob Vinther looked at a 108-million-year-old fossilised bird feather under a scanning electron microscope, he noticed distinctive structures called melanosomes embedded within the feathers. These are tiny bags of the pigment melanin that colour the feathers and fur of many living birds and mammals.

In living animals the shape of the melanosome depends on the type of melanin they contain. Rice-grain shaped melanosomes about a micrometre long contain the black-brown variant eumelanin. Rounded melanosomes contain the reddish-ginger form pheomelanin. Spotting melanosomes on the ancient feather gave Vinther a peek at something long-thought unknowable: the colour of an animal that lived tens of millions of years ago.

Vinther found bands of rice-shaped melanosomes on his feather, suggesting that the bird had dark stripes (*Biology Letters*, vol 4, p 522). Mike Benton of the University of Bristol, UK, and colleagues revealed similar patterning on the tail feathers of *Sinosauropteryx*, a small feathered dinosaur that lived in China 125 million years ago (*Nature*, vol 463, p 1075).

This kind of insight is exactly what palaeontologists hope for. "When you look at specimens you've studied before with a new technique, you'll get new information," says Briggs.

The new techniques have not yet answered any big questions about dinosaurs: researchers like Schweitzer and Manning have devoted much of their effort to persuading sceptics that their results are real. Eventually they think they will win over the doubters and revolutionise palaeontology, but in the meantime they have the satisfaction that drives on amateur and professional fossil hunters alike. "It's quite amazing to discover something that has never been seen before," says Wogelius.

***Jeff Hecht*** *is a New Scientist consultant based in Massachusetts*

http://www.newscientist.com/article/mg20927960.500-softcentred-fossils-reveal-dinosaurs-true-colours.html?full=true&print=true

**How the seahorse gained its shapely body**

- 16:00 25 January 2011 by **Ferris Jabr**

Striking shape (Image: George Grall/Getty)

It is easy to forget that the seahorse is a fish. With its equine head, potbelly and prehensile tail, it rivals the platypus in its peculiarity. But the seahorse's form is not just for show: its arched neck acts like a spring that stores energy, ensuring it is ready to strike when it spots a meal.

Biologist Sam Van Wassenbergh at the University of Antwerp, Belgium, and colleagues created mathematical models based on the body shape of seahorses and their straight-bodied cousins, pipefish.

The models revealed that seahorses' necks have the elasticity and stability needed to let them lunge forward and grab a passing shrimp, even if it is some distance away. Pipefish, in contrast, cannot strike out so far and must settle for closer prey.

This bend and snap technique is a vital hunting method for most seahorse species, as they are weak swimmers. "Every extra millimetre you can reach becomes important because it means more food," says Van Wassenbergh. Seahorses enjoy a 20 per cent increase in their strike zone thanks to the shape of their head and neck, he says.

"Like everyone, I have always wondered why seahorses look so bizarre," says Adam Jones at Texas A&M University in College Station. "This is the first step in establishing it's an adaptation."

Journal reference: *Nature Communications*, DOI: 10.1038/ncomms1168

http://www.newscientist.com/article/dn20023-how-the-seahorse-gained-its-shapely-body.html?full=true&print=true

**Mad cow disease is almost extinct globally**

- 18:00 26 January 2011 by **Andy Coghlan**
- Magazine issue 2797

No longer a game of Russian roulette (Image: Daniel Acker/Bloomberg/Getty)

BOVINE spongiform encephalopathy, aka "mad cow disease", is almost extinct just 25 years after it was discovered. However, more cases of the human equivalent, variant Creutzfeldt-Jakob disease (vCJD), may be waiting in the wings.

*New Scientist*'s analysis of the latest official BSE figures reveal the death throes of a terrifying disease that scratched beef from the menu for decades and decimated much of the world's beef industry. So far vCJD has claimed 170 human lives, mainly through consumption of BSE-infected beef.

In 2010 just 17 cases of BSE were recorded worldwide, according to figures released by the World Organisation for Animal Health (OIE) in Paris, France. Seven were in the UK, where the disease was first identified in 1986 and which became the centre of infection. Although figures for 2010 are not yet in for Spain and Portugal – two countries that experienced "mini" BSE epidemics between 1999 and 2003 – the numbers are not likely to add greatly to the dwindling global tally (see diagram).

In 1992, at the peak of the BSE epidemic, the UK reported 37,280 cases. Over the decade that followed the disease spread to mainland Europe, Japan and then to the US in 2003.

News of its impending demise has been hailed as a triumph for science, which discovered that BSE was caused by mutated brain proteins or prions, and came up with ways to prevent its spread. "It's a great success story for science, for scientific advice to government, and for the measures governments put in place to stop it spreading," says Chris Higgins of the University of Durham, UK, chairman of the Spongiform Encephalopathy Advisory Committee, which advises the British government on BSE.

The first confirmed cases of the mysterious disease, in 1984, came as a surprise. "This was a new type of disease with a new type of causal agent that was neither a bacterium nor a virus," says Higgins. "We had to discover what it was, how it was passed on and how to stop it."

Within two years, vets working for the UK government established that prions were to blame. They produced their first scientific report into the new disease in 1987. It described how mutated prions turn all normal copies they encounter into rogue versions like themselves, forming plaques in the brain that leave it full of holes.

That discovery helped to identify BSE's modus operandi: it was spreading via cattle feed that contained the ground-up remains of infected cow and sheep brains. Some sheep carried scrapie, a related prion disease. In 1988, the British government responded by banning the inclusion of meat and bonemeal in animal feed. "That broke the cycle of spread," says Alex Thiermann, head of the OIE commission responsible for animal health. The number of cases continued to rise until 1992 because of the prolonged incubation period before infected cows succumbed to the disease. After that the number of cases declined steadily, and may drop to single figures in 2011.

The handling of the BSE crisis was not a complete success story, however. Repeated assurances from the UK government that BSE couldn't spread to humans meant that the ban on feeding cattle to cattle and measures to strip infective material out of the human food chain were routinely flouted – a shortcoming deplored by an official inquiry.

In 1996, seven years after the UK government banned the sale of meat components likely to contain prions, such as brain and nerves, the UK's chief medical officer, Kenneth Calman, announced that a form of BSE had spread to people. Fifteen years later, vCJD has claimed 170 lives worldwide. Four people presumed to have vCJD are still alive.

"The average age at death is 28, compared with 70 for the most common form of CJD," says James Ironside of the CJD Surveillance Unit in Edinburgh, UK.

An abiding mystery, he says, is why so few people succumbed, even though almost the whole of the British population was probably exposed to infected brain and nerve tissue in beef before the disease was discovered.

Higgins says that, in theory, relatively few mutated prions are required to trigger the chain reaction that results in disease. He thinks that most of those exposed to infection stayed healthy simply because it is very difficult for prions of one species to influence those of another. "It turned out that the barriers for transfer from cows to humans were quite high," he says. "But at the start of the epidemic we didn't know this, so it was hard to predict whether there would be hundreds of deaths, or hundreds of thousands."

The biggest worry now is whether there will be further waves of vCJD. This may depend on which two copies of the prion gene you inherit. There are two variants, M and V, and three possible combinations – MM, MV and VV. All infections so far have been in people with the MM variants, who make up 37 per cent of the population. But those with the other combinations may also be at risk, based on experience with a disease similar to BSE called kuru, found in the Fore people of Papua New Guinea and spread by the now discontinued ritual of eating relatives' brains at funerals.

Although most victims of kuru are MM, John Collinge of St Mary's Hospital, London, discovered in 2000 that a group who developed it later in life than the others were all MV. The implication is that the gene variants you inherit dictate the incubation period for prion infection, so vCJD may come in three separate waves.

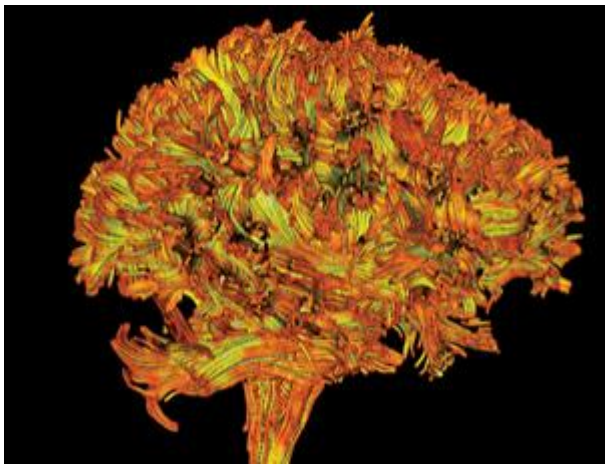
However, Ironside is encouraged by the relatively low numbers of MM cases, and the non-appearance of any definite "new waves" so far. "The longer it goes on without us seeing these cases, the more likely it is that the number of any new cases will be small," he says.

Crucially, the science of prion disease is much more certain than it was in the mid-1980s. Stricter surveillance of all farm animals, coupled with laws to prevent ruminants being fed to other ruminants, should ensure that something like BSE never gets a chance to spread so widely again. "If it does pop up, we should pick it out early," Higgins says.

http://www.newscientist.com/article/dn20033-mad-cow-disease-is-almost-extinct-globally.html

**Transsexual differences caught on brain scan**

- 12:16 26 January 2011 by **Jessica Hamzelou**



The key is in the white matter (Image: Simon Fraser/SPL)

Differences in the brain's white matter that clash with a person's genetic sex may hold the key to identifying transsexual people before puberty. Doctors could use this information to make a case for delaying puberty to improve the success of a sex change later.

Medics are keen to find concrete physical evidence to help those children who feel they are trapped in the body of the opposite sex. One key brain region involved is the BSTc, an area of grey matter. But the region is too small to scan in a living person so differences have only been picked up at post-mortem.

Antonio Guillamon's team at the National University of Distance Education in Madrid, Spain, think they have found a better way to spot a transsexual brain. In a study due to be published next month, the team ran MRI scans on the brains of 18 female-to-male transsexual people who'd had no treatment and compared them with those of 24 males and 19 females.

They found significant differences between male and female brains in four regions of white matter – and the female-to-male transsexual people had white matter in these regions that resembled a male brain (*Journal of Psychiatric Research*, DOI: 10.1016/j.jpsychires.2010.05.006). "It's the first time it has been shown that the brains of female-to-male transsexual people are masculinised," Guillamon says.

In a separate study, the team used the same technique to compare white matter in 18 male-to-female transsexual people with that in 19 males and 19 females. Surprisingly, in each transsexual person's brain the structure of the white matter in the four regions was halfway between that of the males and females (*Journal of Psychiatric Research*, DOI: 10.1016/j.jpsychires.2010.11.007). "Their brains are not completely masculinised and not completely feminised, but they still feel female," says Guillamon.

Guillamon isn't sure whether the four regions are at all associated with notions of gender, but Ivanka Savic-Berglund at the Karolinska Institute in Stockholm, Sweden, thinks they might be. One of the four regions – the superior longitudinal fascicle – is particularly interesting, she says. "It connects the parietal lobe [involved in sensory processing] and frontal lobe [involved in planning movement] and may have implications in body perception."

A 2010 study of 121 transgender people found that 38 per cent realised they had gender variance by age 5. White matter differences could provide independent confirmation that such children might benefit from treatment to delay puberty.

A study by Sean Deoni's team at King's College London suggests it may soon be possible to look for these differences in such children. Deoni's team adapted an MRI scanner to be as quiet as possible so it could be used to monitor the development of white matter in sleeping infants. Using new image analysis software they could track when and where myelin – the neuron covering that makes white matter white – was laid down (*Journal of Neuroscience*, vol 31, p 784). Although the sample was too small to identify any gender differences in development, Deoni expects to see differences developing in the brain "by 2 or 3 years of age".

Guillamon thinks such scans may not help in all cases. "Research has shown that white matter matures during the first 20 to 30 years of life," he says. "People may experience early or late onset of transsexuality and we don't know what causes this difference."

http://www.newscientist.com/article/dn20032-transsexual-differences-caught-on-brain-scan.html

**Kids with low self-control are less successful adults**

- 10:31 26 January 2011 by **Jessica Hamzelou**

Children who lack self-control are more likely to become adults with poor health and finances.

So say Avshalom Caspi at Duke University in North Carolina, Terrie Moffitt at King's College London and colleagues, who followed the progress of 1000 children born between 1972 and 1973 in New Zealand.

The team measured self-control by asking the children, as well as their parents and teachers, about their behaviour every two years between the ages of 3 and 15, and then at 18, 21, 26 and 32.

Children with higher levels of self-control were more likely to have a higher socioeconomic background and a higher IQ.

After adjusting for both factors, the team found that adults who had low self-control as children were more likely to be overweight, have substance abuse problems, gum disease and sexually transmitted infections.

**Criminal offence**

They were also less likely to be homeowners, and more likely to have been convicted of a criminal offence.

In a separate study of non-identical British twins, the team found that the sibling with lower self-control at 5 years of age was more likely to have started smoking and be engaged in anti-social behaviours by age 12.

The team suggests governments should employ policies to target self-control in children.

Kevin Beaver, who researches human behaviour and criminology at Florida State University in Tallahassee, is sceptical of such an approach. "Levels of self-control are highly resistant to change, which is why they have been found to be so stable over long swathes of the life course," he says.

But Alex Piquero, also at Florida State University, disagrees. "People can change," he says. "Identifying low self-control as early as possible and attempting prevention and intervention is so much cheaper than costs associated with prisons, drug programmes and personal financial problems."

Journal reference: *Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.1010076108

http://www.newscientist.com/article/dn20029-kids-with-low-selfcontrol-are-less-successful-adults.html

**Royal rumpus over King Tutankhamun's ancestry**

- 14:09 21 January 2011 by **Jo Marchant**

Degraded DNA may have been detrimental to results (Image: Barry Iverson/Discovery Channel/AP/PA)

Can we be sure which mummy was the daddy? When a state-of-the-art DNA analysis of Tutankhamun and other ancient Egyptian royals was published last year, its authors hailed it as "the final word" on the pharaoh's family tree. But others are now voicing doubts.

The analysis of 11 royal mummies dating from around 1300 BC was carried out by an Egyptian team led by Egypt's chief archaeologist Zahi Hawass. The project was overseen by two foreign consultants, Albert Zink of the EURAC Institute for Mummies and the Iceman in Bolzano, Italy, and Carsten Pusch of the University of Tübingen, Germany.

The researchers used the DNA data to construct a family tree of Tutankhamun and his immediate relatives. The study, published last February in the *Journal of the American Medical Association* (vol 303, p 638), concluded that Tutankhamun's father was the pharaoh Akhenaten, that his parents were brother and sister, and that two mummified foetuses found in Tutankhamun's tomb were probably his stillborn daughters – conclusions that have since become received wisdom.

But many geneticists complain that the team used inappropriate analysis techniques. Far from being definitive, the study is "not seen as rigorous or convincing", says Eline Lorenzen of the Center for GeoGenetics at the Natural History Museum in Copenhagen, Denmark. "Many of us in the DNA community are surprised that this has been published."

**Degraded DNA**

Ian Barnes, a molecular palaeobiologist at Royal Holloway, University of London, is also concerned. "In my experience it is not very easy to get these results," he says. "I can't do it, and I've spent a long time trying."

Zink and his colleagues used a genetic fingerprinting approach that involves testing variable regions of the genome called microsatellites, which are made up of short sequence repeats. The numbers of repeats vary between individuals, and by comparing the number of repeats across several microsatellites it is possible to work out whether or not individuals are related.

However, researchers rarely attempt this approach with ancient samples because the original DNA is likely to be degraded, and dwarfed by modern contamination. It's more common to sequence mitochondrial DNA (mtDNA) – cells contain around a thousand times more copies of mtDNA than of genomic DNA, improving chances of finding large intact samples.

Zink and Pusch defend their choice, saying that they took extensive precautions to guard against contamination. For instance, they extracted samples from deep inside the mummies' bones, and genotyped lab staff to rule out contamination.

**Not deep enough**

But others doubt the precautions were sufficiently rigorous. Robert Connolly of the University of Liverpool, UK, who carried out blood typing of Tutankhamun's mummy in the 1960s, argues that it would be difficult to reach deep enough inside Tutankhamun's thin, fragile bones – or those of the two fetuses – to reach uncontaminated material.

Lorenzen adds that many people – not just the Hawass team – have handled the mummies since they were first unwrapped. The authors should have tested non-human samples from the tombs as negative controls, she says.

To judge the quality of the team's results, Lorenzen and others are asking for access to raw data not included in the *Journal of the American Medical Association* paper – but Zink is reluctant to oblige, fearing the data would spark "a lot of arguing" over technicalities.

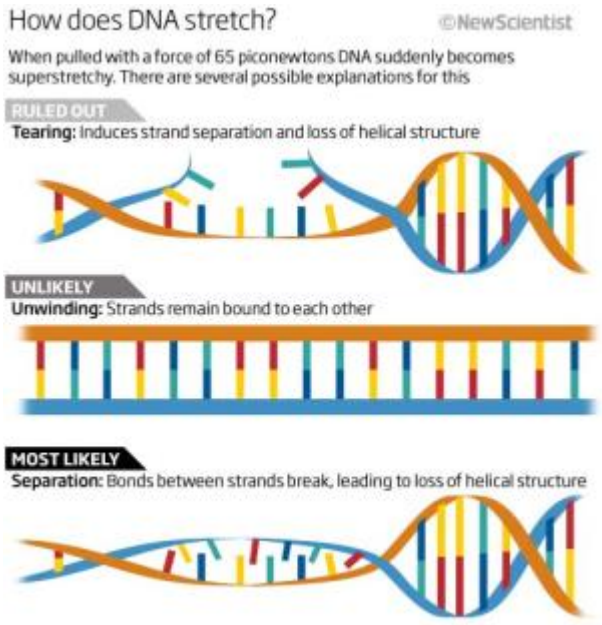
However, Zink, Pusch and colleagues insist that they will soon be able to put any doubts to rest. They say they have also extracted the mtDNA that Lorenzen and others consider necessary for rigorous genetic analysis and are still working on the data. They hope to publish the results this year.

But the critics are still advising caution. "When working with samples that are so well-known, it is important to convince readers that you have the right data," says Lorenzen. "I am not convinced."

http://www.newscientist.com/article/dn20014-royal-rumpus-over-king-tutankhamuns-ancestry.html

**Stretchy DNA shows off its elastic qualities**

- 28 January 2011 by **MacGregor Campbell**
- Magazine issue 2797. **Subscribe and save**




How does DNA stretch?

YOGA fans take note. DNA can stretch to nearly twice its length without breaking. The discovery could help to develop anti-cancer drugs. It also points to a more prosaic role for the blueprint of life, as a reference material for calibrating machines that measure the tiniest of forces.

Despite its immense importance, there is still a lot we don't understand about DNA. One outstanding puzzle concerns its stretchiness. Like many polymers, the twisty molecule stretches easily under an initial, small force but gets progressively more difficult to stretch as the force increases. At 65 piconewtons, however, DNA suddenly loosens up, becoming easy to stretch again, until it reaches around 170 per cent of its original length.

The cause of this sudden transition has long been a mystery. "You'd think it would be easy to answer 'what happens to DNA when you stretch it?'," says Mark Williams, a biophysicist at Northeastern University in Boston, Massachusetts, who was not involved with the work. "But this is something that people have debated for years. You can't just take a picture of the structure."

One option is that the added length comes from untwisting DNA's double helix, leaving a straight structure that looks more like a ladder than a spiral staircase. However, no such structure has ever been observed.

A competing explanation says that when enough force is applied, some of the bonds between the paired strands come apart, causing the strands to lose their double-helical structure and stretch out easily (see diagram). In 2009, an experiment using dye that only binds to sections of DNA in which the two strands are bonded together favoured this option.

In the experiment, separated regions seemed only to arise near nicks in the strand, suggesting the bonds between the strands may not break under force alone but require an initial tear. Now Thomas Perkins of the US National Institute of Standards and Technology and Hern Paik of the University of Colorado, both in Boulder, show this isn't so.

After checking that a length of DNA had no nicks or tears, they attached one end to a stable surface and the other to a tiny bead that could be pushed with laser light. Activating the laser caused the bead to move, gradually stepping up the force on the DNA, which overstretched at 65 piconewtons.

The pair repeated the experiment with strands that had one and two nicks, and found that the DNA still overstretched at 65 piconewtons. They conclude that nicks are not required for overstretching, and that the phenomenon must therefore be due to force-induced breaking of bonds between the two strands, leading to elongation of the helix (*Journal of the American Chemical Society*, DOI: 10.1021/ja108952v).

If further tests confirm this, DNA could find a new use. Its sudden switch to stretchiness means that highly sensitive instruments, such as atomic force microscopes, could be calibrated by tugging on DNA and recording exactly when it overstretches.

Understanding how far DNA can stretch before breaking could also help with the design of anti-cancer drugs that aim to disrupt or break apart maliciously replicating DNA, Williams suggests.

http://www.newscientist.com/article/mg20927973.500-stretchy-dna-shows-off-its-elastic-qualities.html

**Remember the lessons of past clinical trials abuses**

- 26 January 2011 by **Osagie K. Obasogie**

Magazine issue 2796.

Vulnerable target? (Image: David Greedy/Getty)

*Vulnerable people are increasingly targeted as subjects for clinical research. Have we forgotten the lessons of past abuses?*

A GREAT deal of scientific research - especially in medicine - relies on human subjects. Protecting volunteers has been a prominent social and legal issue since the 1950s, when the world recoiled from the horrors of Nazi medicine.

We have come a long way since then, but it pays to remember that the Nazis did not have a monopoly on atrocities committed in the name of science. One of the worst cases of human subject abuse was perpetrated by American scientists who, between 1932 and 1972, misled hundreds of black people with syphilis in Tuskegee, Alabama, by deliberately leaving them untreated to enable researchers to study the progression of the disease.

Tuskegee wasn't an isolated incident. Historian Susan Reverby of Wellesley College in Massachusetts recently uncovered another appalling ethical breach. In the 1940s, researchers from the US Public Health Service deliberately infected Guatemalan patients, prisoners and soldiers with syphilis to test whether penicillin was an effective treatment. In a paper to appear in the *Journal of Policy History*, she describes how in some cases infected prostitutes were paid to have sex with prisoners. This breach happened at almost the same time as Nazi doctors were on trial at Nuremberg for similar abuses.

Reverby's revelation led the US to issue formal apologies to the victims and the Guatemalan government. It also prompted President Barack Obama to instruct his Bioethics Commission to turn its focus away from synthetic biology and take a fresh look at the protection of human subjects, so as to "assure that current rules... protect people from harm or unethical treatment".

Obama should be applauded. But if he and the commission merely review the rules without examining the broader context in which human research occurs, they may vastly underestimate the depth of the problem. Particularly troublesome is the extent to which research on human subjects increasingly targets vulnerable people.

This is seen most clearly in clinical trials. The pharmaceutical industry spends billions of dollars each year testing experimental drugs, with a significant portion of this cost stemming from recruiting and retaining human volunteers.

Subjects for research are in high demand. A 2005 Bloomberg Markets report showed that the pharmaceutical industry conducted 36,839 clinical trials between 2001 and 2004 - six times more than in a similar period starting in 1981. This rapid expansion is causing demand for human subjects to outpace supply. To meet the

need for more bodies while keeping costs down, the industry is resorting to extreme measures, and the most vulnerable members of society are in the crosshairs.

First, poor people and undocumented immigrants are often targeted to participate in drug trials. The industry-wide practice of paying participants hundreds, and in some cases thousands, of dollars attracts poor people who are simply doing it for the money.

As a second trend, drug companies are looking to developing countries, where poverty is extreme and social services non-existent. A 2009 study in *The New England Journal of Medicine* (vol 360, p 816) revealed that one-third of phase III clinical trials sponsored by the 20 largest American drug companies are conducted in foreign countries. Over 50 per cent of all clinical trial sites are outside the US, with India and sub-Saharan Africa becoming increasingly important. The study also found that since 2002, the US Food and Drug Administration has seen a 15 per cent annual increase in the number of clinical trial investigators it regulates outside of the US while the number of domestic investigators has fallen by 5.5 per cent overall.

While clinical trials may offer the developing world some measure of healthcare, they may also give rise to controversial research practices. For example, Pfizer recently paid $75 million in Nigeria to settle charges - without admitting any wrongdoing - that it illegally tested an experimental antibiotic on children, leading to 11 deaths.

Finally, there is a movement in the US to give researchers easier access to prisoners. Current regulations, stemming from past abuses, severely restrict scientists' ability to recruit prisoners for clinical research. But the Institute of Medicine - an influential government advisory body - has recommended relaxing these restrictions. While no decision has been made, the once unthinkable idea of reopening prison gates to biomedical and behavioural research is now back on the table.

These practices highlight how one of the most crucial ethical debates in science and medicine is not over speculative technologies such as synthetic biology. Rather, it concerns the more basic question of how we treat each other. With an entire research industry becoming increasingly dependent upon vulnerable populations to test experimental treatments, not enough thought has been given to issues of justice. We are not back in Tuskegee territory yet, but this approach to recruiting human subjects may give rise to outcomes that are similarly pernicious.

Obama should be commended for instructing his Bioethics Commission to look into ways to prevent further human subject abuses, but its mandate must go beyond checking the rules. Rather, the commission must examine a deeper question: is it ever ethical to ask the most vulnerable members of our society to give their bodies to science?

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http://www.newscientist.com/article/mg20927964.600-remember-the-lessons-of-past-clinical-trials-abuses.html

**Quantum reality: The many meanings of life**

- 24 January 2011 by **Michael Brooks**

Magazine issue 2796

Where the weird things are (Image: Richard Wilkinson)

*Quantum theory is a scientific masterpiece – but physicists still aren't sure what to make of it*

A CENTURY, it seems, is not enough. One hundred years ago this year, the first world physics conference took place in Brussels, Belgium. The topic under discussion was how to deal with the strange new quantum theory and whether it would ever be possible to marry it to our everyday experience, leaving us with one coherent description of the world.

It is a question physicists are still wrestling with today. Quantum particles such as atoms and molecules have an uncanny ability to appear in two places at once, spin clockwise and anticlockwise at the same time, or instantaneously influence each other when they are half a universe apart. The thing is, we are made of atoms and molecules, and we can't do any of that. Why? "At what point does quantum mechanics cease to apply?" asks Harvey Brown, a philosopher of science at the University of Oxford.

Although an answer has yet to emerge, the struggle to come up with one is proving to be its own reward. It has, for instance, given birth to the new field of quantum information that has gained the attention of high-tech industries and government spies. It is giving us a new angle of attack on the problem of finding the ultimate theory of physics, and it might even tell us where the universe came from. Not bad for a pursuit that a quantum cynic - one Albert Einstein - dismissed as a "gentle pillow" that lulls good physicists to sleep.

Unfortunately for Einstein quantum theory has turned out to be a masterpiece. No experiment has ever disagreed with its predictions, and we can be confident that it is a good way to describe how the universe works on the smallest scales. Which leaves us with only one problem: what does it mean?

Physicists try to answer this with "interpretations" - philosophical speculations, fully compliant with experiments, of what lies beneath quantum theory. "There is a zoo of interpretations," says Vlatko Vedral, who divides his time between the University of Oxford and the Centre for Quantum Technologies in Singapore.

No other theory in science has so many different ways of looking at it. How so? And will any one win out over the others?

Take what is now known as the Copenhagen interpretation, for example, introduced by the Danish physicist Niels Bohr. It says that any attempt to talk about an electron's location within an atom, for instance, is meaningless without making a measurement of it. Only when we interact with an electron by trying to observe it with a non-quantum, or "classical", device does it take on any attribute that we would call a physical property and therefore become part of reality.

Then there is the "many worlds" interpretation, where quantum strangeness is explained by everything having multiple existences in myriad parallel universes. Or you might prefer the de Broglie-Bohm interpretation, where quantum theory is considered incomplete: we are lacking some hidden properties that, if we knew them, would make sense of everything.

There are plenty more, such as the Ghirardi-Rimini-Weber interpretation, the transactional interpretation (which has particles travelling backwards in time), Roger Penrose's gravity-induced collapse interpretation, the modal interpretation... in the last 100 years, the quantum zoo has become a crowded and noisy place (see diagram).

For all the hustle and bustle, though, there are only a few interpretations that seem to matter to most physicists.

**Wonderful Copenhagen**

The most popular of all is Bohr's Copenhagen interpretation. Its popularity is largely due to the fact that physicists don't, by and large, want to trouble themselves with philosophy. Questions over what, exactly, constitutes a measurement, or why it might induce a change in the fabric of reality, can be ignored in favour of simply getting a useful answer from quantum theory.

That is why unquestioning use of the Copenhagen interpretation is sometimes known as the "shut up and calculate" interpretation. "Given that most physicists just want to do calculations and apply their results, the majority of them are in the shut up and calculate group," Vedral says.

This approach has a couple of downsides, though. First, it is never going to teach us anything about the fundamental nature of reality. That requires a willingness to look for places where quantum theory might fail, rather than where it succeeds (*New Scientist*, 26 June 2010, p 34). "If there is going to be some new theory, I don't think it's going to come from solid state physics, where the majority of physicists work," says Vedral.

Second, working in a self-imposed box also means that new applications of quantum theory are unlikely to emerge. The many perspectives we can take on quantum mechanics can be the catalyst for new ideas. "If you're solving different problems, it's useful to be able to think in terms of different interpretations," Vedral says.

Nowhere is this more evident than in the field of quantum information. "This field wouldn't even exist if people hadn't worried about the foundations of quantum physics," says Anton Zeilinger of the University of Vienna in Austria.

At the heart of this field is the phenomenon of entanglement, where the information about the properties of a set of quantum particles becomes shared between all of them. The result is what Einstein famously termed "spooky action at a distance": measuring a property of one particle will instantaneously affect the properties of its entangled partners, no matter how far apart they are.

When first spotted in the equations of quantum theory, entanglement seemed such a weird idea that the Irish physicist John Bell created a thought experiment to show that it couldn't possibly manifest itself in the real world. When it became possible to do the experiment, it proved Bell wrong and told physicists a great deal about the subtleties of quantum measurement. It also created the foundations of quantum computing, where a single measurement could give you the answer to thousands, perhaps millions, of calculations done in parallel by quantum particles, and quantum cryptography, which protects information by exploiting the very nature of quantum measurement.

Both of these technologies have, understandably, attracted the attention of governments and industry keen to possess the best technologies - and to prevent them falling into the wrong hands.

Physicists, however, are actually more interested in what these phenomena tell us about the nature of reality. One implication of quantum information experiments seems to be that information held in quantum particles lies at the root of reality.

Adherents of the Copenhagen interpretation, such as Zeilinger, see quantum systems as carriers of information, and measurement using classical apparatus as nothing special: it's just a way of registering change in the information content of the system. "Measurement updates the information," Zeilinger says. This new focus on information as a fundamental component of reality has also led some to suggest that the universe itself is a vast quantum computer.

However, for all the strides taken as a result of the Copenhagen interpretation, there are plenty of physicists who would like to see the back of it. That is largely because it requires what seems like an artificial distinction between tiny quantum systems and the classical apparatus or observers that perform the measurement on them.

Vedral, for instance, has been probing the role of quantum mechanics in biology: various processes and mechanisms in the cell are quantum at heart, as are photosynthesis and radiation-sensing systems (*New Scientist*, 27 November, p 42). "We are discovering that more and more of the world can be described quantum mechanically - I don't think there is a hard boundary between quantum and classical," he says.

Considering the nature of things on the scale of the universe has also provided Copenhagen's critics with ammunition. If the process of measurement by a classical observer is fundamental to creating the reality we observe, what performed the observations that brought the contents of the universe into existence? "You really need to have an observer outside the system to make sense - but there's nothing outside the universe by definition," says Brown.

That's why, Brown says, cosmologists now tend to be more sympathetic to an interpretation created in the late 1950s by Princeton University physicist Hugh Everett. His "many worlds" interpretation of quantum mechanics says that reality is not bound to a concept of measurement.

Instead, the myriad different possibilities inherent in a quantum system each manifest in their own universe. David Deutsch, a physicist at the University of Oxford and the person who drew up the blueprint for the first quantum computer, says he can now only think of the computer's operation in terms of these multiple universes. To him, no other interpretation makes sense.

Not that many worlds is without its critics - far from it. Tim Maudlin, a philosopher of science based at Rutgers University in New Jersey, applauds its attempt to demote measurement from the status of a special process. At the same time, though, he is not convinced that many worlds provides a good framework for explaining why some quantum outcomes are more probable than others.

When quantum theory predicts that one outcome of a measurement is 10 times more probable than another, repeated experiments have always borne that out. According to Maudlin, many worlds says all possible outcomes will occur, given the multiplicity of worlds, but doesn't explain why observers still see the most probable outcome. "There's a very deep problem here," he says.

Deutsch says these issues have been resolved in the last year or so. "The way that Everett dealt with probabilities was deficient, but over the years many-worlds theorists have been picking away at this - and we have solved it," he says.

However Deutsch's argument is abstruse and his claim has yet to convince everyone. Even more difficult to answer is what proponents of many worlds call the "incredulous stare objection". The obvious implication of many worlds is that there are multiple copies of you, for instance - and that Elvis is still performing in Vegas in another universe. Few people can stomach this idea.

Persistence will be the only solution here, Brown reckons. "There is a widespread reluctance to accept the multiplicity of yourself and others," he says. "But it's just a question of getting used to it."

Deutsch thinks this will happen when technology starts to use the quantum world's stranger sides. Once we have quantum computers that perform tasks by being in many states at the same time, we will not be able to think of these worlds as anything other than physically real. "It will be very difficult to maintain the idea that this is just a manner of speaking," Deutsch says.

He and Brown both claim that many worlds is already gaining traction among cosmologists. Arguments from string theory, cosmology and observational astronomy have led some cosmologists to suggest we live in one of many universes. Last year, Anthony Aguirre of the University of California, Santa Cruz, Max Tegmark of the Massachusetts Institute of Technology, and David Layzer of Harvard University laid out a scheme that ties together ideas from cosmology and many worlds (*New Scientist*, 28 August 2010, p 6).

But many worlds is not the only interpretation laying claim to cosmologists' attention. In 2008, Anthony Valentini of Imperial College London suggested that the cosmic microwave background radiation (CMB) that has filled space since just after the big bang might support the de Broglie-Bohm interpretation. In this scheme, quantum particles possess as yet undiscovered properties dubbed hidden variables.

The idea behind this interpretation is that taking these hidden variables into account would explain the strange behaviours of the quantum world, which would leave an imprint on detailed maps of the CMB. Valentini says that hidden variables could provide a closer match with the observed CMB structure than standard quantum mechanics does.

Though it is a nice idea, as yet there is no conclusive evidence that he might be onto something. What's more, if something unexpected does turn up in the CMB, it won't be proof of Valentini's hypothesis, Vedral reckons: any of the interpretations could claim that the conditions of the early universe would lead to unexpected results.

"We're stuck in a situation where we probably won't ever be able to decide experimentally between Everett and de Broglie-Bohm," Brown admits. But, he adds, that is no reason for pessimism. "I think there has been significant progress. A lot of people say we can't do anything because of a lack of a crucial differentiating experiment but it is definitely the case that some interpretations are better than others."

For now, Brown, Deutsch and Zeilinger are refusing to relinquish their favourite views of quantum mechanics. Zeilinger is happy, though, that the debate about what quantum theory means shows no sign of going away.

Vedral agrees. Although he puts himself "in the many worlds club", which interpretation you choose to follow is largely a matter of taste, he reckons. "In most of these cases you can't discriminate experimentally, so you really just have to follow your instincts."

The idea that physicists wander round the quantum zoo, choosing a favourite creature on a whim might seem rather unscientific, but it hasn't done us any harm so far.

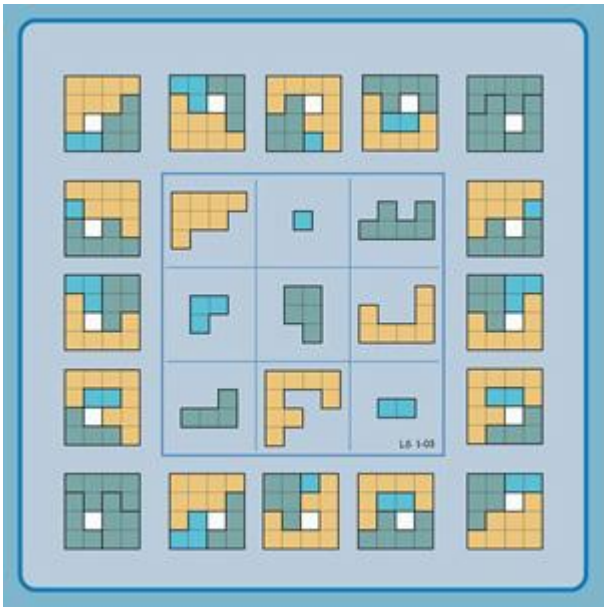
Quantum theory has transformed the world through its spin-offs - the transistor and the laser, for example - and there may be more to come. Having different interpretations to follow gives physicists ideas for doing experiments in different ways. If history is anything to go by, keeping an open mind about what quantum theory means might yet open up another new field of physics, Vedral says. "Now that really would be exciting."

***Michael Brooks*** *is a consultant for New Scientist*

http://www.newscientist.com/article/mg20927960.200-quantum-reality-the-many-meanings-of-life.html

**Ancient puzzle gets new lease of 'geomagical' life**

- 13:30 24 January 2011 by **Jacob Aron**



See more geomagic squares in our gallery (Image: Lee Sallows)

An ancient mathematical puzzle that has fascinated mathematicians for centuries has found a new lease of life.

The magic square is the basis for Sudoku, pops up in Chinese legend and provides a playful way to introduce children to arithmetic. But all this time it has been concealing a more complex geometrical form, says recreational mathematician Lee Sallows.

He has dubbed the new kind of structure the "geomagic square", and recently released dozens of examples online.

Click here to see a gallery of geomagic squares.

"To come up with this after thousands of years of study of magic squares is pretty amazing," blogged Alex Bellos, author of the book *Alex's Adventures in Wonderland*.

Peter Cameron, a mathematician at Queen Mary, University of London, believes that an even deeper structure may lie hidden beyond geomagic squares. "I can immediately see a lot of things I'd like to do with this," he says.

**Turtle mathematics**

The traditional magic square is a square grid of numbers arranged so that each row, column and diagonal adds up to the same total. For example, in this magic square, that total is 15:

2 9 4
7 5 3
6 1 8

In fact, this particular magic square has been around for thousands of years – Chinese legend calls it the *Lo Shu* and claims it was found carved into the shell of a turtle.

Now Sallows, who lives in the Netherlands and says he has spent about 10 years playing around with geometric versions of magic squares, has shown how it is possible to extend the idea in entirely new ways.

**Tetris bricks**

In his geomagic square, each digit of the grid is replaced by a Tetris-like shape called a polyomino, which is made up of different numbers of identical squares. Crucially, there must be a way to combine the polyominos in each row, column and diagonal to build a single master shape (see picture).

The bricks can be in two, three, or, in theory, even more dimensions – though visually representing a 4D geomagic square would be challenging.

Sallows's first attempt at a geomagic square was based on a formula for creating magic squares devised by the 19th-century French mathematician Édouard Lucas. Sallows found that applying the formula to shapes didn't quite produce the result he was looking for, but it inspired him to develop a series of computer programs to help him build dozens of true geomagic squares.

Among those he's generated is a geomagic version of the *Lo Shu*, in which each digit is represented by a polyomino consisting of that number of smaller squares (see picture).

**Copernican revolution**

But while any magic square can be represented geometrically, he explains, the reverse is not true. "Magic squares are not numerical, they're geometrical objects. They were only seen like that before because we always represented them with numbers."

Sallows describes his discovery as a "Copernican revolution in our understanding of magic squares".

So could geomagic squares have applications outside the study of puzzles? Cameron certainly thinks so. "You can ask these questions in much more general terms," he says.

For example, the concepts behind geomagic squares might be applied in a more abstract way in the fields of set and group theory, where you can examine the mathematical properties of hypothetical objects without reference to their physical form. He outlines this idea in more detail on his blog.

**Geolatin square**

Geomagic squares might even be put to work in the real world. A variant of the magic square known as the Latin square is already used to help create codes for transmitting information and in the design of drug trials, where it can be used to check that participants receive the right combination of treatments. Sudoku is also a particular type of Latin square.

Cameron speculates that a "geolatin" square – if such a thing exists – might also have applications.

In the meantime, Sallows is happy to keep exploring the geomagic world. Placing the work online has already helped him achieve his long-standing goal of finding a 2 × 2 geomagic square. Smaller squares are harder than larger ones, because the larger squares give you more options – and Sallows had been drawing a blank. But shortly after his site went live, fellow square-hunter Frank Tinkelenberg sent him an example.

And the search doesn't end there, Sallows is now looking for a geomagic square in which the master shape is smooth, without any gaps for missing cells. "As soon as you find one that has the properties you're looking for, you're on to the next challenge," he explains.

**See more:** view our gallery to see a selection of Sallows's geomagic squares – and what they mean.

http://www.newscientist.com/article/dn20017-ancient-puzzle-gets-new-lease-of-geomagical-life.html

**Deep meaning in Ramanujan's 'simple' pattern**

- 12:56 27 January 2011 by **Jacob Aron**

Contemplating partition (Image: Konrad Jacobs/Oberwolfach Photo Collection)

The first simple formula has been found for calculating how many ways a number can be created by adding together other numbers, solving a puzzle that captivated the legendary mathematician Srinivasa Ramanujan.

The feat has also led to a greater understanding of a cryptic phrase Ramanujan used to describe sequences of so-called partition numbers.

A partition of a number is any combination of integers that adds up to that number. For example, 4 = 3+1 = 2+2 = 2+1+1 = 1+1+1+1, so the partition number of 4 is 5. It sounds simple, yet the partition number of 10 is 42, while 100 has more than 190 million partitions. So a formula for calculating partition numbers was needed.

Previous attempts have only provided approximations or relied on "crazy infinite sums", says Ken Ono at Emory University in Atlanta, Georgia.

**Pattern in partition**

Ramanujan's approximate formula, developed in 1918, helped him spot that numbers ending in 4 or 9 have a partition number divisible by 5, and he found similar rules for partition numbers divisible by 7 and 11.

Without offering a proof, he wrote that these numbers had "simple properties" possessed by no others. Later, similar rules were found for the divisibility of other partition numbers so no one knew whether Ramanujan's words had a deeper significance.

Now Ono and colleagues have developed a formula that spits out the partition number of any integer. They may also have discovered what Ramanujan meant.

They found "fractal" relationships in sequences of partition numbers of integers that were generated using a formula containing a prime number. For example, in a sequence generated from 13, all the partition numbers are divisible by 13, but zoom in and you will find a sub-sequence of numbers that are divisible by $13^2$, a further sequence divisible by $13^3$ and so on.

**Mathematical metaphor**

Ono's team were able to measure the extent of this fractal behaviour in any sequence; Ramanujan's numbers are the only ones with none at all. That may be what he meant by simple properties, says Ono.

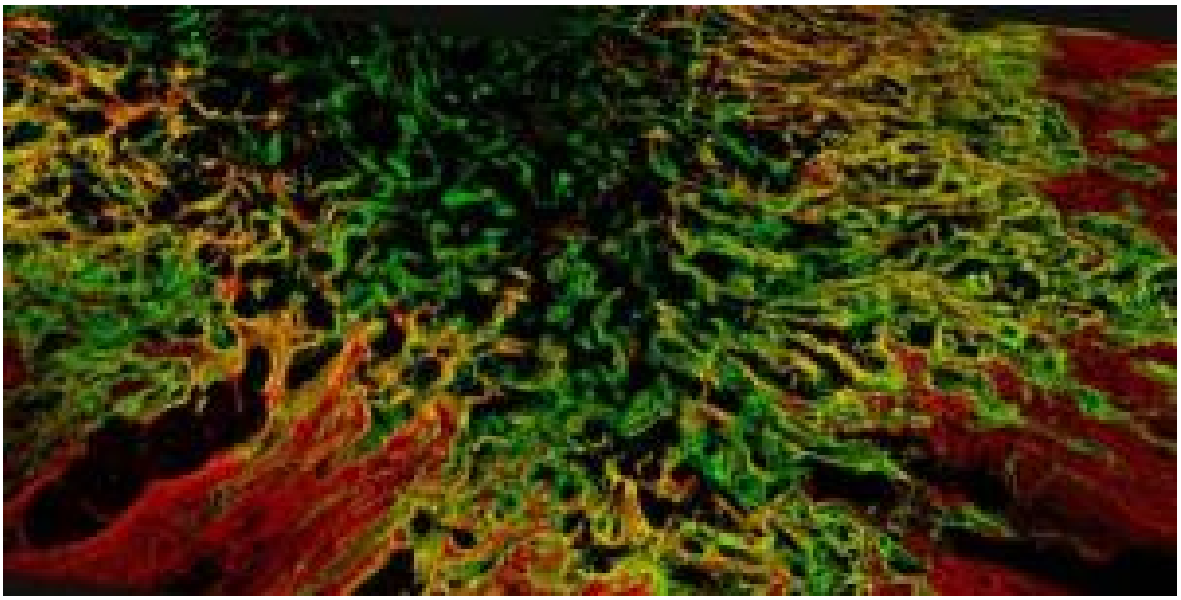
"It's a privilege to explain Ramanujan's work," says Ono, whose interest in partition numbers was sparked by a documentary about Ramanujan that he watched as a teenager. "It's something you'd never expect to be able to do."

Trevor Wooley, a mathematician at the University of Bristol, UK, cautions that the use of the term "fractal" to describe what Ono's team found is more mathematical metaphor than precise description. "It's a word which conveys some of the sense of what's going on," he says.

Wooley is more interested in the possibility of applying Ono's methods to other problems. "There are lots of tools involved in studying the theory of partition functions which have connections in other parts of mathematics."

http://www.newscientist.com/article/dn20039-deep-meaning-in-ramanujans-simple-pattern.html

**Cancer Drug Aids Regeneration of Spinal Cord After Injuries**



*The scar tissue creates a barrier for growing nerve cells in spinal cord injuries. Scientists have now found a way to render this cell wall more permeable for regenerating nerve cells. (Credit: Copyright Max Planck Institute of Neurobiology / Bradke & Hellal)*

ScienceDaily (Jan. 28, 2011) — After a spinal cord injury a number of factors impede the regeneration of nerve cells. Two of the most important of these factors are the destabilization of the cytoskeleton and the development of scar tissue. While the former prevents regrowth of cells, the latter creates a barrier for severed nerve cells. Scientists of the Max Planck Institute of Neurobiology in Martinsried and their colleagues from the Kennedy Krieger Institute and University of Miami in the United States, and the University of Utrecht in the Netherlands, have now shown that the cancer drug Taxol reduces both regeneration obstacles.

Paraplegia. This is often the long-lasting result, when nerve fibers have been crushed or cut in the spinal cord. In contrast, for example, to the nerves in a cut finger, the injured nerve cells in the central nervous system (CNS) won't regrow. Scientists have been working for decades to discover the reasons for this discrepancy in the regeneration abilities of nerve cells. They have found a variety of factors that prevent the regeneration of CNS nerve cells. One by one a number of substances that act like stop signs and halt the resumption of growth have been discovered. Other obstacles lie within the cells: The microtubules, small protein tubes which compose the cells' cytoskeleton, are completely jumbled in an injured CNS nerve cell. A structured growth becomes impossible. In addition to this, the lost tissue is progressively replaced by scar tissue creating a barrier for growing nerve cells.

**Understanding regeneration**

Frank Bradke and his team at the Max Planck Institute of Neurobiology in Martinsried study the mechanisms inside CNS nerve cells responsible for stopping their growth: "We try to provoke the cells to ignore the stop signs so that they regrow." For this task, the neurobiologists have focused on studying the role of microtubules. These protein tubes have a parallel arrangement in the tip of growing nerve cells, stabilizing cells and actively pushing the cell end forward. This arrangement is lost in injured CNS cells. So how can the order of the microtubule be kept or regained in these cells? And once the cells start growing, how can they overcome the barrier of the scar tissue? Together with their colleagues from the United States and the Netherlands, the Max Planck scientists have now found a common solution for both problems.

**New application for an established drug**

Taxol, the trade name of a drug currently used for cancer treatment, has now been shown to promote regeneration of injured CNS-nerve cells. The scientists report in the online issue of the journal *Science* that Taxol promotes regeneration of injured CNS-nerve cells in two ways: Taxol stabilizes the microtubules so that their order is maintained and the injured nerve cells regain their ability to grow. In addition, Taxol prevents the production of an inhibitory substance in the scar tissue. The scar tissue, though reduced by Taxol, will still develop at the site of injury and can thus carry out its protective function. Yet growing nerve cells are now better able to cross this barrier. "This is literally a small breakthrough," says Bradke.

Experiments in rats performed by this group verified the effects of Taxol. These researchers supplied the injury site after a partial spinal cord lesion with Taxol via a miniature pump. After just a few weeks, animals showed a significant improvement in their movements. "So far we tested the effects of Taxol immediately after a lesion," explains Farida Hellal, the first author of the study. "The next step is to investigate whether Taxol is as effective when applied onto an existing scar several months after the injury."

**Cautious hope**

The fact that a clinically approved drug shows these effects has a number of advantages. Much is already known about its interactions with the human body. In addition, Taxol can be applied directly at the site of injury for the treatment of spinal cord injuries and the amount needed is far less than what is used in cancer therapy. This should reduce side effects. "We are still in the state of basic research and a variety of obstacles remain -- and eventually, pre-clinical trials will need to be done ," cautions Bradke. "However, I believe that we are on a very promising path."

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Max-Planck-Gesellschaft**.

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**Journal Reference**:

1. F. Hellal, A. Hurtado, J. Ruschel, K. C. Flynn, C. J. Laskowski, M. Umlauf, L. C. Kapitein, D. Strikis, V. Lemmon, J. Bixby, C. C. Hoogenraad, F. Bradke. **Microtubule Stabilization Reduces Scarring and Causes Axon Regeneration After Spinal Cord Injury**. *Science*, 2011; DOI: 10.1126/science.1201148

http://www.sciencedaily.com/releases/2011/01/110128095038.htm

**Dinosaurs Survived Mass Extinction by 700,000 Years, Fossil Find Suggests**


*U of A researcher Larry Heaman with the actual fossil that now throws into questions the KT paradigm. He is sitting in front the laser ablation machine. (Credit: Image courtesy of University of Alberta)*

ScienceDaily (Jan. 27, 2011) — University of Alberta researchers determined that a fossilized dinosaur bone found in New Mexico confounds the long established paradigm that the age of dinosaurs ended between 65.5 and 66 million years ago.

The U of A team, led by Larry Heaman from the Department of Earth and Atmospheric Sciences, determined the femur bone of a hadrosaur as being only 64.8 million years old. That means this particular plant eater was alive about 700,000 years after the mass extinction event many paleontologists believe wiped all non-avian dinosaurs off the face of earth, forever.

Heaman and colleagues used a new direct-dating method called U-Pb (uranium-lead) dating. A laser beam unseats minute particles of the fossil, which then undergo isotopic analysis. This new technique not only allows the age of fossil bone to be determined but potentially can distinguish the type of food a dinosaur eats. Living bone contains very low levels of uranium but during fossilization (typically less than 1000 years after death) bone is enriched in elements like uranium. The uranium atoms in bone decay spontaneously to lead over time and once fossilization is complete the uranium-lead clock starts ticking. The isotopic composition of lead determined in the hadrosaur's femur bone is therefore a measure of its absolute age.

Currently, paleontologists date dinosaur fossils using a technique called relative chronology. Where possible, a fossil's age is estimated relative to the known depositional age of a layer of sediment in which it was found or constrained by the known depositional ages of layers above and below the fossil-bearing horizon. However, obtaining accurate depositional ages for sedimentary rocks is very difficult and as a consequence the depositional age of most fossil horizons is poorly constrained. A potential weakness for the relative chronology approach is that over millions of years geologic and environmental forces may cause erosion of a fossil-bearing horizon and therefore a fossil can drift or migrate from its original layer in the strata. The researchers say their direct-dating method precludes the reworking process.

It's widely believed that a mass extinction of the dinosaurs happened between 65.5 and 66 million years ago. It's commonly believed debris from a giant meteorite impact blocked out the Sun, causing extreme climate conditions and killing vegetation worldwide.

Heaman and his research colleagues say there could be several reasons why the New Mexico hadrosaur came from a line of dinosaurs that survived the great mass extinction events of the late Cretaceous period (KT extinction event). Heaman says it's possible that in some areas the vegetation wasn't wiped out and a number of the hadrosaur species survived. The researchers also say the potential survival of dinosaur eggs during extreme climatic conditions needs to be explored.

Heaman and his colleagues believe if their new uranium-lead dating technique bears out on more fossil samples then the KT extinction paradigm and the end of the dinosaurs will have to be revised.

The research was published online, January 26, in the journal, *Geology*.

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Alberta**, via EurekAlert!, a service of AAAS.

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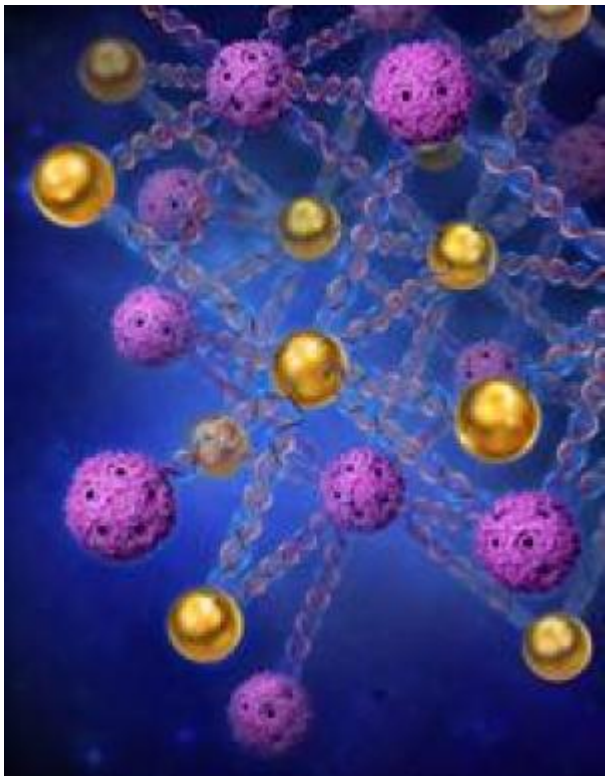
**Journal Reference**:

1. J. E. Fassett, L. M. Heaman, A. Simonetti. **Direct U-Pb dating of Cretaceous and Paleocene dinosaur bones, San Juan Basin, New Mexico**. *Geology*, 2011; 39 (2): 159 DOI: 10.1130/G31466.1

http://www.sciencedaily.com/releases/2011/01/110127141707.htm

**A Mix of Tiny Gold and Viral Particles, and the DNA Ties That Bind Them**



*Crystal lattice created by Sung Yong Park and colleagues. (Credit: Illustration by Adolf Lachman)*

ScienceDaily (Jan. 28, 2011) — Scientists have created a diamond-like lattice composed of gold nanoparticles and viral particles, woven together and held in place by strands of DNA. The structure -- a distinctive mix of hard, metallic nanoparticles and organic viral pieces known as capsids, linked by the very stuff of life, DNA -- marks a remarkable step in scientists' ability to combine an assortment of materials to create infinitesimal devices.

The research, done by scientists at the University of Rochester Medical Center, Scripps Research Institute, and Massachusetts Institute of Technology, was published recently in *Nature Materials.*

While people commonly think of DNA as a blueprint for life, the team used DNA instead as a tool to guide the precise positioning of tiny particles just one-millionth of a centimeter across, using DNA to chaperone the particles.

Central to the work is the unique attraction of each of DNA's four chemical bases to just one other base. The scientists created specific pieces of DNA and then attached them to gold nanoparticles and viral particles, choosing the sequences and positioning them exactly to force the particles to arrange themselves into a crystal lattice.

When scientists mixed the particles, out of the brew emerged a sodium thallium crystal lattice. The device "self assembled" or literally built itself.

The research adds some welcome flexibility to the toolkit that scientists have available to create nano-sized devices.

"Organic materials interact in ways very different from metal nanoparticles. The fact that we were able to make such different materials work together and be compatible in a single structure demonstrates some new opportunities for building nano-sized devices," said Sung Yong Park, Ph.D., a research assistant professor of Biostatistics and Computational Biology at Rochester.

Park and M.G Finn, Ph.D., of Scripps Research Institute are corresponding authors of the paper.

Such a crystal lattice is potentially a central ingredient to a device known as a photonic crystal, which can manipulate light very precisely, blocking certain colors or wavelengths of light while letting other colors pass. While 3-D photonic crystals exist that can bend light at longer wavelengths, such as the infrared, this lattice is capable of manipulating visible light. Scientists foresee many applications for such crystals, such as optical computing and telecommunications, but manufacturing and durability remain serious challenges.

It was three years ago that Park, as part of a larger team of colleagues at Northwestern University, first produced a crystal lattice with a similar method, using DNA to link gold nanospheres. The new work is the first to combine particles with such different properties -- hard gold nanoparticles and more flexible organic particles.

Within the new structure, there are actually two distinct forces at work, Park said. The gold particles and the viral particles repel each other, but their deterrence is countered by the attraction between the strategically placed complementary strands of DNA. Both phenomena play a role in creating the rigid crystal lattice. It's a little bit like how countering forces keep our curtains up: A spring in a curtain rod pushes the rod to lengthen, while brackets on the window frame counter that force, creating a taut, rigid device.

Other authors of the paper include Abigail Lytton-Jean, Ph.D., of MIT, Daniel Anderson, Ph.D., of Harvard and MIT, and Petr Cigler, Ph.D., formerly of Scripps Research Institute and now at the Academy of Sciences of the Czech Republic. Park's work was supported by the National Institute of Allergy and Infectious Diseases.

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Rochester Medical Center**.

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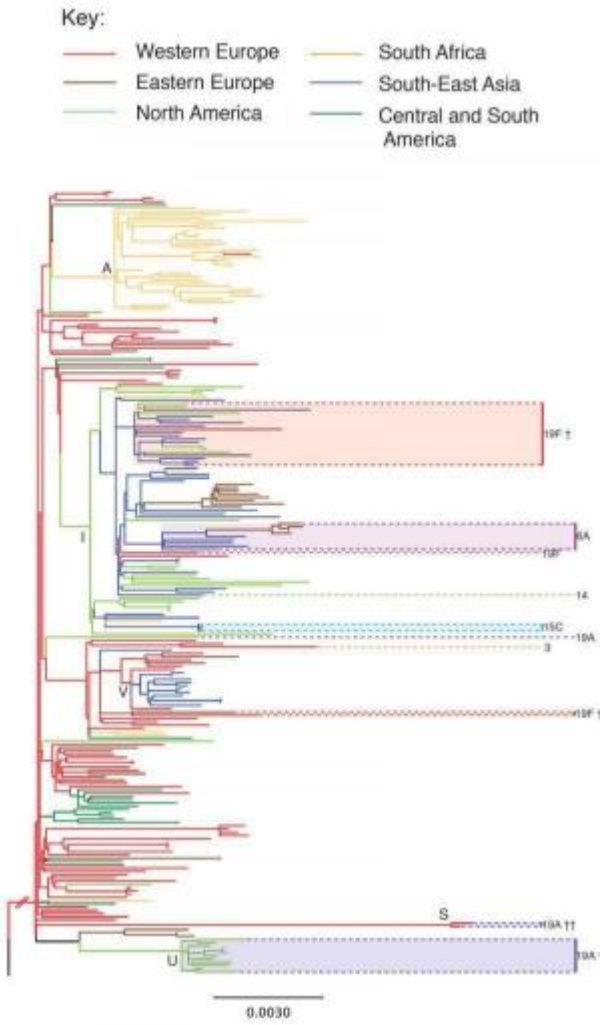
**Journal Reference**:

1. Petr Cigler, Abigail K. R. Lytton-Jean, Daniel G. Anderson, M. G. Finn, Sung Yong Park. **DNA-controlled assembly of a NaTl lattice structure from gold nanoparticles and protein nanoparticles**. *Nature Materials*, 2010; 9 (11): 918 DOI: 10.1038/nmat2877

http://www.sciencedaily.com/releases/2011/01/110127131111.htm

**How Bacteria Keep Ahead of Vaccines and Antibiotics**




*Global phylogeny of PMEN1. The maximum likelihood tree, constructed using substitutions outside of recombination events, is coloured according to location, as reconstructed through the phylogeny using parsimony. Shaded boxes and dashed lines indicate isolates that have switched capsule type from the ancestral 23F serotype. Specific clades referred to in the text are marked on the tree: 'A' (South Africa), 'I' (International), 'V' (Vietnam), 'S' (Spain 19A) and 'U' (USA 19A). (Credit: Image courtesy of Wellcome Trust Sanger Institute)*

ScienceDaily (Jan. 28, 2011) — New research provides the first detailed genetic picture of an evolutionary war between *Streptococcus pneumoniae* bacteria and the vaccines and antibiotics used against it over recent decades. Large-scale genome sequencing reveals patterns of adaptation and the spread of a drug-resistant lineage of the *S. pneumoniae* bacteria.

The study unmasks the genetic events by which bacteria such as *S. pneumoniae* respond rapidly to new antibiotics and vaccines. The team suggest that knowing the enemy better could improve infection control measures.

*S. pneumoniae* is responsible for a broad range of human diseases, including pneumonia, ear infection and bacterial meningitis. Since the 1970s, some forms of the bacteria have gained resistance to many of the antibiotics traditionally used to treat the disease. In 2000 *S. pneumoniae* was responsible for 15 million cases of invasive disease across the globe. A new vaccine was introduced to the US in 2000 in an attempt to control disease resulting from the most common and drug resistant forms of the bacteria.

The new research uses DNA sequencing to precisely describe the recent evolution and success of a drug-resistant lineage of the bacteria called PMEN1 that has spread successfully to all continents.

"Drug resistant forms of *S. pneumoniae* first came onto the radar in the 1970s," says Dr Stephen Bentley, from the Wellcome Trust Sanger Institute and senior author on the study. "We sequenced 240 samples collected over the course of 24 years from the PMEN1 lineage of *S. pneumoniae*. By comparing the sequences, we can begin to understand how this bacterium evolves and reinvents itself genetically in response to human interventions."

The power of next-generation sequencing exposes *S. pneumoniae* as a pathogen that evolves and reinvents itself with remarkable speed. The degree of diversity was a real surprise in such seemingly closely related organisms.

First, the team had to distinguish between single letter mutations that are passed down 'vertically' when cells divide in two, and so-called 'horizontal' changes -- called recombinations -- where chunks of DNA letters are passed across from one bacterium to another and swapped over, changing the structure of their genomes.

"Separating these two kinds of change was the critical first step in unlocking the evolutionary history of the PMEN1 lineage," says Professor Julian Parkhill, Head of Pathogen Genomics at the Wellcome Trust Sanger Institute. "By looking only at the DNA mutations that are passed down through direct ancestry, we constructed an evolutionary tree. When we looked at our tree, we could see that the drug-resistant PMEN1 lineage originated around 1970 -- about the time that saw the introduction of the widespread use of antibiotics to fight pneumococcal disease."

The team also use their tree to trace the origin of PMEN1 to Europe, and suggest that the lineage may have been introduced to the Americas and Asia on multiple occasions.

The 'vertical' mutations, however, could not fully account for the evolution and adaptability of this pathogen.

The team found that the 'horizontal' transfer of DNA had affected three-quarters of the *S. pneumoniae* genome. The team also found hotspots -- areas of the genome that are particularly affected by horizontal transmission.

"We found that genes for antigens -- the molecules that trigger our immune response -- were particularly prone to this kind of change," says Dr William Hanage, Associate Professor of Epidemiology at Harvard School of Public Health, and a Visiting Reader at Imperial College London, where he devised the study with scientists at the Wellcome Trust Sanger Institute. "The remarkable amount of variation at these hotspots hints at ways *S. pneumoniae* can evade vaccines against these antigens.

"If the immune system targets these antigens, then the bacteria can simply change them, like a criminal changing their appearance to evade detection."

The authors also identify differences in the patterns of adaptation in response to antibiotics and vaccines.

"With antibiotics, different strains quite often adapt in the same way to become resistant," says Nicholas Croucher, from the Wellcome Trust Sanger Institute and first author on the paper. "With vaccines, it is quite different. What we see is a decline in the prevalence of bacteria that are susceptible to the vaccine. This, in turn, opens the door for bacteria that can evade the vaccine to fill the niche and become the dominant strain."

While the latest vaccination measures in the USA have almost completely removed the target pneumococcal strains from the population, the pathogen has deep resources to draw on in response. The research suggests that variants that allowed some bacteria to escape the new vaccine were present before the vaccine was introduced. These variants then flourished, expanding to fill a 'gap in the market' as the grip of the dominant strain was weakened through vaccination.

The researchers suggest that the study provides important new clues into the genetic adaptability of bacteria like *S. pneumoniae*. They suggest that further focused sequencing programs may prove crucial to the future control of this, and other, bacterial pathogens that use similar mechanisms to outsmart human control measures.

**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Wellcome Trust Sanger Institute**.

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http://www.sciencedaily.com/releases/2011/01/110127141655.htm

**Warming North Atlantic Water Tied to Heating Arctic**

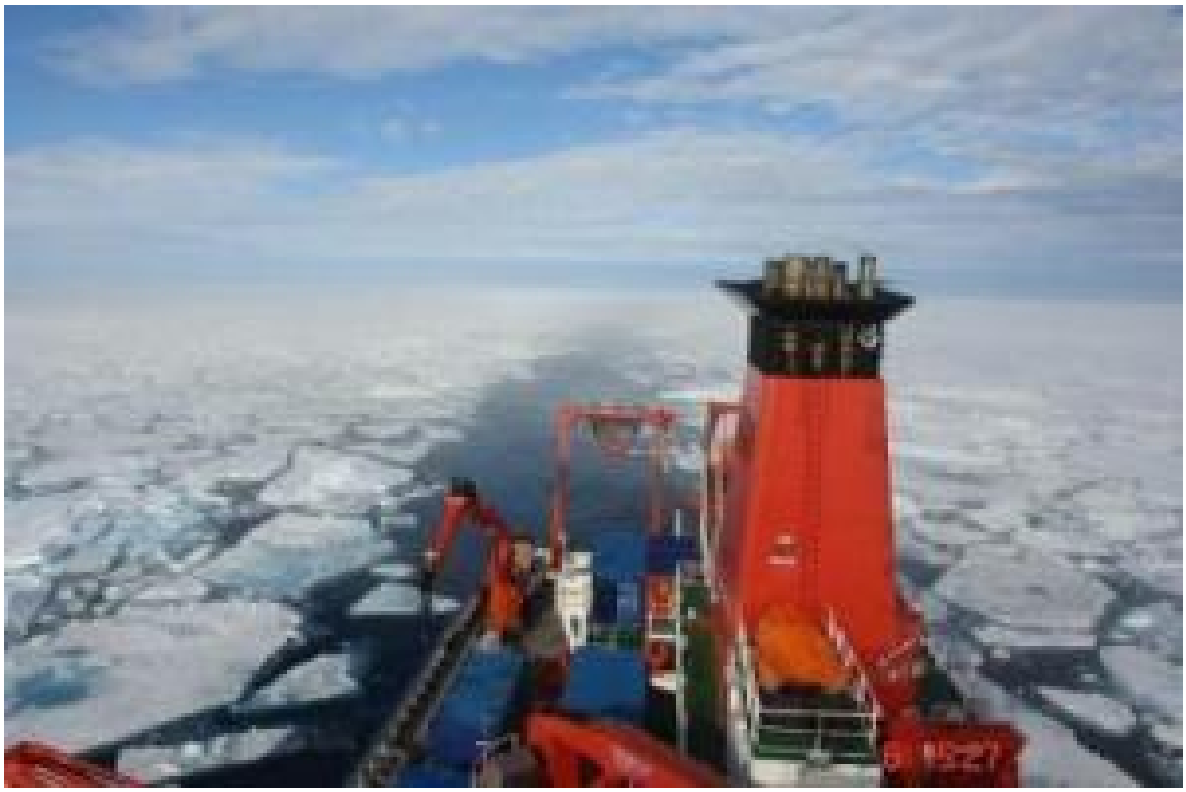

*Photo of the German research vessel Maria S. Merian moving through sea ice in Fram Strait northwest of Svalbard. The research team discovered the water there was the warmest in at least 2,000 years, which has implications for a warming and melting Arctic. (Credit: Nicolas van Nieuwenhove (IFM-GEOMAR, Kiel))*

ScienceDaily (Jan. 28, 2011) — The temperatures of North Atlantic Ocean water flowing north into the Arctic Ocean adjacent to Greenland -- the warmest water in at least 2,000 years -- are likely related to the amplification of global warming in the Arctic, says a new international study involving the University of Colorado Boulder.

Led by Robert Spielhagen of the Academy of Sciences, Humanities and Literature in Mainz, Germany, the study showed that water from the Fram Strait that runs between Greenland and Svalbard -- an archipelago constituting the northernmost part of Norway -- has warmed roughly 3.5 degrees Fahrenheit in the past century. The Fram Strait water temperatures today are about 2.5 degrees F warmer than during the Medieval Warm Period, which heated the North Atlantic from roughly 900 to 1300 and affected the climate in Northern Europe and northern North America.

The team believes that the rapid warming of the Arctic and recent decrease in Arctic sea ice extent are tied to the enhanced heat transfer from the North Atlantic Ocean, said Spielhagen. According to CU-Boulder's National Snow and Ice Data Center, the total loss of Arctic sea ice extent from 1979 to 2009 was an area larger than the state of Alaska, and some scientists there believe the Arctic will become ice-free during the summers within the next several decades.

"Such a warming of the Atlantic water in the Fram Strait is significantly different from all climate variations in the last 2,000 years," said Spielhagen, also of the Leibniz Institute of Marine Sciences in Keil, Germany.

According to study co-author Thomas Marchitto, a fellow at CU-Boulder's Institute of Arctic and Alpine Research, the new observations are crucial for putting the current warming trend of the North Atlantic in the proper context.

"We know that the Arctic is the most sensitive region on the Earth when it comes to warming, but there has been some question about how unusual the current Arctic warming is compared to the natural variability of the last thousand years," said Marchitto, also an associate professor in CU-Boulder's geological sciences department. "We found that modern Fram Strait water temperatures are well outside the natural bounds."

A paper on the study will be published in the Jan. 28 issue of *Science*. The study was supported by the German Research Foundation; the Academy of Sciences, Humanities and Literature in Mainz, Germany; and the Norwegian Research Council.

Other study co-authors included Kirstin Werner and Evguenia Kandiano of the Leibniz Institute of Marine Sciences, Steffen Sorensen, Katarzyna Zamelczyk, Katrine Husum and Morten Hald from the University of Tromso in Norway and Gereon Budeus of the Alfred Wegener Institute of Polar and Marine Research in Bremerhaven, Germany.

Since continuous meteorological and oceanographic data for the Fram Strait reach back only 150 years, the team drilled ocean sediment cores dating back 2,000 years to determine past water temperatures. The researchers used microscopic, shelled protozoan organisms called foraminifera -- which prefer specific water temperatures at depths of roughly 150 to 650 feet -- as tiny thermometers.

In addition, the team used a second, independent method that involved analyzing the chemical composition of the foraminifera shells to reconstruct past water temperatures in the Fram Strait, said Marchitto.

The Fram Strait branch of the North Atlantic Current is the major carrier of oceanic heat to the Arctic Ocean. In the eastern part of the strait, relatively warm and salty water enters the Arctic. Fed by the Gulf Stream Current, the North Atlantic Current provides ice-free conditions adjacent to Svalbard even in winter, said Marchitto.

"Cold seawater is critical for the formation of sea ice, which helps to cool the planet by reflecting sunlight back to space," said Marchitto. "Sea ice also allows Arctic air temperatures to be very cold by forming an insulating blanket over the ocean. Warmer waters could lead to major sea ice loss and drastic changes for the Arctic."

The rate of Arctic sea ice decline appears to be accelerating due to positive feedbacks between the ice, the Arctic Ocean and the atmosphere, Marchitto said. As Arctic temperatures rise, summer ice cover declines, more solar heat is absorbed by the ocean and additional ice melts. Warmer water may delay freezing in the fall, leading to thinner ice cover in winter and spring, making the sea ice more vulnerable to melting during the next summer.

Air temperatures in Greenland have risen roughly 7 degrees F in the past several decades, thought to be due primarily to an increase in Earth's greenhouse gases, according to CU-Boulder scientists.

"We must assume that the accelerated decrease of the Arctic sea ice cover and the warming of the ocean and atmosphere of the Arctic measured in recent decades are in part related to an increased heat transfer from the Atlantic," said Spielhagen.

**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Colorado at Boulder**.

**Journal Reference**:

1. Robert F. Spielhagen, Kirstin Werner, Steffen Aagaard Sørensen, Katarzyna Zamelczyk, Evguenia Kandiano, Gereon Budeus, Katrine Husum, Thomas M. Marchitto, and Morten Hald. **Enhanced Modern Heat Transfer to the Arctic by Warm Atlantic Water**. *Science*, 28 January 2011: 450-453 DOI: 10.1126/science.1197397

http://www.sciencedaily.com/releases/2011/01/110127141659.htm

**Brain 'GPS' Illuminated in Migratory Monarch Butterflies**

*A monarch butterfly. (Credit: iStockphoto/Brandon Laufenberg)*

ScienceDaily (Jan. 27, 2011) — A new study takes a close look at the brain of the migratory monarch butterfly to better understand how these remarkable insects use an internal compass and skylight cues to navigate from eastern North America to Mexico each fall. The research, published by Cell Press in the January 27 issue of the journal *Neuron*, provides key insights into how ambiguous sensory signals can be integrated in the brain to guide complex navigation.

Previous research has shown that migrants use a time-compensated "sun compass" to maintain a southerly direction during flight. "In general, this sun compass mechanism proposes that skylight cues providing directional information are sensed by the eyes and that this sensory information is then transmitted to a sun compass system in the brain," explains senior study author, Dr. Steven Reppert from the University of Massachusetts Medical School. "There, information from both eyes is integrated and time compensated for the sun's movement by a circadian clock so that flight direction is constantly adjusted to maintain a southerly bearing over the day."

Dr. Reppert and coauthor Dr. Stanley Heinze were interested in studying exactly how skylight cues are processed by migrating monarchs and how the skylight pattern of polarized light may provide directional information on cloudy days. "The pattern of linearly polarized skylight is arranged as concentric circles of electric field vectors (E-vectors) around the sun, and they can indicate the sun's position, even when the sun itself is covered with clouds," says Dr. Reppert. "However, the symmetrical nature of the polarized skylight pattern leads to directional uncertainty unless the pattern is integrated with the horizontal position of the sun, called the solar azimuth."

Dr. Heinze compared the neuronal organization of the monarch brain sun compass network to that of the well-characterized desert locust and found it to be remarkably similar. He went on to show that individual neurons in the sun compass were tuned to specific E-vector angles of polarized light, as well as azimuth-dependent responses to unpolarized light. Interestingly, the responses of individual neurons to these two different stimuli

were mediated through different parts of the monarch eye. The responses were then integrated in the sun compass part of the monarch brain to form an accurate representation of skylight cues throughout the day.

"Our results reveal the general layout of the neuronal machinery for sun compass navigation in the monarch brain and provide insights into a possible mechanism of integrating polarized skylight information and solar azimuth," conclude the authors. "More generally, our results address a fundamental problem of sensory processing by showing how seemingly contradictory skylight signals are integrated into a consistent, neural representation of the environment."

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Cell Press**, via EurekAlert!, a service of AAAS.

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**Journal Reference**:

1. Stanley Heinze, Steven M. Reppert. **Sun Compass Integration of Skylight Cues in Migratory Monarch Butterflies**. *Neuron*, 2011; 69 (2): 345-358 DOI: 10.1016/j.neuron.2010.12.025

http://www.sciencedaily.com/releases/2011/01/110126121450.htm

**Mass Extinction Linked to Ancient Climate Change, New Details Reveal**

*This is rock strata on Anticosti Island, Quebec, Canada, one of the sites from which the researchers collected fossils. (Credit: Woody Fischer)*

ScienceDaily (Jan. 27, 2011) — About 450 million years ago, Earth suffered the second-largest mass extinction in its history -- the Late Ordovician mass extinction, during which more than 75 percent of marine species died. Exactly what caused this tremendous loss in biodiversity remains a mystery, but now a team led by researchers at the California Institute of Technology (Caltech) has discovered new details supporting the idea that the mass extinction was linked to a cooling climate.

"While it's been known for a long time that the mass extinction is intimately tied to climate change, the precise mechanism is unclear," says Seth Finnegan, a postdoctoral researcher at Caltech and the first author of the paper published online in *Science* on January 27. The mass extinction coincided with a glacial period, during which global temperatures cooled and the planet saw a marked increase in glaciers. At this time, North America was on the equator, while most of the other continents formed a supercontinent known as Gondwana that stretched from the equator to the South Pole.

By using a new method to measure ancient temperatures, the researchers have uncovered clues about the timing and magnitude of the glaciation and how it affected ocean temperatures near the equator. "Our observations imply a climate system distinct from anything we know about over the last 100 million years," says Woodward Fischer, assistant professor of geobiology at Caltech and a coauthor.

The fact that the extinction struck during a glacial period, when huge ice sheets covered much of what's now Africa and South America, makes it especially difficult to evaluate the role of climate. "One of the biggest sources of uncertainty in studying the paleoclimate record is that it's very hard to differentiate between changes in temperature and changes in the size of continental ice sheets," Finnegan says. Both factors could have played a role in causing the mass extinction: with more water frozen in ice sheets, the world's sea levels would have been lower, reducing the availability of shallow water as a marine habitat. But differentiating between the two effects is a challenge because until now, the best method for measuring ancient temperatures has also been affected by the size of ice sheets.

The conventional method for determining ancient temperature requires measuring the ratios of oxygen isotopes in minerals precipitated from seawater. The ratios depend on both temperature and the concentration of isotopes in the ocean, so the ratios reveal the temperature only if the isotopic concentration of seawater is known. But ice sheets preferentially lock up one isotope, which reduces its concentration in the ocean. Since no one knows how big the ice sheets were, and these ancient oceans are no longer available for scientists to analyze, it's hard to determine this isotopic concentration. As a result of this "ice-volume effect," there hasn't been a reliable way to know exactly how warm or cold it was during these glacial periods.

But by using a new type of paleothermometer developed in the laboratory of John Eiler, Sharp Professor of Geology and professor of geochemistry at Caltech, the researchers have determined the average temperatures during the Late Ordovician -- marking the first time scientists have been able to overcome the ice-volume effect for a glacial episode that happened hundreds of millions of years ago. To make their measurements, the researchers analyzed the chemistry of fossilized marine animal shells collected from Quebec, Canada, and from the midwestern United States.

The Eiler lab's method, which does not rely on the isotopic concentration of the oceans, measures temperature by looking at the "clumpiness" of heavy isotopes found in fossils. Higher temperatures cause the isotopes to bond in a more random fashion, while low temperatures lead to more clumping.

"By providing independent information on ocean temperature, this new method allows us to know the isotopic composition of 450-million-year-old seawater," Finnegan says. "Using that information, we can estimate the size of continental ice sheets through this glaciation." And with a clearer idea of how much ice there was, the researchers can learn more about what Ordovician climate was like -- and how it might have stressed marine ecosystems and led to the extinction.

"We have found that elevated rates of climate change coincided with the mass extinction," says Aradhna Tripati, a coauthor from UCLA and visiting researcher in geochemistry at Caltech.

The team discovered that even though tropical ocean temperatures were higher than they are now, moderately sized glaciers still existed near the poles before and after the mass extinction. But during the extinction intervals, glaciation peaked. Tropical surface waters cooled by five degrees, and the ice sheets on Gondwana grew to be as large as 150 million cubic kilometers -- bigger than the glaciers that covered Antarctica and most of the Northern Hemisphere during the modern era's last ice age 20,000 years ago.

"Our study strengthens the case for a direct link between climate change and extinction," Finnegan says. "Although polar glaciers existed for several million years, they only caused cooling of the tropical oceans during the short interval that coincides with the main pulse of mass extinction."

In addition to Finnegan, Eiler, Tripati, and Fischer, the other authors on the *Science* paper, "The magnitude and duration of Late Ordovician-Early Silurian glaciation magnitude," are Kristin Bergmann, a graduate student at Caltech; David Jones of Amherst College; David Fike of Washington University in St. Louis; Ian Eisenman, a postdoctoral scholar at Caltech and the University of Washington; and Nigel Hughes of the University of California, Riverside.

This research was funded by the Agouron Institute and the National Science Foundation.

**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **California Institute of Technology**. The original article was written by Marcus Woo.

**Journal Reference**:

1. Seth Finnegan, Kristin Bergmann, John M. Eiler, David S. Jones, David A. Fike, Ian Eisenman, Nigel C. Hughes, Aradhna K. Tripati, and Woodward W. Fischer. **The Magnitude and Duration of Late Ordovician–Early Silurian Glaciation**. *Science*, 27 January 2011 DOI: 10.1126/science.1200803

http://www.sciencedaily.com/releases/2011/01/110127141703.htm

**Modern Humans Reached Arabia Earlier Than Thought, New Artifacts Suggest**

*Jebel Faya rockshelter from above, looking north, shows eboulis blocks from roof collapse and the location of excavation trenches. (Credit: Copyright Science/AAAS)*

ScienceDaily (Jan. 27, 2011) — Artifacts unearthed in the United Arab Emirates date back 100,000 years and imply that modern humans first left Africa much earlier than researchers had expected, a new study reports. In light of their excavation, an international team of researchers led by Hans-Peter Uerpmann from Eberhard Karls University in Tübingen, Germany suggests that humans could have arrived on the Arabian Peninsula as early as 125,000 years ago -- directly from Africa rather than via the Nile Valley or the Near East, as researchers have suggested in the past.

The timing and dispersal of modern humans out of Africa has been the source of long-standing debate, though most evidence has pointed to an exodus along the Mediterranean Sea or along the Arabian coast approximately 60,000 years ago.

This new research, placing early humans on the Arabian Peninsula much earlier, will appear in the 28 January issue of *Science.*

The team of researchers, including lead author Simon Armitage from Royal Holloway, University of London, discovered an ancient human toolkit at the Jebel Faya archaeological site in the United Arab Emirates. It resembles technology used by early humans in east Africa but not the craftsmanship that emerged from the Middle East, they say. This toolkit includes relatively primitive hand-axes along with a variety of scrapers and perforators, and its contents imply that technological innovation was not necessary for early humans to migrate onto the Arabian Peninsula. Armitage calculated the age of the stone tools using a technique known as luminescence dating and determined that the artifacts were about 100,000 to 125,000 years old.

"These 'anatomically modern' humans -- like you and me -- had evolved in Africa about 200,000 years ago and subsequently populated the rest of the world," said Armitage. "Our findings should stimulate a re-evaluation of the means by which we modern humans became a global species."

Uerpmann and his team also analyzed sea-level and climate-change records for the region during the last interglacial period, approximately 130,000 years ago. They determined that the Bab al-Mandab Strait, which separates Arabia from the Horn of Africa, would have narrowed due to lower sea-levels, allowing safe passage prior to and at the beginning of that last interglacial period. At that time, the Arabian Peninsula was much wetter than today with greater vegetation cover and a network of lakes and rivers. Such a landscape

would have allowed early humans access into Arabia and then into the Fertile Crescent and India, according to the researchers.

"Archaeology without ages is like a jigsaw with the interlocking edges removed -- you have lots of individual pieces of information but you can't fit them together to produce the big picture," said Armitage. "At Jebel Faya, the ages reveal a fascinating picture in which modern humans migrated out of Africa much earlier than previously thought, helped by global fluctuations in sea-level and climate change in the Arabian Peninsula."

This report by Armitage *et al.* was funded by the Government of Sharjah, the ROCEEH project (Heidelberg Academy of Sciences), Humboldt Foundation, Oxford Brookes University and the German Science Foundation (DFG).

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **American Association for the Advancement of Science**.

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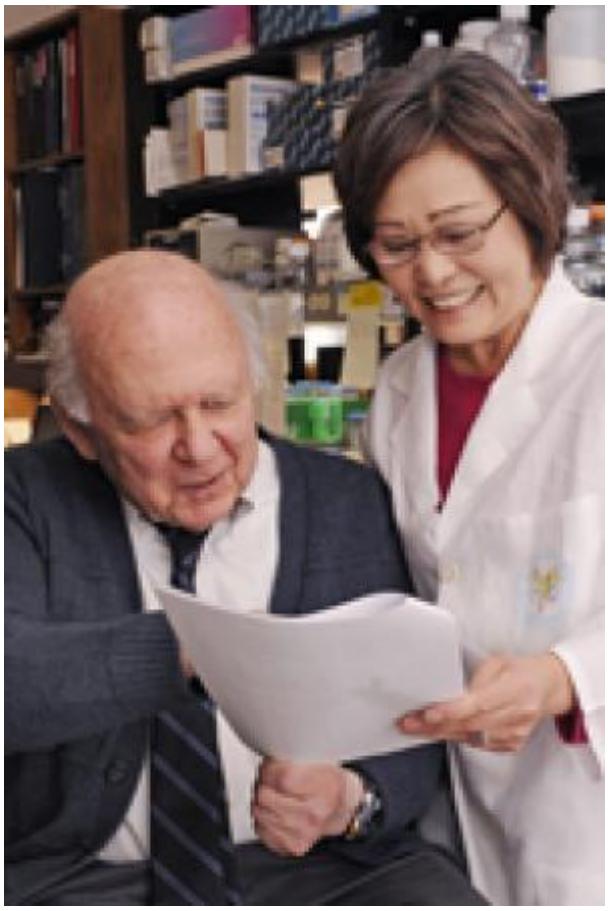
http://www.sciencedaily.com/releases/2011/01/110127141651.htm

**Potential 'Cure' for Type 1 Diabetes?**



*Dr. Roger Unger (left) and Dr. Young Lee found in an animal study that blocking the hormone glucagon might eliminate the symptoms of type 1 diabetes. (Credit: Image courtesy of UT Southwestern Medical Center)*

ScienceDaily (Jan. 27, 2011) — Type 1 diabetes could be converted to an asymptomatic, non-insulin-dependent disorder by eliminating the actions of a specific hormone, new findings by UT Southwestern Medical Center researchers suggest.

These findings in mice show that insulin becomes completely superfluous and its absence does not cause diabetes or any other abnormality when the actions of glucagon are suppressed. Glucagon, a hormone produced by the pancreas, prevents low blood sugar levels in healthy individuals. It causes high blood sugar in people with type 1 diabetes.

"We've all been brought up to think insulin is the all-powerful hormone without which life is impossible, but that isn't the case," said Dr. Roger Unger, professor of internal medicine and senior author of the study appearing online and in the February issue of *Diabetes*. "If diabetes is defined as restoration of glucose homeostasis to normal, then this treatment can perhaps be considered very close to a 'cure.' "

Insulin treatment has been the gold standard for type 1 diabetes (insulin-dependent diabetes) in humans since its discovery in 1922. But even optimal regulation of type 1 diabetes with insulin alone cannot restore normal

glucose tolerance. These new findings demonstrate that the elimination of glucagon action restores glucose tolerance to normal.

Normally, glucagon is released when the glucose, or sugar, level in the blood is low. In insulin deficiency, however, glucagon levels are inappropriately high and cause the liver to release excessive amounts of glucose into the bloodstream. This action is opposed by insulin, which directs the body's cells to remove sugar from the bloodstream.

Dr. Unger's laboratory research previously found that insulin's benefit resulted from its suppression of glucagon.

In type 1 diabetes, which affects about 1 million people in the U.S., the pancreatic islet cells that produce insulin are destroyed. As a countermeasure to this destruction, type 1 diabetics currently must take insulin multiple times a day to metabolize blood sugar, regulate blood-sugar levels and prevent diabetic coma. They also must adhere to strict dietary restrictions.

In this study, UT Southwestern scientists tested how mice genetically altered to lack working glucagon receptors responded to an oral glucose tolerance test. The test -- which can be used to diagnose diabetes, gestational diabetes and prediabetes -- measures the body's ability to metabolize, or clear, glucose from the bloodstream.

The researchers found that the mice with normal insulin production but without functioning glucagon receptors responded normally to the test. The mice also responded normally when their insulin-producing beta cells were destroyed. The mice had no insulin or glucagon action, but they did not develop diabetes.

"These findings suggest that if there is no glucagon, it doesn't matter if you don't have insulin," said Dr. Unger, who is also a physician at the Dallas VA Medical Center. "This does not mean insulin is unimportant. It is essential for normal growth and development from neonatal to adulthood. But in adulthood, at least with respect to glucose metabolism, the role of insulin is to control glucagon.

"And if you don't have glucagon, then you don't need insulin."

Dr. Young Lee, assistant professor of internal medicine at UT Southwestern and lead author of the study, said the next step is to determine the mechanism behind this result.

"Hopefully, these findings will someday help those with type 1 diabetes," Dr. Lee said. "If we can find a way to block the actions of glucagon in humans, then maybe we can minimize the need for insulin therapy."

Dr. Unger said anything that reduces the need for injected insulin is a positive.

"Matching the high insulin levels needed to reach glucagon cells with insulin injections is possible only with amounts that are excessive for other tissues," he said. "Peripherally injected insulin cannot accurately duplicate the normal process by which the body produces and distributes insulin. If these latest findings were to work in humans, injected insulin would no longer be necessary for people with type 1 diabetes."

Dr. May-Yun Wang, assistant professor of internal medicine at UT Southwestern, and researchers from the Albert Einstein College of Medicine also contributed to the work.

The study was supported in part by the VA North Texas Health Care System, the American Diabetes Association and the National Institutes of Health.

**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **UT Southwestern Medical Center**.

**Journal Reference**:

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http://www.sciencedaily.com/releases/2011/01/110126161835.htm

**Ancient Body Clock Discovered That Helps Keep All Living Things on Time**

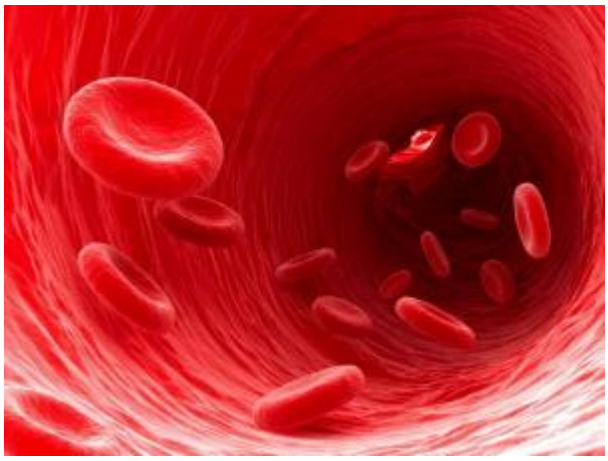

*Image of blood cells. The mechanism that controls the internal 24-hour clock of all forms of life from human cells to algae has been identified. (Credit: iStockphoto/Sergey Panteleev)*

ScienceDaily (Jan. 27, 2011) — The mechanism that controls the internal 24-hour clock of all forms of life from human cells to algae has been identified by scientists.

Not only does the research provide important insight into health-related problems linked to individuals with disrupted clocks -- such as pilots and shift workers -- it also indicates that the 24-hour circadian clock found in human cells is the same as that found in algae and dates back millions of years to early life on Earth.

Two new studies in the journal *Nature* from the Universities of Cambridge and Edinburgh give insight into the circadian clock which controls patterns of daily and seasonal activity, from sleep cycles to butterfly migrations to flower opening.

One study, from the University of Cambridge's Institute of Metabolic Science, has for the first time identified 24-hour rhythms in red blood cells. This is significant because circadian rhythms have always been assumed to be linked to DNA and gene activity, but -- unlike most of the other cells in the body -- red blood cells do not have DNA.

Akhilesh Reddy, from the University of Cambridge and lead author of the study, said: "We know that clocks exist in all our cells; they're hard-wired into the cell. Imagine what we'd be like without a clock to guide us through our days. The cell would be in the same position if it didn't have a clock to coordinate its daily activities.

"The implications of this for health are manifold. We already know that disrupted clocks -- for example, caused by shift-work and jet-lag -- are associated with metabolic disorders such as diabetes, mental health problems and even cancer. By furthering our knowledge of how the 24-hour clock in cells works, we hope that the links to these disorders -- and others -- will be made clearer. This will, in the longer term, lead to new therapies that we couldn't even have thought about a couple of years ago."

For the study, the scientists, funded by the Wellcome Trust, incubated purified red blood cells from healthy volunteers in the dark and at body temperature, and sampled them at regular intervals for several days. They then examined the levels of biochemical markers -- proteins called peroxiredoxins -- that are produced in high levels in blood and found that they underwent a 24-hour cycle. Peroxiredoxins are found in virtually all known organisms.

A further study, by scientists working together at the Universities of Edinburgh and Cambridge, and the Observatoire Oceanologique in Banyuls, France, found a similar 24-hour cycle in marine algae, indicating that internal body clocks have always been important, even for ancient forms of life.

The researchers in this study found the rhythms by sampling the peroxiredoxins in algae at regular intervals over several days. When the algae were kept in darkness, their DNA was no longer active, but the algae kept their circadian clocks ticking without active genes. Scientists had thought that the circadian clock was driven by gene activity, but both the algae and the red blood cells kept time without it.

Andrew Millar of the University of Edinburgh's School of Biological Sciences, who led the study, said: "This groundbreaking research shows that body clocks are ancient mechanisms that have stayed with us through a billion years of evolution. They must be far more important and sophisticated than we previously realised. More work is needed to determine how and why these clocks developed in people -- and most likely all other living things on earth -- and what role they play in controlling our bodies."

Additional funding for the studies was provided by the Biotechnology and Biological Sciences Research Council, the Engineering and Physical Sciences Research Council, the Medical Research Council, the French Agence Nationale de la Recherche, and the National Institute of Health Research.

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Cambridge**.

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**Journal References**:

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**On the Hunt for Universal Intelligence**

*On the hunt for the universal intelligence test. (Credit: SINC)*

ScienceDaily (Jan. 27, 2011) — How do you use a scientific method to measure the intelligence of a human being, an animal, a machine or an extra-terrestrial? So far this has not been possible, but a team of Spanish and Australian researchers have taken a first step towards this by presenting the foundations to be used as a basis for this method in the journal *Artificial Intelligence*, and have also put forward a new intelligence test.

We have developed an 'anytime' intelligence test, in other words a test that can be interrupted at any time, but that gives a more accurate idea of the intelligence of the test subject if there is a longer time available in which to carry it out," José Hernández-Orallo, a researcher at the Polytechnic University of Valencia (UPV), said.

This is just one of the many determining factors of the universal intelligence test. "The others are that it can be applied to any subject -- whether biological or not -- at any point in its development (child or adult, for example), for any system now or in the future, and with any level of intelligence or speed," points out Hernández-Orallo.

The researcher, along with his colleague David L. Dowe of the Monash University, Clayton (Australia), have suggested the use of mathematical and computational concepts in order to encompass all these conditions. The study forms part of the "Anytime Universal Intelligence" project, in which other scientists from the UPV and the Complutense University of Madrid are taking part.

The authors have used interactive exercises in settings with a difficulty level estimated by calculating the so-called 'Kolmogorov complexity' (they measure the number of computational resources needed to describe an object or a piece of information). This makes them different from traditional psychometric tests and artificial intelligence tests (Turing test).

**Use in artificial intelligence**

The most direct application of this study is in the field of artificial intelligence. Until now there has not been any way of checking whether current systems are more intelligent than the ones in use 20 years ago, "but the existence of tests with these characteristics may make it possible to systematically evaluate the progress of this discipline," says Hernández-Orallo.

And what is even "more important" is that there were no theories or tools to evaluate and compare future intelligent systems that could demonstrate intelligence greater than human intelligence.

The implications of a universal intelligence test also impact on many other disciplines. This could have a significant impact on most cognitive sciences, since any discipline depends largely on the specific techniques and systems used in it and the mathematical basis that underpins it.

"The universal and unified evaluation of intelligence, be it human, non-human animal, artificial or extraterrestrial, has not been approached from a scientific viewpoint before, and this is a first step," the researcher concludes.

**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **FECYT - Spanish Foundation for Science and Technology**, via EurekAlert!, a service of AAAS.

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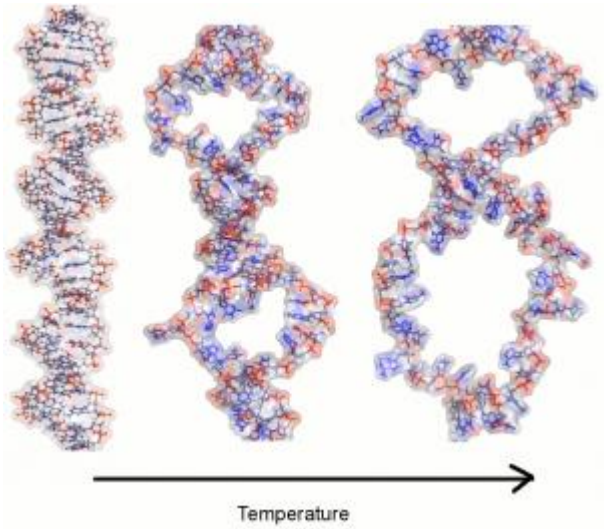
http://www.sciencedaily.com/releases/2011/01/110127131122.htm

**Unlocking the Secrets of DNA**




*Neutron scattering has been used to investigate the structure of fibre DNA during the melting transition. This is the range of temperatures over which the bonds between base pairs break, or denature, causing the two strands of DNA to separate. (Credit: Copyright Santiago Cuesta)*

ScienceDaily (Jan. 28, 2011) — Neutron scattering has been used to investigate the structure of fibre DNA during the melting transition. This is the range of temperatures over which the bonds between base pairs break, or denature, causing the two strands of DNA to separate.

Neutron scattering gives information about the correlation between base pairs during denaturation, which is not possible using other techniques. This is used to measure the characteristic size of the denatured regions as the temperature is changed, and these sizes can be compared with those predicted by the theoretical model.

The Peyrard-Bishop-Dauxois (PBD) model predicted that fibre DNA denaturation due to temperature would happen in patches along the molecule, rather than 'unzipping' from one end to another. This experiment, the first to investigate the model, strongly supported the model's predications for the first part of the transition, as the molecule is heated. The experiment could only measure the first stage because when the strands become 50% denatured they are too floppy to remain ordered and the fibre structure is no longer stable -- the DNA sample literally falls to pieces.

"This is an important verification of the validity of model and the associated theory, so it can be applied with more confidence to predict the behaviour and properties of DNA," says Andrew Wildes, an instrument scientist at ILL. "This will help to understand biological processes such as gene transcription and cell reproduction, and is also a step toward technological applications such as using DNA as nanoscale tweezers or as computer components."

"There's been a lot of research producing good data -- eg nice melting curves -- about the transition point, but these couldn't tell us how it was happening. For example at 50% melted are half the DNA molecules totally denatured and the other half still firmly joined? Or are the strands of each molecule partially separated? Neutron scattering has enabled us to get structural information on the melting process to answer this kind of question," says Michel Peyrard Professor of Physics at Ecole Normale Supérieure de Lyon, and co-developer of the PBD model. "As well as implications for technological development it could also help biological applications, such as predicting where genes might be located on long stretches of DNA sequences."

The experiment follows from the pioneering work of Rosalind Franklin, who showed that x-ray scattering from DNA fibres would give structural information. Based on her work, James Watson and Francis Crick deduced the well-known double helix structure of DNA in 1953. DNA is a dynamic molecule that undergoes large structural changes during normal biological processes. For example, DNA inside the cell nucleus is usually 'bundled up' into chromosomes, but when the genetic information is being copied it must be unravelled and the strands separated to allow the code to be read.

**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Institut Laue-Langevin (ILL)**.

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http://www.sciencedaily.com/releases/2011/01/110124120848.htm

**Inventor of Plastic Solar Cells Sees Bright Future**

**Niyazi Serdar Sariciftci, inventor of the plastic solar cell, reviews the past, present and bright future of his invention with Miller-McCune's solar guru, John Perlin.**

By John Perlin

*Niyazi Serdar Sariciftci received the Austria Prize for Research in 2008. (Wolfgang Beigl)*

In 1974, future Nobel laureates Alan Heeger, Alan MacDiarmid and Hideki Shirakawa discovered a new type of plastic — conjugated conducting polymers.

"This polymer was a completely new type that acted more like a metal than like other plastics as it was an excellent conductor of electricity," recalled Niyazi Serdar Sariciftci, who started working with the polymers as a doctoral student at the University of Vienna in the mid-1980s. "It became quite the rage and elicited great interest due to its unique behavior."

Drawing on that breakthrough, Sariciftci would create the plastic solar cell, one of the most promising avenues yet discovered for popularizing the photovoltaic approach to solar energy.

Known as organic or plastic photovoltaics, the new solar material not only converts sunlight into electricity, as do its inorganic counterparts, but it can be mixed in solution to become an ink or paint. Plastic photovoltaics lend themselves to printing on fabric or film, as in a newspaper-printing plant, or brushed or sprayed onto a surface like paint. Either way, production becomes fast, and they can conform to the shape of the structure they are placed on.

But plastic cells currently require a trade-off, considering their low efficiency and lack of durability compared to less flexible (and more expensive) silicon cells.

The Turkish-born Sariciftci spent four years, 1992-1996, working alongside Heeger at the University of California, Santa Barbara, before accepting the chairmanship of the Institute for Physical Chemistry at the Johannes Kepler University in Linz, Austria. He is the founding director of the Linz Institute for Organic

Solar Cells (Linzer Institut für organische Solarzellen, or LIOS). His interests are not confined to the work bench: In 2003, he was elected to the City Council of Linz, Austria's third-largest city, and he also has studied classical piano. In 2006, he was awarded the Turkish National Science Prize.

Miller-McCune.com's John Perlin, himself the author of "From Space to Earth: The Story of Solar Electricity," spent time with Sariciftci this summer at UCSB, where the chemist spoke about the past, present and future of this approach to harvesting sunlight for electrical production.

**John Perlin:** When did you get interested in plastic solar cells?

**Niyazi Serdar Sariciftci:** When I joined the Institute of Polymers in January 1992 at UCSB. I had asked myself for many years that if conjugated conducting polymers had been famous for light-emitting diodes and for conducting polymers, why don't we also use these materials for the conversion of solar energy into electricity like silicon does. This was my big dream and motivation that I brought with me when I arrived here.

Conjugated conducting polymers alone would not do the job because in their light-excited state, they don't create enough charge carriers. To facilitate their photovoltaic capability, I needed a trick, which is called photo-electron transfer. For this we needed two components: One is an electron donor; the other is an electron acceptor. The electron donor was clearly the conjugated conducting polymer. The electron acceptor was chosen for me by my colleague Fred Wudl. By pure chance, Fred was working on fullerene molecules and fullerenes make very good electron acceptors. So he opened up his drawer and gave me this black powder, saying, "Take it! This is a great electron acceptor. You will like it. It looks just like a soccer ball."

So I took these fullerenes as acceptors and by mixing them with conjugated polymers, I came up with a functioning solar cell. This was the basis of the [November 1992] paper in Science magazine titled, "Photoinduced Electron Transfer from a Conducting Polymer to Buckminsterfullerene," and the patent, which Alan Heeger, my chief and professor, and myself obtained.

The article and patent brought on great interest throughout the world, encouraging many to engage in work on the new plastic solar cell we developed. Currently, there is a great amount of work coming out from many laboratories. But our paper and patent was the basis of all the exciting new developments in plastic solar cells that have occurred since our original work.

But that's just part of the story. The fullerenes I got from Fred weren't very soluble. We needed a more soluble fullerene to make a solar cell. That's when I went to a chemist colleague, Kees Hummelen, and asked for such a material. And not to bother himself too much, Kees [now part of the Dutch Polymer Solar Energy Initiative] handed me something his group had synthesized for something else, thinking that as a physicist, I wouldn't know the difference anyhow! And that material he pawned off on me — PCVN — turned out to be just the right stuff and still the best material ever introduced as the acceptor in a plastic solar cell.

**JP:** Were you the first to work with organic solar cells?

**NSS:** No. Small molecules were already being used as solar cells developed by Dr. Ching Tang, the chief engineer at Kodak. Ching discovered, in the early 1980s, light emission and photovoltaic action of organic molecules. His work predates all other work in organic photovoltaics.

**JP:** Why is the use of conjugated polymers better?

**NSS:** Conjugated polymers have the great advantage of combining the semiconducting properties of a true semiconductor like silicon with the large scale-up capability of plastics — easily synthesized, easily

manipulated — which you cannot achieve with any other material out there. You can see this in the plastic revolution of our daily life — its scalability, low price and large production potentiality. We are bringing plastic technology and semiconductor technology together. This is unique in the world, this special quality of conjugated polymers. It is no wonder that Heeger, MacDiarmid and Shirakawa won the Nobel Prize for discovering this new polymer.

**JP:** You have made plastic solar cells your life's work. Could you elaborate on the odyssey you have taken?

**NSS:** The first solar cells we made were well below 1 percent efficient. The materials we used were not very well understood, not very well engineered, and not very well purified. The technology was in its infancy. During the following four years which I spent at UCSB, we mostly concentrated on the photo physics and material characterization to better understand the fundamental nature of these solar cells.

When I took over as chairman in 1996 of physical chemistry at the University of Linz, the Johannes Kepler University of Linz, I decided it was time to research the fabrication and production aspects, which are quite different from what we had previously done. This is much more difficult because it involves an infinite number of small, small steps, hard, hard steps, toward creating a product. That work is greatly underestimated by many people but it is the most difficult part.

People expect a discovery to immediately become a product. But this is not how it happens in real life. It is impossible to overcome the hurdles to production overnight because we hadn't whatsoever a clue how these new materials behaved, especially considering the very tiny size we were working with. Imagine, these thin films we produce are on the order of 100 nanometers — 0.1 micrometers — where even the smallest piece of dust becomes Mount Everest in the landscape we are working in.

**JP:** Please list the significant milestones in the development of plastic solar cells.

**NSS:** The very significant milestones after the discovery came about by using materials and material combinations that have a very good nanomorphology. In 2000 and 2001, we reached an efficiency of 2.5 percent. This got tremendous attention to our work. When the scientific world saw that we could double or triple the light-to-energy conversion factor, interest grew dramatically. In the last three years, progress has accelerated and one group reported a plastic solar cell turning 8 percent of the incoming light into electricity.

**JP:** What are the basic issues that need to be overcome for improved performance?

**NSS:** For one thing, light harvesting has to be improved. We have the wrong color. We have to adjust the color to harvest more photons from the sun. This means adjusting absorption to include the full spectrum of the sun. Organic solar cells also suffer from being very disordered, causing terrible efficiencies. The better ordered the material, the higher efficiency will be achieved. To overcome these obstacles, we will need the help of many disciplines, including organic, polymer and super molecular chemistry, as well as biology, semiconductor physics and device engineering. We need people from all these fields on board to make the real breakthroughs we require.

**JP:** Please give me the road map of the development of practical plastic solar applications.

**NSS:** Plastic solar cells powering mobile electronics are already on the market. Their efficiencies of 5-8 percent are perfect for this application. Their one- to three-year lifetime poses no obstacle since most of mobile electronics become obsolete in this time frame. We estimate that for outdoor remote applications, plastic photovoltaics will be ready by 2012, requiring cell lifetimes between three to five years. Building-integrated photovoltaics, plastic solar cells used as building material, will need an efficiency of 10 percent and must last for at least 10 years to be feasible. Such systems should be on the market by 2013 or at the latest,

2015. Grid-connected plastic photovoltaics will come on line by 2020. Durability has to be enhanced. Price and cost advantages over silicon will definitely be ours.

Increasing efficiency and stability combined with lower cost are the triad that will lead us to each step of the way. Ten percent efficiency will probably be achieved quite soon as we have experienced a rise in efficiency of 1 to 2 percent per annum. Stability will be a little more challenging, but we will get there by using new encapsulation methods or new materials. As for cost, I am very optimistic because the technology lends itself to roll-to-roll production with enormously high throughput. On this score, we will beat silicon production by an order of magnitude.

To arrive at each of our road stops will rely on advances in material science and nanotechnology. Nano-engineering is the key. There is no way around it. We will not get to the Holy Grail by chance. But we know what we need and through interdisciplinary, interactive science we will find our way. Work in organic solar cells has become a worldwide pursuit. I always say to my students that the ultimate material has yet to be found. We will probably have to find it through a lot of sweat and toil. We know the physical properties we need but we don't have the ideal material as of this moment. We probably will have to design and synthesize it piece by piece. And, of course, there will be surprises at all levels. Sometimes, what we believe is correct turns out to be wrong and we have to learn from these processes. The pursuit makes it great fun from a scientific perspective but, of course, tries our patience.

**JP:** What is the current scientific interest in your field?

**NSS:** Young scientists, whom I encounter in all my lectures throughout the world, are very enthusiastic in this new approach of ours. I think their enthusiasm stems from a great deal of frustration in current photovoltaic technology because of its slow penetration in the energy market. They remark if we have such good systems with silicon at 20 percent efficiency and 30-year lifetimes, why doesn't everyone switch to photovoltaics?

The organic solar cell approach has brought a great deal of new activity in the field. Suddenly, even the silicon people have started to embrace silicon nano-inks, thanks to our discoveries. And I am very proud to have contributed to this new development. I always say, even if organic solar cells fail to become the dominant technology in the future, we still have created such an avalanche on the silicon side to bring about such a great leap forward that we all will profit from that.

But as shown by the recent revolution in the television business, perhaps plastic solar cells will prevail. Look back 10 years ago: TV tubes seemed to have become so refined as to be regarded as the ultimate piece of equipment in its field, being extremely rugged, long lasting and producing brilliant picture quality. The only problem was their size and weight. They were quite heavy to carry and took up a lot of space.

Now, you go to any electronic store and you will not find any of these TVs. A new technology has replaced them, an organic electronic technology, which we call liquid crystal displays. LCDs allow consumers to enjoy the same picture quality and product durability as before — with a television only one inch thick — completely wiping out the old technology which had reached perfection as far as performance. Perhaps, the same story will hold true in the photovoltaic world.

http://www.miller-mccune.com/science-environment/inventor-of-plastic-solar-cells-sees-bright-future-27718/?utm_source=Newsletter146&utm_medium=email&utm_content=0201&utm_campaign=newsletters

**Song Lyrics, Twitter Help Chart Public Mood**

**Trying to divine the mood of a group of people is hard and requires trust in their answers. A new method has researchers whistling a happier tune.**

By Michael Haederle

*Researchers have shown that how calm the public mood is — as measured by the language used in millions of 140-character Twitter tweets — accurately predicts how well the stock market will do in the following few days. (hidesy/istockphoto.com)*

Social scientists seeking to assess the collective mood of large groups of people traditionally have relied on slow, laborious sampling methods that usually entail some form of self-reporting.

Peter Dodds and Chris Danforth, mathematicians at the University of Vermont, dreamed up an ingenious way to sample the feelings of many more people much more quickly.

They downloaded the lyrics to 232,000 popular songs composed between 1960 and 2007 and calculated how often emotion-laden words like “love,” “hate,” “pain” and “baby” occurred in each.

Then they graphed their results, averaging over the emotional valence of individual words. A clearly negative trend emerged over the 47-year period, from bright and happy (think Pat Boone) to dark and depressive (death metal and industrial music come to mind).

The pair has used similar methods to analyze millions of sentences downloaded from blogs, as well as the text of every U.S. State of the Union address and a vast trove of Twitter tweets.

They see distinctive patterns emerging in how collective moods shift over time. The Internet, with its ability to transmit vast amounts of data, is the key.

“People have been trying to take a picture of what’s happening on the Web in real time and feed it into essentially another dial, like the Consumer Confidence Index or the gross domestic product,” Danforth

explains. “That would help decision-makers decide what it is that people are feeling at the moment or how well social programs are working.”

Other researchers are onto the same idea. A team at Indiana University has shown that how calm the public mood is — as measured by the language used in millions of 140-character Twitter tweets — accurately predicts how well the stock market will do in the following few days.

Recently, scientists have even shown they could predict movie box office receipts based solely on Twitter chatter and the number of theaters in which a film is showing.

This new field of looking for hidden patterns in vast quantities of text or other user-generated information — variously called “sociotechnical data mining” or “computational social science” — is deceptively simple: just add together the numerical values assigned to various emotionally positive or negative words in a sentence and take their average.

The method starts with established lists of commonly used words that have been ranked according to their emotional valence.

For the song lyrics experiment, Danforth and Dodds used the Affective Norms for English Words list, developed from a 1999 study in which participants graded their reactions to 1,034 words on a 1-9 scale (in which 9 is “happy, pleased, satisfied [and] contented”). On this scale, “triumphant” scores an 8.82, for example, while “suicide” comes in at 1.25.

Song lyrics — which presumably reflect audience taste — were analyzed mostly to prove that the data-mining technique worked, Danforth says. In breaking out the results, he and Dodds also classified lyrics by genres and individual artists. Not surprisingly, gospel music ranked as the genre having the most positive lyrics.

“One of the things that had surprised us was that we had expected rap and hip-hop to be down near the bottom — but it’s really not, it’s actually sort of in the middle,” Danforth says. “It’s metal, industrial music and punk at the bottom, at least in the lyrics.”

The method may not accurately characterize the meaning of a given text. For example, The Beatles’ “Maxwell’s Silver Hammer” recounts acts of violence — (“*Bang! Bang! Maxwell’s silver hammer came down upon her head/Bang! Bang! Maxwell’s silver hammer made sure that she was dead.”*) — but most listeners would understand the song’s lyrics to be comical. Yet when the technique is applied to thousands of song lyrics, differences in intended meaning tend to average out, Danforth says.

Meanwhile, he says, the method avoids the self-reporting pitfalls in social science studies of the sort that typically are performed on freshman psychology majors, chief among them the tendency to tailor one’s responses to please the interviewer.

Still, popular song lyrics provide only limited insight into society’s emotional state. After proving their sampling concept with song lyrics (and song titles), Danforth and Dodds examined nearly 10 million blog sentences starting with “I feel . . . ” downloaded from the website http://www.wefeelfine.org.

Graphing the results for a period from 2005-2009, they detected an annual up-tick in positive sentiments as Thanksgiving and Christmas approached. They also saw dips that corresponded with the anniversaries of 9/11 and the onset of the economic crisis in 2008.

The pair has expanded the research to encompass some 2 billion Twitter tweets, classifying them based on where the tweeters live, and whether that affects the emotional content of the words they use.

People using the happiest language also use a less-diverse suite of words, they have found. “That tends to be in places that voted Republican in the last election,” Danforth says. “So, happier tweets, less diversity of thought — and predominantly those were in the Republican counties.”

The reverse was true in Democratic counties, but he hastens to add, “It’s purely observational. There’s no causal story here. We’re not trying to predict the next election.”

They are also generating their own list of words and their valences by collecting the most frequently used words from the Twitter and *New York Times* databases and posting them on Amazon’s Mechanical Turk website. Each user receives a random list of 50 words drawn from the 10,000 words in the database and is asked to assign valence scores.

“We want to get a better picture between individual words,” Danforth says. “We’re going to try to build the language up from scratch and see whether it’s a reasonable thing to assign a happiness score to sentences based on a few words we find in them.”

At Indiana University, computer scientist Johan Bollen also wanted to see whether Twitter posts could accurately gauge the public mood. He decided to test his data against the daily fluctuations of the Dow Jones Industrial Average to see whether there was any correlation.

His team started with a collection of 9.8 million tweets gathered between February and December 2008. Using a Google-generated list of 964 words, they applied an existing six-dimensional psychological measure of mood states: Calm, Alert, Sure, Vital, Kind and Happy.

When they graphed the fluctuating mood states individually, they noticed a remarkable correlation between peaks in the “Calm” category and improvements in the stock market.

“We had that eureka moment when we looked at our results,” he says. “We thought, ‘We can actually do that? That’s amazing.’”

Showing that calmness was a precondition for stock market rallies was “a big shock,” because it reversed the presumed order of things. “We assumed that if the markets do well, people are happy,” he says. “We were expecting that happiness or sadness would be driven by the markets.”

Most people would be tempted to use a crystal ball into how the stock market will perform to make a killing, but Bollen remains on focused on the scientific implications of his research.

“People have been talking to me about this,” he says. “My students have been trying to convince me that we should put some money where our collective mouths are. If the results hold up it could be worth quite a bit of money.”

Noting that more than 500 million people use Facebook and 140 million are on Twitter, Bollen says these data collection methods have the potential to revolutionize social science.

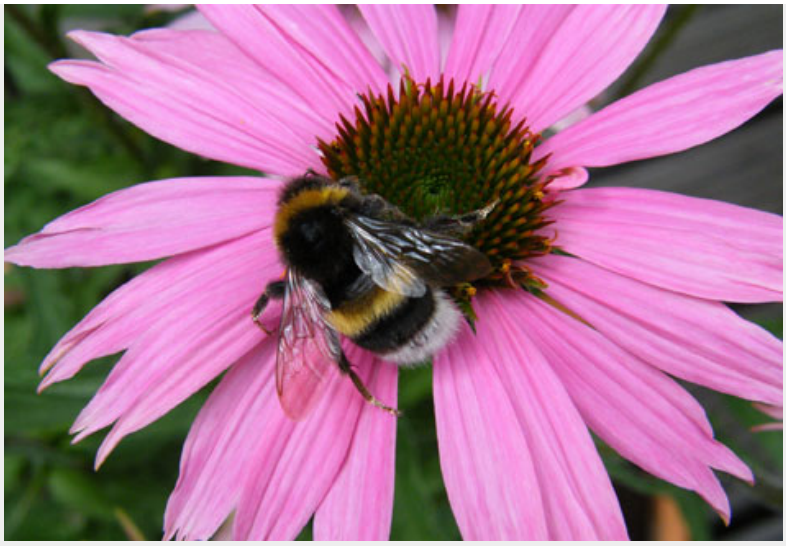
“We’re talking about environments that have more users than you have inhabitants in most industrialized nations on Earth,” he says. “You could never ever get a sample like that in any other way.”

http://www.miller-mccune.com/media/song-lyrics-twitter-help-chart-public-mood-26787/

**Pollinating Local Is the New Buzz**

**An annual Woodstock for honeybees highlights one of the factors leading to pollinators' decline in North America. Perhaps keeping bees at home is the solution.**

By David Richardson



*With news of bee numbers declining, researchers are still looking into the causes of colony collapse disorder and some possible workarounds including keeping bees local. (KimPouss/stockxchange.com)*

Scientists say if bees were better homebodies it might be better for them and for us.

During a few weeks in February, some 1.5 million honeybee hives will be drawn from all over North America for a pilgrimage to California, in which they will descend on the state's almond groves at a critical moment in the trees' flowering cycle. More than three quarters of North America's honeybees will arrive in the Central Valley just in time to pollinate the $2.3 billion almond crop. And when their work there is done the beekeepers will fan out with their bees to provide the same service for nearly every farm field in North America.

Gordon Wardell, senior biologist and bee expert for Paramount Farming Company, the nation's largest almond producer, says hives are already pulling in by the truckload for what has been called "the great promiscuity" by the beekeepers who attend.

Scientists and beekeepers alike wonder if, in this vast melting pot of insects, dangerous pathogens could be exchanged as bees from different hives visit the same flowers. The question matters hugely as so-called "colony collapse disorder," or CCD, over the past four years has killed up to a third of all honeybees in the United States, accelerating an existing decline in native pollinators in North America and Europe.

From his vantage, Wardell says, beekeepers arriving for the festivities this year "are all saying the same thing about their hives — 'looking good' — so far.'"

While many hypotheses have been advanced for the decline in pollinators, researchers have not yet arrived at a definitive cause of CCD. There is evidence to suggest one or more biological pathogens may be involved,

and recent findings from Pennsylvania State University suggest that pollen itself may serve as a vector in spreading some of the viruses associated with CCD.

Results of three years of research published earlier this month find that North America's native bumblebees have also been experiencing steep declines, and it may be that pathogens are jumping from domesticated honeybees to pollinators in the wild.

The Pennsylvania pollen researchers, led by entomologist Rajwinder Singh, found evidence that viruses attacking honeybees had spread beyond that species to their wild cousins, likely through pollen. Meanwhile, since pollen is sometimes purchased to feed stocks of domesticated bees, concerns about contaminated pollen adds yet another vector to the mix.

With at least a third of our food supply, from fruits to nuts, and even beef on the hoof that fattens on alfalfa, depending on bees for pollination, the disappearance of bees, domesticated and wild, is cause for major concern.

"It's hard to know if there is interspecies transfer of viruses, but there is a potential," says Neal Williams, native pollinator specialist in the department of entomology at the University of California, Davis.

While "it's not good to lose any species," Williams says, losing the very productive bumblebees would be especially troubling. Thanks in part to their larger size, fuzzy pollen-grabbing coats and greater range, "bee for bee, bumblebees are better pollinators than honeybees."

Although the cause of the bumblebee's disappearance has not been established, William's says, "We've seen a trend where some species seem to drop out as we lose natural habitat."

Eric Mader, assistant pollinator program director at the Xerces Society, a nonprofit organization dedicated to conservation of invertebrates, places the accidental importation of exotic pests and diseases high on the list of suspects responsible for killing off pollinators. In particular, he sees that as a likely cause of honeybee decline, which coincidentally began after bees from outside North America were first imported in 2005 (after an 83-year hiatus). "We're seeing the unintended consequences of globalization.

"We're likely seeing several bee species go extinct," he adds.

Until recently growers could import bee hives from Australia to supplement services available to bee keepers in the United States, but the USDA placed a permanent ban on that practice in December 2010. The goal is to prevent the introduction of bee pathogens that had been detected among invasive feral bees from Asia that had been accidentally let loose Down Under.

While scientists are not ready to give up on bumblebees or honeybees, researchers like Mader and others have suggested that now might be a good time to work toward assuring the health of North America's remaining native bees.

Williams says he is confident that if their habitat can be restored and protected, some of the 4,000 species of bees native to North America could play a more important role in supplying pollination services to agriculture.

But they need to be healthy. Mader and Williams agree that, from the immune system to the gene pool, habitat is the path to that health. Bees need a varied diet, with ample food sources and nesting sites nearby, and a fluid gene pool, Williams says. For farmers who need wild bees for pollination, that could mean flowers and weeds smack in the middle of their fields.

And that presents a dilemma.

“The challenge is the fear of losing cropland, that affects the economic bottom line,” Williams says.

But it may not be an either/or situation, suggests a 2005 study of wild pollinators in Canada’s canola fields. Mark L. Winston, co-author with Lora Morandin of that study, said the detailed research demonstrated that growers who left roughly 30 percent of their fields wild, allowing weeds and native plants to grow untended near or interspersed among their crops attracted more native pollinators, achieved considerably higher yields in canola seed, and as a result generated higher incomes than those who planted 100 percent of their fields with canola.

Williams declined to put a figure on what percentage of habitat would need to be untilled to foster a profitable relationship between native bees and farmers in the United States, saying it would vary depending on the crop involved, the intensity of agriculture and other local conditions.

Location, too, matters. Because farmers still spray for pests, he says, “You wouldn’t want to put your habitat in the middle of a field — you don’t want to attract the bees to an area and then spray them.”

Still, he said, given the uncertainties in the managed population, “almost anything we can do to promote habitat will be beneficial.”

The 2008 U.S. Farm Bill provides some support for restoring this natural pollinator habitat. “Right now we have a unique opportunity to try and work through this,” Williams said. “We have programs that are funded through USDA for cost share, through a direct payment to farmers, to establish and maintain those habitats.”

Williams says getting people to change “is as big a challenge as anything.”

“But farmers can surprise you. You’ll always have some early adopters — people who would do it even if you didn’t pay them, but some of the farmers who have been really willing to participate in this, have been really conventional growers who grow large acreages of high-value crops for seed production and things like that.”

He is now researching whether there are threshold levels of habitat that different species require within certain landscapes and how that habitat can be configured in agricultural areas to be of greatest benefit to the bees. “One of the challenges is working around arable farmland and finding places we can reserve that would provide food and nesting sites for different kinds of bees.

“And that is very likely to be a benefit to managed honeybees as well.”

Mader says, “Areas of robust habitat can serve as a corridor connecting distinct populations including populations that may have some natural resistance to disease, enabling them to get out and share those resistant genes with other members of their species.”

Furthermore, “bees have a very interesting reproductive system that makes them particularly prone to inbreeding depression. In the case of bumblebees, isolated populations can quickly become locally extinct without a regular transfer of new genes between different groups of bees.”

Wardell says many almond growers, too, are looking for ways to work more cooperatively with native bees.

"It's always a challenge to find enough bees to pollinate Paramount Farms' 45,000 acres of almonds." Although he said the company has put some effort into installing stretches of wild plantings along the farms' roadsides and borders, the semiarid region has never been home to a large population of native bees.

Nonetheless, Wardell says he's found a promising understudy to the honeybee. Although it has to be plied with artificial heating to emerge from its nest in time for the almond bloom, the blue orchard bee, *Osmia lignaria*, from Utah, is an efficient pollinator with many characteristics an almond grower would appreciate.

After making a stop by Paramount's *Osmia* breeding enclosures, Wardell noted his satisfaction with the progress of the emerging young insects. He conceded it will take a while to work out the best techniques for the propagation, release and recovery of this wild species.

He added hopefully that they seem to get along well with the honeybees, and that with their divergent lifestyles and behaviors he might even like to see the two species work the groves together.

"We may even get better pollination."

http://www.miller-mccune.com/environment/pollinating-local-is-the-new-buzz-27843/

**I Gave It a Nudge But It Won't Budge**

**New research suggests the superficial appeal of governing by light touch founders in the health arena where so many "unhealthy nudges" are already in place.**

By Emily Badger

*New research suggests the idea of "nudging" may not be effective in the health arena where there is a tidal wave of unhealthy choices for consumers already in place. (stockxchange.com)*

Legal scholar Cass Sunstein and behavioral economist Richard Thaler unleashed an incredibly seductive idea in 2008 with their popular book *Nudge*. Many of society's biggest problems, they suggested, from poor public health to environmental degradation to lousy retirement planning, could be solved without expensive interventions or intrusive regulation.

All policymakers have to do is alter the environments in which people make decisions, gently nudging them toward the choices that would improve their lives — away from the potato chips, say, or toward that corporate 401(k) match.

"To count as a nudge, the intervention must be easy and cheap to avoid," the authors wrote. "Nudges are not mandates. Putting the fruit at eye level counts as a nudge. Banning junk food does not."

As an added bonus, Sunstein and Thaler figured the concept — recognized by some as "libertarian paternalism" — ought to appeal to liberal and conservative politicians alike.

Beyond the influence of their book, Sunstein and Thaler have taken these ideas straight to government. Sunstein now heads the White House Office of Information and Regulatory Affairs (under a liberal president), and Thaler is advising conservative British Prime Minister David Cameron's cabinet through a group known cheekily as the "nudge unit."

"It's pretty popular over here," said Theresa Marteau, director of the Behavior and Health Research Unit at the University of Cambridge Institute of Public Health. "These ideas are forming really the framework for how government wants to improve population health."

And this gives her pause.

"The U.S. and the U.K. spend a lot of money on research — not enough in my view — trying to develop interventions, develop the evidence base for us to know what is more or less effective," she said. "Then here comes a new book with the promise of changing behavior through the relatively simple means of altering environments, or the context in which behavior occurs, without using bans, without using pricing."

Marteau and several of her colleagues question whether the elegant solution is really as effective as *Nudge* suggests (and as British and American politicians would like it to be), particularly when it comes to the vast and complex challenges of public health.

"As researchers, we're paid to be skeptical, to say, 'OK, well that's interesting. Let's now see where the evidence is,'" Marteau said. "Will this not only change behavior, but will it result in sustained change and sustained change that is large enough to be able to achieve the scale of change that's needed to have an impact on population health?"

Her conclusion after an initial review of the research: "There was remarkably little evidence to support the ideas behind nudging in the context of changing health-related behavior."

She and four colleagues expand on the critique in an analysis published this week on the website of the *British Medical Journal*. They're planning a more extensive review, but Marteau is skeptical that light-touch government nudges could ever be effective in a world where so many powerful "unhealthy nudges" already are in place.

Nudges clearly can be effective — advertising uses the concept to great effect, priming our automatic impulses to go grab a sweet snack or to drink the new beer everyone on TV is already swigging. So, in theory, healthy nudges could work, too. But they're up against the tide of significantly more powerful unhealthy influences backed by companies needing to sell you something.

And their nudges are just so much more *appealing*.

"It's much easier to nudge someone toward drinking a beer and eating a pizza and lying on a sofa than it is to nudge them toward the opposite," Marteau said. "Given the power of that, having fruit at a checkout [counter] is most unlikely to be able to compete with that in any meaningful way."

Good government health policy, she suggests, would have to tackle both the helpful nudges and the unhelpful ones (and more research is needed to determine if this is really possible and just how to do it). But curbing the lure of fat, salt and sugar certainly won't be as cost-free as suggestively planting fruit displays in your neighborhood grocery store. And nudging has come to represent shorthand for the cheap and simple solution everyone can agree on.

"This is why this idea has caught on, because it's selling a very attractive proposition," Marteau said. "It's a political philosophy rather than behavioral science."

http://www.miller-mccune.com/politics/i-gave-it-a-nudge-but-it-wont-budge-27816/

**In India, a Busy Fair and a Spirited Art Scene**

**By SOMINI SENGUPTA**

Prakash Singh/Agence France-Presse — Getty Images

A work by Paresh Maity at the India Art Summit in New Delhi, where 84 galleries and 500 artists were represented this year.

NEW DELHI — The third India Art Summit, an art fair that ended last week, took up more than 90,000 square feet of Pragati Maidan, the main public exhibition hall here in India's capital. Eighty-four galleries were represented, showing the work of 500 mostly Indian modern and contemporary artists. Organizers reported 128,000 visitors over the fair's three-day run, and millions of dollars changed hands, with a couple of buyers each taking home more than $2 million in art.

The Armory Show it was not. The quality of works varied much more widely than at that premier New York art fair, and there was a lot less money involved. But it was also a far cry from the first version in 2008, when only 34 galleries and 10,000 visitors showed up, and Neha Kirpal, the event's 27-year-old founder, didn't manage to break even.

This time around Ms. Kirpal, now 30, bustled around the crowded hall on the first day of the fair, collecting business cards and stuffing them in the suit pocket of an assistant who trailed her.

"There are people who are coming who are saying: 'I have money in my bag. Where do I start?' " Ms. Kirpal said.

She was only half joking. Just as the prolonged economic boom in China has contributed to globalized tastes and a major art scene in recent decades, India is now experiencing its own, relatively modest version of that phenomenon. At the Art Summit, the largest event of its kind in the country, many newly moneyed visitors were clearly curious about their options. Wealth managers turned up at panel discussions led by curators and

college professors; a Kolkata businessman listened as a dealer patiently explained the French influence in the work S. H. Raza, a prominent Indian artist long based in Paris.

But they were also buying, across a wide spectrum of prices. One gallery owner from Mumbai said she was somewhat unprepared for what happened on preview day, before the fair opened to the public, when all three editions of a $13,000 neon light-and-acrylic piece by Tejal Shah, a young Mumbai artist, were snapped up by buyers. A New Delhi gallery sold 10 contemporary pieces, including photographs, paintings and sculpture, at prices ranging from $7,700 to $270,000.

Other dealers reported sales of contemporary Indian works for as much as $400,000. And two sold paintings by Picasso, each of which went for more than $1 million.

“In the hierarchy of needs, people are at a place now where they want to aesthetically satisfy themselves,” Ms. Kirpal said.

One of the most aggressive buyers in India in recent years has been Kiran Nadar, the wife of the billionaire technology baron Shiv Nadar and the founder of the unabashedly named Kiran Nadar Museum of Art, which opened on the eve of the Art Summit inside a new shopping mall a few miles away.

Ms. Nadar, who was a competitive bridge player long before she became an art collector, seems to have brought some of the same energy to acquiring art. She has built her collection swiftly and aggressively, turning up at international art auctions and buying several important examples of modern and contemporary Indian work.

At her museum she is showing major pieces like a haunting three-panel green-and-ivory canvas called “Mahishasura” by the painter Tyeb Mehta, who died in 2009 and was associated with the influential Bombay Progressive Artists’ Group of the 1940s; a set of nudes by one of that group’s founders, F. N. Souza; a room-size steel-and-muslin mobile by Ranjani Shettar, a young Bangalore artist who shows widely in Europe and the United States as well as India; and a mammoth elephant by Bharati Kher of New Delhi, another internationally known artist, covered in her signature bindis.

Ms. Nadar’s most famous acquisition came last year: a large square canvas of geometric reds and oranges, called “Saurashtra,” by Mr. Raza, which she bought for nearly $3.5 million at a Christie’s auction, setting a record for Indian modern art. The piece takes up one wall at the top of her museum’s main exhibition hall.

It’s the kind of collection one might expect at a national art museum, except that in India government museums — in addition to being woefully neglected — rarely collect new work. Ms. Nadar is one of a number of the new private collectors who are trying to make up for that deficiency with museums of their own.

At least two other private museums are in the planning stages, one in Coimbatore, the other in eastern Kolkata. And there is already one devoted to new, often unknown contemporary work from across South Asia, called Devi Art Foundation, in the New Delhi suburb Gurgaon, which reflects the interests of its backers, the mother-and-son duo Lekha and Anupam Poddar, scions of one of India’s most established business families.

For her part Ms. Nadar sees investment in art among the newly rich as a civic good and does what she can to encourage it. “It can improve your aesthetics and be something you can bank on,” is one bottom-line argument she offers. “It’s like jewelry.”

The vogue for art buying was strong enough by this year's Art Summit to attract galleries from 19 countries outside India, and the expanded fair also drew representatives from a handful of foreign museums like the Tate Modern, interested at the very least in the "spectacle and schmoozathon," as one local dealer put it.

And in a scene reminiscent of "satellite" events held around more established art fairs, Feroze Gujral, a well-known socialite, invited four artists to put up an installation in a gutted villa that her family had acquired in the city's most exclusive neighborhood. Then she staged a party.

Still, the summit faced its share of typically Indian challenges. One dealer kept a worried eye on a tangle of electrical cables buried under the carpet. Ms. Kirpal had to get the 10 domes of the exhibition hall covered with waterproof sheeting at the last minute. And thugs threatened the exhibition of India's most famous painter, M.F. Husain; the Hindu right has for years railed against Mr. Husain for his representations of Hindu goddesses in the nude. Ms. Kirpal agreed to put up his works, then, fearing attacks, ordered them taken down, but was again persuaded to let them be mounted. By then Mr. Husain's defenders had publicly criticized fair organizers.

Among those who came to view Mr. Husain's paintings was India's most powerful politician, Sonia Gandhi, head of the ruling Congress Party, and her visit too proved a headache. Inconveniently for the art-viewing public, she came toward the end of the last day of the fair. The police closed the gates, effectively shutting down the fair earlier than scheduled, leaving dealers and would-be Art Summit visitors angry.

And Mr. Husain himself did not attend. Out of fear, he lives in self-imposed exile in Dubai and London.

http://www.nytimes.com/2011/01/31/arts/design/31summit.html

**White Paint, Chocolate, and Postmodern Ghosts**

**By RANDY KENNEDY**

Richard Perry/The New York Times

Sue de Beer in her studio in Red Hook, Brooklyn. Her new video has its debut on Thursday

SURVEYING the row of door buzzers outside the hulking Brooklyn building where the artist Sue de Beer works, it somehow seems fitting to find a lone occupant listed on the building's top floor, with no further explanation: "GOD."

"I don't know who that is or what they do," Ms. de Beer said, breaking into a laugh when a reporter pointed out the small handwritten label next to the buzzer. "I've never really been up to that floor."

But given the nature of her work and especially her most recent creation — a lush, frankly mystical video piece called "The Ghosts" that will have its debut Thursday in an unlikely place, one of the stately period rooms at the Park Avenue Armory — it is tempting to imagine the Holy Ghost himself at work up there in an old warehouse on the Red Hook flatlands, not far from a dingy bus depot, an Ikea and a discount store called 99 Cent Dreams.

Over the last decade Ms. de Beer has built a cult following for the dark and often disturbing ways that she mixes the profane and the sacred — or at least a postmodern version of the sacred, a longing to escape the confines of ordinary consciousness for something perhaps more beautiful or true.

The exhibition at the Armory and a show of related sculpture to open Feb. 18 at the Marianne Boesky Gallery in Chelsea are the most prominent presentation of Ms. de Beer's work in the United States since she first became known through her inclusion in the 2004 Whitney Biennial and entered many prominent public collections, like those of the Museum of Modern Art and the New Museum of Contemporary Art.

In the work for which she is best known, videos that have mined the underbelly of youth culture — a critic once described her as “the pre-eminent auteur of teen angst” — the supernatural, or at least supranormal, has never been quite so front and center as it is in “The Ghosts,” which Ms. de Beer describes as a turning point, three years in the making.

But it has never been far outside the frame. The adolescent bedrooms that so often serve as the centerpieces of her creations, cluttered with posters and guitars and packs of cigarettes, have seemed at times like existential anterooms, where the occupants await some kind of apotheosis with the help of love or drugs or other mechanisms for escape.

Like, for instance, the sensory deprivation tank in which Ms. de Beer spent many dark, quiet hours when she lived in Berlin, with a pyramid above it for energy-channeling. (“It was kind of hokey,” she said.) Or the hypnotists she began to visit there and in New York, who informed the creation of the central character in “The Ghosts,” a hollow-cheeked hypnotist convincingly played by a fellow artist, Jutta Koether, a painter and musician.

“What I wanted was some kind of a nonverbal, non-narrative experience outside myself, something like a state of total belief without having to articulate a belief system,” Ms. de Beer, 37, said in a recent interview in her studio, where she shot much of the new video in small rooms with the windows blacked out. “But I don’t know if I ever got there.”

The new 30-minute two-screen video grew out of a period of desperation in her life, after a year in which she made no art at all. At that time, in 2007, she was traveling almost nonstop, mostly between Berlin, where she lived for several years, and New York, where she is now an assistant professor at New York University.

“I was burned out to the point where I just couldn’t do anything creative, and so I actually kind of gave up, and it was liberating,” said Ms. de Beer, who, despite the Stygian nature of her fascinations, is engaging and open in person, exuding a kind of rock-geek cool.

In the winter of her bad year, the sun would set in Berlin before 4 in the afternoon, she said. She started venturing out only at night, riding the U-Bahn subway trains alone with a notebook, trying to write. Then for two months she locked herself in a room with only a desk, a chair and a blanket, rarely coming out.

When she did, she had written the basic script for “The Ghosts,” which follows three characters — a young woman, a record-store clerk and a money manager (played by Jon Spencer, singer and guitarist for the Jon Spencer Blues Explosion, whom Ms. de Beer persuaded to act for the first time) — as they seek the help of the hypnotist to deal with loss and longing.

In doing so, they conjure up ghosts — frightening-looking ones, who owe a visual debt to Ms. de Beer’s long fascination with horror films and, lately, to the particularly bloody 1970s Italian subgenre known as giallo. The ghosts seem to be challenging the viewer to decide whether they are mere memories or phantasms of a more substantial sort — or whether, in the end, it really matters.

In her early years Ms. de Beer was often identified among the practitioners of a death-haunted, neo-Gothic strain of contemporary art that emerged after 9/11, a list that included Banks Violette and David Altmejd. But the new work, while playing with those expectations, owes a lot more to Proust than to Poe, as a wrenching examination of memory and the ways it shapes identity.

“I think that over the last several years she’s developed a signature style and voice that’s all her own,” said Lauren Ross, the curator and director of arts programs for the High Line and a former chief curator at White Columns, who has followed Ms. de Beer’s work. “It’s always seemed to me that she is after a certain kind of

character, one constantly in danger of losing control of the self. I think she's very interested in how thin that line is."

She added: "I've always found her work to be extremely unsettling, It's always taken me out of my comfort zone."

Doreen Remen, one of the founders of the Art Production Fund, the nonprofit organization that is bringing the video to the Armory with the help of Sotheby's, the event's sponsor, said the fund was interested in helping stage a video project in New York partly because "video has the ability to bridge a kind of audience gap that exists in contemporary art."

"And," she added, "I think that with this work, Sue is playing more with the conventions of movie entertainment in a way that is going to grab people, even though it's not a conventional movie by any means."

Because of great difficulty finding production money for the video in 2008 as the economy plunged, Ms. de Beer's ghosts were whipped up mostly on the cheap, using naked actresses spray-painted white, head to toe, and chocolate sauce for the blood that oozes from the mouth of one of them, all of it transformed later in the editing room, where she spent months shaping two terabyte hard drives full of footage.

"I was doing all this research on how to make a ghost on essentially a two-dollar budget without making it look just laughably hilarious," she said.

Her sets, which have always worn their high-school-play artificiality proudly, in this case really needed to do so because of budget concerns. A few helpers built a late '70s Trans Am from wood — complete with the phoenix hood decal known in its day as the screaming chicken — spending little money except on a certain smokeable substance to make the experience more enjoyable. The only real splurge, Ms. de Beer said, was hiring a cat trainer and a large white Persian cat named Snoebell, indulging a visual fascination she finds hard to explain. (Snoebell also appeared in a 2009 video.)

Ms. de Beer met Mr. Spencer through the members of a German band called the Cobra Killers. He said he became involved partly because she described the project as a horror film and he is a fan of the genre. But during the shooting, which he squeezed into an exhausting Australian tour schedule, he was unsure at times what he had gotten himself into.

"Things were always a little vague, even sometimes the address where I was supposed to show up," he said. "I don't know if she was doing this to increase my sense of disorientation, to keep me in the dark. But I guess if she was, in some ways it kind of worked. It was a strange experience all around."

Ms. de Beer, who doesn't like to use trained actors in her works, said she was drawn to Mr. Spencer mostly because of his weathered voice and "world-weary face" and was pleased with the character he helped bring to life, a businessman who seems to be trying to exorcise a lost love by summoning her from the dead only so that he can leave her, repaying her for abandoning him. (The dreamlike dialogue in the video was written by Alissa Bennett, who has collaborated with Ms. de Beer before, and by Ms. Koether.)

Ms. de Beer said during the interview in her studio one blustery afternoon that the video was "really very personal for me, partly because I had benched myself."

"When I finished with the initial script, it felt very important to me to make it," she said.

Growing up in a rambling Victorian house with a widow's walk in Salem, Mass., which still exudes an air of its witchy past, she felt that mysticism was a kind of birthright, and it has been a more prominent element of

her work in recent years. A 2006 video, “The Quickening,” set in a cartoon-ish Puritan New England, delved into the spiritual seeking of the French novelist Joris-Karl Huysmans and quoted from the sermon “Sinners in the Hands of an Angry God,” putting the Jonathan Edwards warhorse to work in probably the strangest context it has ever found itself. Ms. de Beer has also borrowed from the dark, violent post-religious mysticism of the novelist Dennis Cooper. (From his novel “Period,” used in a 2005 de Beer video: “I could open the other dimension right now if I wanted. Or I could stay here with you. I’m kind of like a god.”)

But Ms. de Beer said that her fascination with ghosts is in one sense simply about finding a way to explore how we all must deal with the past and with loss as we grow older, a struggle that finds a metaphor in the artistic process itself.

“As an artist, you shed all these objects which were the ‘you’ back in the moment when you made them,” she said. “And then you go back and hardly recognize them and feel like the person who made them wasn’t you but someone else, like a sister or something. And you wonder ‘What was she like?’ ”

http://www.nytimes.com/2011/01/30/arts/design/30debeer.html?ref=design

**Photography, in the Family Way**

**By SUSAN HODARA**

NEW ROCHELLE, N.Y.

Toni Parks

"Twins," 1988, by Toni Parks.

IN Gordon Parks's 1942 photograph "American Gothic — Washington, D.C.," a grim-faced cleaning woman in a well-worn polka-dot dress stands against the backdrop of an American flag. With a broom in one hand and a mop beside her, she stares directly at the camera.

In "Twins," shot 46 years later by Mr. Parks's daughter, Toni Parks, two equally unsmiling young girls wear frilly headdresses and festive tops. They, too, gaze straight into the lens.

These images and more are currently on view in "Bridging the Gap: Photography by Gordon Parks and Toni Parks," at the Castle Gallery at the College of New Rochelle. Curated by Katrina Rhein, the gallery's director, the show is the first two-person exhibition featuring the father-daughter pair. It presents nearly 70 pieces from the college's collection, including photographs spanning seven decades and an assortment of books and videos by and about the artists.

The relationship between the Parkses and the College of New Rochelle dates back 20 years. In 1991, in recognition of Mr. Parks's work, the school opened the Gordon A. Parks Gallery and Cultural Arts Center on its campus in the South Bronx; in 1992, it granted Mr. Parks an honorary degree. At the time, Ms. Parks was working at the college as both a counselor for adults returning to school and a photographer during graduations. She has since curated exhibitions at the Gordon A. Parks Gallery, and shown her work there on several occasions, most recently in a solo exhibition in 2009.

But exhibiting at the Castle Gallery, as well as showing her work alongside her father's, remained unfulfilled goals until now. "This is a dream come true," Ms. Parks said at the show's opening in December.

Given the photographers' familial relationship, gallery visitors might find themselves focusing on the parallels among the works rather than appreciating the individual images. But, Ms. Rhein said, "Each piece in this exhibition stands on its own. I believe there are as many dissimilarities as there are similarities."

"Gordon was a mentor to Toni, schooling her on life and the arts, " she said, but they had "different processes for seeking out subjects and creating works."

Mr. Parks's many accomplishments include directing the film adaptation of his autobiographical novel, "The Learning Tree," in 1969, and the blaxploitation film "Shaft" in 1971; writing memoirs, novels and books of poetry; performing as a jazz pianist; and composing orchestral scores. But he was most prolific as a photographer. He was the first African-American to work for Vogue and Life magazines, with subjects ranging from well-known actors and entertainers to victims of abject poverty in the United States and abroad.

Both ends of this spectrum are represented here in 10 black-and-white photographs, which Mr. Parks donated to the college in 1991. Among them are highlights from his 20-year stint at Life, including "Red Jackson, Harlem," part of his first assignment for the magazine, a photo essay shot in 1948 about the Midtowners gang; and "Bessie Fontenelle and Children at Welfare Office," part of another photo essay, this one from 1968, taken during a monthlong stay in the Fontenelle family's Harlem tenement. Then there's Muhammad Ali after his fight with Henry Cooper in 1966, his face glistening with beads of sweat, the intensity of his glare palpable.

The exhibition's title, proposed by Ms. Parks, conveys multiple meanings. One suggests the gap that Mr. Parks, who died in 2006, referred to in his 2005 memoir, "A Hungry Heart," between the primarily white audiences of his magazine photos and the residents of the ghettos where he often shot. Another reference recognizes Mr. Parks's middle name, Alexander, making his initials, G.A.P. Finally, the exhibit bridges the work of Mr. Parks, who discovered his photographic calling early in life, and Ms. Parks, who said she did not pick up a camera until she was in her 40s.

Given her father's accomplishments and reputation, Ms. Parks's avoidance of the field was understandable. "Of course he was intimidating!" she said. "That's why it took me so long."

A tall, slender woman with silver hair that falls past her shoulders, Ms. Parks, 70, was raised in White Plains, where she studied piano and musical composition; she currently lives in England. As soon as she started shooting, she said, she knew she had found her passion. She recalled presenting an early contact sheet to her father and telling him, "I don't care what you say — this is me!"

The "me" that is on display in "Bridging the Gap" includes a dozen color shots of a dress rehearsal of "Martin: A Tribute to Martin Luther King Jr.," the five-movement ballet re-enacting Dr. King's life that Mr. Parks wrote, scored and helped to choreograph, and that he later directed and narrated as a film. "It was my first professional assignment," Ms. Parks said. "Martin" aired in 1990 on PBS on what would have been Dr. King's birthday.

The exhibition also contains images taken by Ms. Parks in Manhattan between 1986 and 1993: black-and-white portraits and street scenes, and several Cibachrome prints, including an urban sunset and moonrise. “In New York, there are so many types of people and so many things happening within one block,” said Ms. Parks, who is a member of Kamoinge, a collective of African-American photographers founded in 1963 and based in New York. “Whatever I see that delights me, I take the photograph.”

“Bridging the Gap: Photography by Gordon Parks and Toni Parks” runs through Feb. 20 at the Castle Gallery at the College of New Rochelle, 29 Castle Place, New Rochelle. Six of Mr. Parks’s feature films will be screened in the gallery on Tuesdays and Wednesdays, 6 to 8 p.m., Feb. 1, 2, 8, 9, 15 and 16. For a schedule of films, gallery hours and more information: cnr.edu/cg or (914) 654-5423.

http://www.nytimes.com/2011/01/30/nyregion/30artwe.html?ref=design

**Artifacts of an Imagined Time**

**By KEN JOHNSON**

Jason Mandella

Ursula von Rydingsvard's "Ocean Floor" at SculptureCenter.

Legions of modern artists have been attracted to things prehistoric, archaic and primordial. Gauguin painted fantasies of a South Pacific Eden. Picasso drew inspiration from African masks, which, misguidedly or not, he took for signs of timeless human ferocity. A traveler happening on Robert Smithson's "Spiral Jetty" could mistake it for a ceremonial maze built by ancient pagans.

The huge, semiabstract woodworks impressively sampled in "Ursula von Rydingsvard: Sculpture 1991-2009" at SculptureCenter look as if they had been made by Druids oriented to endless cycles of nature. And yet, like all archaic-style artworks, the 10 pieces in this show are conspicuously of their time. While they date from the last 20 years, their animating spirit is Post-Minimalist 1970s, when Ms. von Rydingsvard was in her 30s and had earned a master's degree in fine arts at Columbia University. (The exhibition was organized for SculptureCenter by Helaine Posner, chief curator at the Neuberger Museum of Art in Purchase, N.Y.)

That timely dimension is most evident and least exciting in works involving serial repetition. "Krasawica II," for example, consists of five similar vaselike forms, each 6 feet tall and collectively extending 22 feet along one wall. As is typical of Ms. von Rydingsvard's work they are made of laminated lengths of cedar roughly carved by hand and electric tools into gargantuan empty vessels. One of these objects has the vigorous rawness of a centuries-old artifact, but the quintupling mitigates that impression.

Eva Hesse, one of Ms. von Rydingsvard's major influences, made serial sculptures in the late 1960s, giving the Minimalist machinery of artists like Sol LeWitt and Donald Judd a personal, human touch. By the end of the '70s, however, the coupling of manual processes and grid-based serial repetition had become an overly popular shtick in contemporary sculpture.

Consider Ms. von Rydingsvard's "Five Lace Medallions" (2001-7), a quintet of nine-foot-tall rectangular panels, each with something resembling an ornate necklace incorporated into the upper half like a thick puzzle piece. Multiplying one section fivefold into an extravaganza that is more than 40 feet wide produces the effect of overblown, primitivist-style architectural decoration.

You sense more factory production than intuitive process. All the panels appear unfinished, with pencil and chalk marks indicating areas presumably meant to be more extensively carved. It looks like a lesson for people who don't know how sculptures are made rather than a fully realized work of art.

Ms. von Rydingsvard's most compelling constructions are mysterious and singular. Installed by itself in a square room that it almost completely fills, "Ocean Floor" (1996) is a knockout. A giant, graphite-darkened wood bowl 13 feet in diameter, it might have been unearthed by archaeologists from a site where colossal ogres once lived. This haunting object has a strangely suggestive series of twin pods connected by arching tubes around the outside of its waist-high rim. Made of stuffed cow intestines, their gonadal shapes hint at a possible fertility cult, and the whole piece evokes a time immemorial — a time out of time — long before (or after) the bells and whistles of industrial civilization came along.

"Droga" (2009) looks even older. An organic form, like a giant slug with a cavernous interior, it could be a pre-Paleolithic fossil from an age when dinosaurs roamed the earth.

Ms. von Rydingsvard's works can also suggest a postapocalyptic time. Born in 1942 in Poland, she has spoken of her earliest memories: of war and of being shuttled among refugee camps before arriving in the United States in 1950. The nearly 14-foot-tall "Wall Pocket" (2003-4) recalls the remains of a chimney in a carpet-bombed city. The Holocaust comes to mind, and, in a larger, existential sense, the piece suggests the fragility of humanity in the face of the universe's violent energies.

A tendency for overbearing dourness — especially seen in her often enormous outdoor sculptures — is sometimes offset by an inventive playfulness. A 2006 diptych of roughly circular wall pieces, each nine feet across with a rimlike pie crust surrounding a flat expanse resembling hardwood flooring and with clusters of blobby forms hanging from the bottom edges, has the sad title "Weeping Plates." But they seem more comical, like parodies of Rococo mirrors, than tragic. "Collar With Dots" (2008), in which a nubby section is appended to a ropy element with flyaway ends, could be a false beard for an actor or a spy. Such works promise other possible discoveries to be made along less well-worn paths.

Allegorical tombstones, monuments, cenotaphs and elegies for a broken century are all very well, but grieving over the past can become routine, and an artist as industrious as Ms. von Rydingsvard can start to look like a professional mourner with a too-predictable bag of tricks. You want a bit of new life too, a sprig of hope for a new millennium.

"Ursula von Rydingsvard: Sculpture 1991-2009" continues through March 28 at SculptureCenter, 44-19 Purves Street, Long Island City, Queens; (718) 361-1750, sculpture-center.org.

http://www.nytimes.com/2011/01/28/arts/design/28sculpture.html?ref=design

**As China Evolves, So Does an Artist**

**By KAREN ROSENBERG**

Wang Qingsong

"Competition" (2004) is one of 15 works in the exhibition "Wang Qingsong: When Worlds Collide" at the International Center of Photography.

The Beijing artist Wang Qingsong, born at the beginning of the Cultural Revolution, has seen China morph from an insular, rural society to a globally engaged dynamo. His art has evolved just as rapidly, from Gaudy Painting (a Chinese variation on Pop) to giant photographs staged in movie studios and short, performance-based videos. All of these works regard recent changes in Chinese culture — the proliferation of McDonald's, overcrowded cities, even a booming art scene — from an ironic stance that needs no translation.

In the 2004 photograph "Competition," for instance, he stands on a ladder with megaphone in hand in front of a wall of hand-lettered advertisements, giving a Western-inflected, consumerist twist to the old Red Guard posters that adorned city walls during the Cultural Revolution. Brand names including Citibank, Starbucks and Art Basel are visible, though much of the writing is in Chinese.

That striking image is part of a small survey, "Wang Qingsong: When Worlds Collide," at the International Center of Photography. It's not the first appearance at the center for Mr. Wang (whose full name is pronounced wahng ching-SAHNG); he appeared in the 2004 exhibition "Between Past and Future: New Photography and Video From China," organized jointly with Asia Society.

The current show is Mr. Wang's biggest presentation in the United States so far, though at just a dozen photographs and three videos it's a bit of a tease. It leaves you wanting to see more from this gimlet-eyed artist — and from the Center of Photography.

The curator Christopher Phillips, who organized the show, links Mr. Wang to Western photographers and painters like Gregory Crewdson and the Weimar-era satirist George Grosz. Other Westerners that may come to mind are Andreas Gursky, for his hyper-detailed depictions of unchecked globalism, and Thomas Demand, whose photographs of meticulously constructed paper-and-cardboard environments make fictions of "real" political events.

But it seems disingenuous to talk about the staged photograph, in this context, without acknowledging its Socialist Realist history. Government censorship is another subject left untouched in the show, even as the art world digests news about the destruction of the artist Ai Weiwei's studio in Shanghai this month. (Mr. Wang, though less outspoken than Mr. Ai, has in the past been questioned by the police and has had negatives confiscated.)

The earliest works on view date from the late 1990s, after Mr. Wang abandoned his Gaudy Art paintings. They're sharply observant but not very nuanced; the image of a materialist Buddha clutching cigarettes, beer and a cellphone is typical.

The humor is more sophisticated in Mr. Wang's interpretation of the 10th-century scroll painting "Night Revels of Han Xizai." He casts the Beijing art critic Li Xianting in the role of the debauched court official Han Xizai, and himself as the emperor's spy. Scantily clad "courtesans" sip Pepsi and Jack Daniel's as Mr. Wang peeks out from behind a curtain. Beyond the voyeurism there is a parable about the fate of the intellectual in contemporary China.

Almost as rich are the works from 2003-5, "Competition" among them, elaborately staged in a Beijing film studio and starring Mr. Wang. The sets are artworks in themselves, as is made clear by short behind-the-scenes videos at the photography center.

In "Follow Me" Mr. Wang sits at a desk in front of an enormous chalkboard covered in English and Chinese writing. The setup riffs on a popular BBC-Central China Television language-instruction program from the 1980s, but the words and phrases being taught here seem to have more to do with the millennial art boom; they include "Documenta," "Venice Biennale" and "Uli Sigg," the major Chinese-contemporary collector.

Other works offer wry commentary on the fast-tracked development of Chinese cities and the plight of the migrant workers who come from rural areas to build them. In the most recent of these images, "Dormitory" (2005), dozens of nude figures inhabit small compartments in what is essentially a giant bunk bed constructed by Mr. Wang. Curiously, some of them seem to be occupied by artist models (note the seated figure plucked from Man Ray's "Ingres Violin," one of many Western art references in Mr. Wang's photographs).

Just as he shifted from painting to photography Mr. Wang has lately turned to video, making short works that, in a familiar YouTube idiom, compress lengthy or difficult endeavors into just a couple of minutes. Some of them pick up on the urban themes in the photographs; for "Skyscraper" Mr. Wang hired construction workers to erect a 115-foot golden scaffold on the outskirts of Beijing.

Others, though, are more performance oriented. In "Iron Man," for instance, the artist is pummeled bloody by spectral fists. The work's title, in Chinese, describes positive attributes of ambition and endurance. Westerners, though, are likely to perceive the violence as a dark meditation on human-rights abuses — notwithstanding Mr. Wang's broad grin at the end of the video, or his vague comments on the wall label. "We all get hit in one form or another in life," he says, "perhaps not literally but figuratively."

Violence also dominates "123456 Chops," in which Mr. Wang's younger brother hacks a goat carcass into minuscule pieces on a wooden platform. It's a spectacularly grisly version of process art.

If the videos are any indication, Mr. Wang is moving from critiques of materialism to more subversive topics and from Hollywood-style set design to stripped-down, body-centric actions. His art is getting tougher as it gets lighter.

"Wang Qingsong: When Worlds Collide" continues through May 8 at the International Center of Photography, 1133 Avenue of the Americas, at 43rd Street; (212) 857-0000; icp.org.

http://www.nytimes.com/2011/01/28/arts/design/28qingsong.html?ref=design

**Gehry Design Plays Fanfare for the Common Man**

**By NICOLAI OUROUSSOFF**

Moris Moreno for The New York Times

New World Center: Frank Gehry designed this home for the New World Symphony in Miami Beach.

MIAMI BEACH — Can an architect save classical music? That seems to be what Michael Tilson Thomas, the artistic director of the New World Symphony, was counting on when he hired Frank Gehry to design him a new music center.

Like others running classical music institutions today, Mr. Thomas is struggling to connect to a younger audience. The 81-year-old Mr. Gehry, who used to baby-sit for Mr. Thomas, 66, when both were living in Los Angeles, built his reputation as an architect with a knack for tapping into the popular imagination.

Together they have created a building, opening here on Tuesday, that spills over with populist ideas, sometimes to the point of distraction. Enclosed inside a simple stucco box, its raucous interior forms — a pileup of rehearsal studios joined to a 756-seat hall — are part of an effort to break down the emotional distance between performers and the public, and in doing so to pump new life into an art form that is often perceived as stuffy and old-fashioned.

The project also seems to represent a turning point of sorts for Mr. Gehry. In recent years he has often been castigated for working with the type of big-money developers that he came to scorn in his youth, and his work sometimes seemed to get overly slick and refined. The new music center's rough-and-tumble appeal, by contrast, is a return to the kind of project that made him a revolutionary figure in American architecture in the 1980s and '90s. The symphony center, which overlooks the rambling new SoundScape park designed by the Dutch firm West 8, is the centerpiece of a 15-year effort to rejuvenate a depressed area of Miami Beach midway between the bustling pedestrian shopping strip along Lincoln Road to the south and the convention center to the north. (The park, a gorgeous composition of sinuous paths and curvy concrete benches that taper down to the ground at each end, is a perfect counterpoint to Mr. Gehry's more ebullient architecture.)

From a distance the music center resembles the kind of anonymous white stucco building you see all over Miami, blown up to civic scale. Its shoebox-shaped exterior brings to mind early Gehry projects like the 1986 Frances Howard Goldwyn branch library and the 1964 Danziger Studio, both in Los Angeles — buildings whose blank facades and crude materials helped establish Mr. Gehry's talent for bridging the gap between high architecture and urban grit.

Once you reach the park, however, and turn toward the main facade, the center erupts with life. A towering glass wall extends up the front of the building, exposing the entire lobby. Inside, rehearsal rooms are set on top of one another like unevenly stacked crates. When I first saw this view — at night, with the rooms lighted from behind — it made me think of gigantic figures on a stage jostling for space. It also suggested the lobby of Charles Garnier's 19th-century Paris opera house, a soaring space where the public is as much a part of the spectacle as the works being performed onstage.

But while Garnier's creation reflected the exhibitionistic spirit of Paris's rising bourgeoisie, drawing the energy of the well-dressed crowds strolling the boulevards up through the building, Mr. Gehry's vision is more casual and democratic. People who can't afford the price of a ticket will be able to set up folding chairs in the park and watch live feeds of performances, which will be projected onto the side of the building. During the day, when no performances are going on, visitors will be able to wander through the lobby and see directly into one of the main rehearsal halls.

Paying concertgoers, on the other hand, are likely to arrive through the back door: a concrete parking structure tucked behind the building and wrapped in a lightweight metal screen decorated with colorful LED images. From there they will cross a bridge to a second-floor mezzanine, where they can gaze out at a spectacular view of the city's Art Deco skyline, or (if they arrive late) look down at musicians preparing to enter the main hall. A vertiginous staircase, snaking down between the rehearsal rooms, will deposit them in the main lobby.

The idea, according to Mr. Thomas, is not just to allow the audience to observe musicians going about their daily tasks, but also to draw musicians "out of their bubble" and make them more aware of the public around them. In doing so, he hopes to create a more accessible musical experience.

This vision comes through with particular force in the concert hall, one of the best spaces Mr. Gehry has designed in years. Just as he did in his Walt Disney Concert Hall in Los Angeles, Mr. Gehry laid out the seats here in a "vineyard pattern," with the bulk of them stepping down toward the semicircular stage from three sides. Big, billowing convex panels, finished in white acoustical plaster, cover the walls and ceiling, giving the room a remarkably warm — even Baroque — feel.

But the Miami Beach hall, a third the size of the Disney one, is more intimate, and the audience's experience here will be more immersive. Small balconies have been placed at various points around the hall so that individual musicians can be scattered through the audience during a performance. And Mr. Thomas plans to project video images across the surfaces of the convex panels that frame the stage.

There are obvious risks to all of this. Rehearsing musicians may find the presence of so many outsiders a distraction, even if they are kept on the other side of a glass wall. And the videos, which will involve collaborations between artists and composers, may annoy those who would rather lose themselves in the music. (When I saw one being tested, the effect was absolutely dreamy, but there were no musicians in the room.)

Those issues aside, however, there is something extraordinary about this building, which I suspect is tied to Mr. Gehry's personal history. Years ago, when he was designing Disney Hall, he told me that when he first arrived in Los Angeles as a teenager, his family lived in a cramped one-bedroom apartment on Ninth Street in a run-down area near downtown. He and his sister took turns sleeping on a Murphy bed in the living room. Their father, who had just suffered a heart attack, was working nights in a liquor store. To keep her children

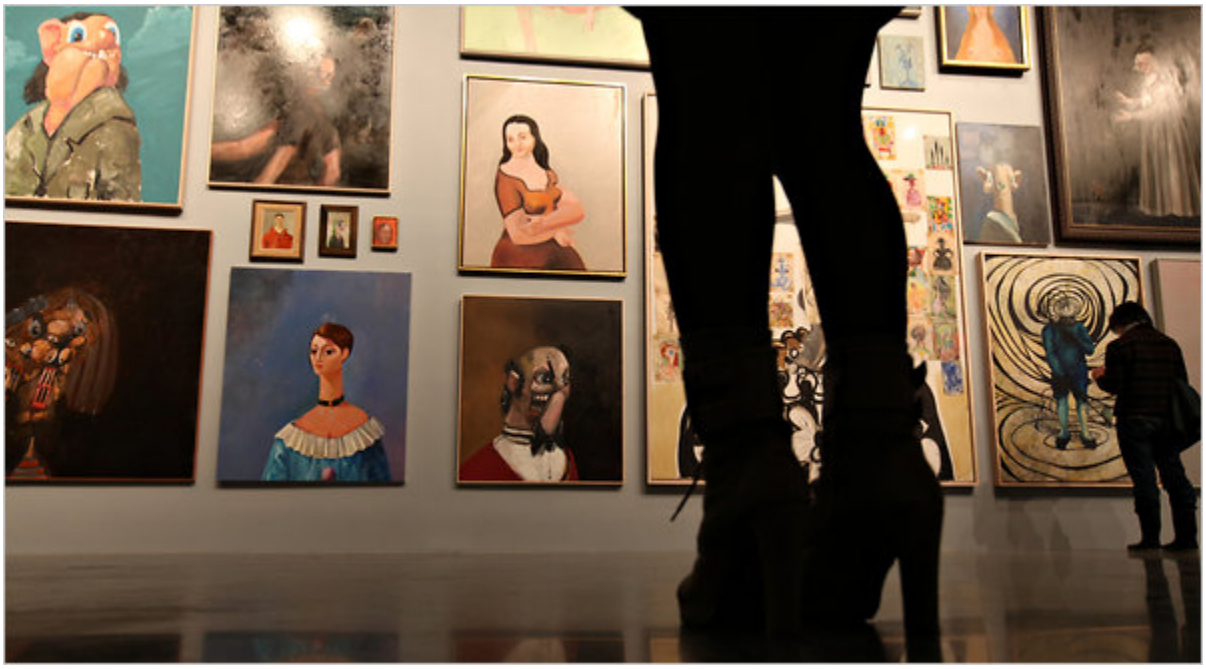
from falling into despair, their mother played classical music every night after dinner. It was, Mr. Gehry said, a way of binding them together as a family.

The story reflects Mr. Gehry's belief that music, like other creative endeavors, should be more than an aesthetic matter. As a shared experience, one that reaches each of us at our emotional core, it helps unite us into a civilized community. This is probably why it's the first Gehry building I have fallen in love with in years — not because it is perfect but because of the values it embodies.

http://www.nytimes.com/2011/01/24/arts/design/24gehry.html

**A Mind Where Picasso Meets Looney Tunes**

**By HOLLAND COTTER**



Chester Higgins Jr./The New York Times

This survey of three decades of work by George Condo includes about 50 portraits, most of fictional subjects

The American artist George Condo made a splash in New York in the early 1980s with a line of surrealist-style figure paintings. It was tasty, erudite stuff, freaky but classy, a Mixmaster version of old master, with a big glop of Pop tossed in. Then he went to Europe, found an avid audience and stayed for a decade, mostly in Paris. To the New York art world, myopic and memoryless, he might have moved to Mars.

In 1995 he resettled in Manhattan, and has been there since, producing at high volume and exhibiting prominently without generating the kind of main-stage mojo that has made a younger artist like John Currin — who is hugely indebted to Mr. Condo's example — a star.

But now, finally, and with minimum fanfare, he's having his first institutional career survey here. It's titled "George Condo: Mental States." It's at the New Museum. And it's sensational.

It demonstrates, among other things, what anyone who has tracked his career already knows. He's the missing link, or one of them (Carroll Dunham is another), between an older tradition of fiercely loony American figure painting — Willem de Kooning's grinning women, Philip Guston's ground-meat guys, Jim Nutt's cubist cuties, anything by Peter Saul — and the recent and updated resurgence of that tradition in the work of Mr. Currin, Glenn Brown, Nicole Eisenman, Dana Schutz and others.

Not that Mr. Condo — born in 1957 in New Hampshire — requires historical positioning to justify a survey. One glance at the installation of about 50 of his mainly fictional portraits on the New Museum's fourth floor tells you otherwise. Some of the paintings are stronger and stranger than others. But covering a long wall up

to the ceiling, with no two images alike, they add up to a tour de force of stylistic multitasking and figurative variety.

Your first instinct is to spot sources for those styles and figures: Picasso, Arcimboldo, Cookie Monster, Goya, Looney Tunes. But you only go so far with this because Mr. Condo isn't much into wholesale appropriation. He's interested in invention. Everything is pretty much straight from his brain.

The earliest picture in the show, "The Madonna," dates from 1982 and gives a basic sense of how Mr. Condo works. He painted his subject, a Renaissance staple, straightforwardly, then did something funny to it. He scraped some paint away so that the face became blurred and slightly separated from the head, like a slipping mask. This subtle effect turned a historically and ideologically loaded subject into contemporary caprice, though without taking the history and ideas away. They're here, but detached, like the Madonna's face.

Even after being messed around with, she looks fairly normal, which cannot be said of most of the figures surrounding her. These include other quasi-religious images — Mr. Condo grew up as a Roman Catholic — including a Mary Magdalene with bared breasts and sticking-out rodent ears. Taken as an icon it's deeply bizarre, yet it doesn't feel entirely irreverent, which makes it even odder.

Various gods of art history get their due and take their licks. The 1994 "Memories of Rembrandt" borrows the tawny palette of that Dutch artist's late self-portraits but reduces his facial features to a juicy stew of eyeballs and chunks of flesh. Throughout the show pieces of Picasso are everywhere, puzzled together, piled up like kindling, broken up, gnawed on, inserted wherever there's room. Mr. Condo clearly can't get enough of him.

News photographs of public personalities have served as models for portraits, and occasionally he leaves these people looking more or less like themselves, as he did a few years back in a series of 15 portraits of Elizabeth II of Britain. One of these images at the New Museum, "The Insane Queen," is, in its zany way, almost respectful of her. Others — the queen with a detachable chin, a clown smile, a carrot stuck through her head — are not, and landed Mr. Condo in hot water when he brought them to the Tate Modern.

A few paintings, and several gilded bronze heads in the show, are named for characters — "The Barber," "The Butler," "The Alcoholic" — in Mr. Condo's private mythology of cultural types. And then there are portraits that are just mysterious hallucinations, floating free and unrooted.

In "Red Antipodular Portrait" a bug-eyed creature stares out apprehensively from behind cascades of scarlet fur. A kind of Bichon Maltese-Yosemite Sam hybrid, it exists in a one-species universe, unconnected to art or life or history. Yet it gives the impression of having feelings, so it evokes a complicated response: amusement with a tug of empathy. Isn't empathy going too far? Isn't this picture just a cartoon? Within the world of Mr. Condo's portraits, nothing is "just" anything.

The exhibition continues on the museum's third floor with groups of nonportrait paintings in which the content tends to be at least obliquely topical and emotions forcefully projected. Much of the work dates from after 9/11; some of it alludes to recent Wall Street scandals. The prevailing mood shifts between confused sadness and suppressed anger.

In a small gallery labeled "Melancholia" male-and-female couples with tiny batlike faces, like the pair in "The Stockbroker," pose in embattled silence. A black-suited executive stands beneath a suspended carrot, once a lure, now a sword of Damocles. Jesus appears. Child size, dwarfed by darkness, he's a little mound of raw matter with rodent teeth, startled eyes and flowers — or maybe thorns — laced through his stringy hair.

The adjoining gallery, with the theme of "Manic Society," has the opposite kind of energy, clamorous and violent. Copulating lovers snarl like beasts; a priest with a Francis Bacon mouth lets out a scream. In an

extraordinary painting called “Uncle Joe” a hirsute man with a demonic smile relaxes with a cigarette and a bottle of wine on a patch of grass, unaware that he’s at the edge of a precipice.

In its third and last room a show of many surprises concludes with yet another one: a sampling of the abstract painting that Mr. Condo has been doing almost since he career began. His version of abstraction bears the same relationship to the traditional nonobjective thing as his portraits do to conventional portraiture. It’s different, but if it’s interesting, who cares?

“Dancing to Miles” and “Internal Constellation” look, from a distance, like exercises in nuanced color and tone. But as you come closer, intricate, all-over networks of imagery come into focus: popping eyes, open mouths, breasts, hands, heads, all recognizable from the portraits. The patterns are so detailed and attention demanding as to be exhausting. Two paintings from 2010 with larger, cubistic forms are easier to see, but they’re too Picassoid for comfort. They smudge a fine line between emulation and imitation, always a danger for artists who have a naturally ventriloqual grasp of styles.

The miracle is that Mr. Condo doesn’t succumb to imitation more often, or doesn’t in this survey, which has been scrupulously selected and edited by Ralph Rugoff, director of the Hayward Gallery in London, and Laura Hoptman, a former senior curator at the New Museum and now at the Museum of Modern Art. They are also responsible for a superlative installation, one that demonstrates, for the first time, that there are ways to exhibit painting effectively in this museum’s high, tight, object-squelching spaces.

But much of that effectiveness can be attributed to the artist they’re dealing with. Mr. Condo is not a producer of single precious items consistent in style and long in the making. If that’s what you want from painting, he’ll disappoint you. He’s an artist of variety, plentitude and multiformity. He needs to be seen in an environment that presents him not as a virtuoso soloist but as the master of the massed chorale, and that’s what Mr. Rugoff and Ms. Hoptman have done.

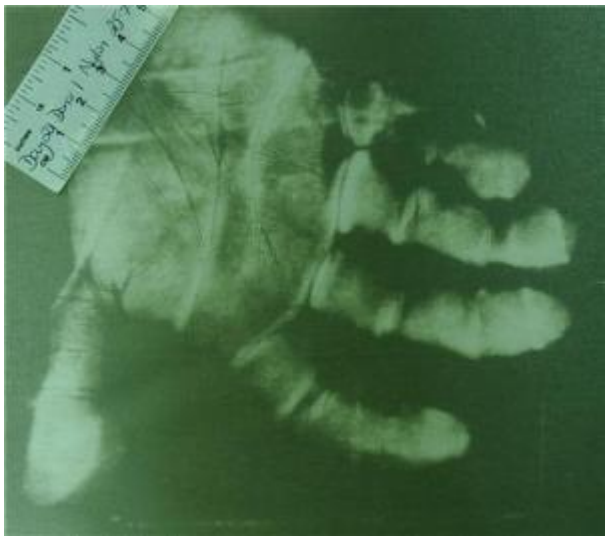
**GEORGE CONDO: MENTAL STATES**

**WHEN AND WHERE** Through May 8; New Museum, 235 Bowery, at Prince Street, Lower East Side.

**MORE INFO** (212) 219-1222, newmuseum.org.

http://www.nytimes.com/2011/01/28/arts/design/28condo.html?ref=design

**Forensic Breakthrough: Recovering Fingerprints on Fabrics Could Turn Clothes Into Silent Witnesses**



*A 21-day sample on nylon demonstrating palmar flexion creases. (Credit: University of Abertay Dundee/Scottish Police Services Authority)*

ScienceDaily (Feb. 2, 2011) — Forensic experts at the University of Abertay Dundee and the Scottish Police Services Authority (SPSA) are leading the way in the research of new ground-breaking forensic techniques within the field of fingerprints.

The new research seeks to recover fingerprint ridge detail and impressions from fabrics -- a technique that has up until now proved difficult. It is the first time in more than 30 years that fingerprints on fabrics have been a major focus for research and the team have already had a number of successes.

A technique known as vacuum metal deposition (VMD) that uses gold and zinc to recover the fingerprint mark is being investigated as part of the research project. VMD is a highly sensitive technique already used to detect fingerprint marks on smooth surfaces such as carrier bags, plastics and glass.

The current research study by the University of Abertay Dundee and SPSA forensic experts is exploring its use in the examination of clothing and the potential value it could bring to a police investigation.

Joanna Fraser, a forensic sciences researcher at the University of Abertay Dundee, said: "The research uses fine layers of metals to display fingerprints people may have left on fabrics, something which is far harder to do with soft surfaces. The technique has been around since the 1970s and is used on many surface but was never widely used on fabrics.

"We take these fabrics, place them in a vacuum chamber, then heat up gold to evaporate it and spread a fine film over the fabric. We then heat up zinc, which attaches to the gold where there are no fingerprint residues. This helps reveal the fingerprint -- where contact has been made we see the original fabric, where there was no contact we're left with the grey colour of the metal film."

She added: "One way of explaining it is like a photographic negative, where colours show up as their opposites. Here the fingerprint ridges show through as clear fabric, but where there are no ridges we see the distinctive grey colour of the metal.

"Previously it had proved difficult to reveal a clear fingerprint on fabric, but we've shown that this is now possible. This is great, but the challenge is to develop this further and confirm its effectiveness."

Paul Deacon, fingerprint unit manager at the Scottish Police Services Authority (SPSA) and one of the experts on the project said: "Fingerprints have been used as a means of identification for over 100 years but recovering fingerprints from fabrics has always proven to be fairly difficult. We wanted to change that.

"The research is still in its early stages but we are starting to see results. We have shown that fabrics with a high thread count are best for revealing a print and have recovered identifiable fingerprints on a number of fabrics including silk, nylon and polyester."

Only 20 per cent of the public are classed as "good donors" for leaving fingerprints, so while the success rate is still low for recovering a full fingerprint from items of clothing, the researchers have had great success in revealing the shape of a handprint on a number of fabric types.

Paul Deacon added: "Such an impression could help the police piece together a timeline of events and could be used to provide evidence in cases where someone was pushed, or grabbed, in a particular area of their clothing.

"For example, an impression of a palm print on the back of someone's shirt might indicate they were pushed off a balcony, rather than jumping. Fingerprints left on fabric and other surfaces can leave DNA traces, so it can also help forensic scientists to visualise the best area to target on an item of clothing to recover DNA evidence."

Director of SPSA Forensic Services Tom Nelson said: "Used on its own fingerprints and impressions recovered on fabrics will not necessarily convict a criminal but used alongside other evidence it will present a more robust case to the court.

"I am determined that we continue to balance the consolidation of the core forensic support we provide to the police and the Crown, with new innovations and techniques. This is just one such innovation we are pursuing as we strive to ensure that forensics makes an even greater contribution to convicting the guilty and protecting the public."

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Abertay Dundee**.

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**Journal Reference**:

1. Joanna Fraser, Keith Sturrock, Paul Deacon, Stephen Bleay, David H. Bremner. **Visualisation of fingermarks and grab impressions on fabrics. Part 1: Gold/zinc vacuum metal deposition**. *Forensic Science International*, 2010; DOI: 10.1016/j.forsciint.2010.11.003

http://www.sciencedaily.com/releases/2011/01/110131073141.htm

**Arctic Mercury Mystery: Meterological Conditions in the Spring and Summer to Blame?**

*Polar bears and humans that eat marine mammals are particularly at risk from the bioaccumulation of mercury in the Arctic. (Credit: Jenny Bytingsvik, NTNU)*

ScienceDaily (Feb. 2, 2011) — More mercury is deposited in the Arctic than anywhere else on the planet. Researchers from the Norwegian University of Science and Technology (NTNU) think that one explanation for this may lie in the meteorological conditions in the Arctic spring and summer.

The concentration of mercury in humans and animals that live in polar regions is on the increase. Polar bears and humans that eat marine mammals are the most affected. But why is there more mercury in the Arctic than elsewhere?

Scientists have been puzzling over this question since the beginning of the 1990s. Their first breakthrough came when it was discovered that under certain meteorological conditions, mercury from the air is deposited on the snow and ice in polar areas. The phenomenon occurs when the sun rises over the horizon in the spring, after a long polar night.

Now new research from NTNU PhD candidate Anne Steen Orderdalen and Professor Torunn Berg at the Department of Chemistry and the Norwegian Institute for Air Research (NILU) shows that this process also occurs in the summer as well as in the spring. In a series of publications, the researchers have documented the types of mercury found over the Arctic and are tracking its fate and transport. Essentially, far more mercury is deposited in the Arctic than initially thought, which may be due to the extended time period during which it can be transformed and deposited. Scientists still don't know exactly why and how the process occurs. But sunlight appears to be an important factor.

**A dangerous transformation**

Most of the anthropogenic mercury emissions come from industry. However, natural sources such as erosion and volcanic eruptions also contribute to atmospheric mercury. All the air around us contains gaseous mercury that is not that reactive and thus not harmful, either to animals or to humans, at normal concentrations.

Concentrations worldwide are fairly similar. But it appears that a reaction between sea salt, sunlight and atmospheric mercury transforms the less hazardous gaseous mercury in the air into more reactive mercury. When this more reactive type of mercury is deposited on the ground, it can be converted into toxic methylmercury -- which then can poison the entire food chain.

**Accumulates in the food chain**

When mercury enters the food chain, it is taken up by microorganisms, and then by ever larger organisms. Marine mammals, polar bears and humans are the top of the food chain in the Arctic, and thus are subject to the most contamination, because the farther up the food chain you go, the higher the concentration of mercury becomes.

Mercury is stored in the body and there is much evidence that the contaminant damages the nervous system. Mercury can also have a serious effect animal health, but also threatens people who largely live off marine mammals. Some studies of children in the Faeroe Islands have shown learning disabilities which are suspected to be linked to high mercury concentrations in the food that they eat.

**Long-term air measurements**

The discovery may help to explain the high levels of mercury found in marine mammals and polar bears, because the mechanism would enable significant amounts of mercury to be carried into the ocean during snowmelt. In addition, climate change can play a role.

The findings are based on air measurements at Svalbard, where a series of field studies have been undertaken at the air station in Ny-Ålesund. The measurement station records the concentration of mercury and other substances continuously throughout the year. Only Canadians have a longer record of mercury measurements than those that are available from the station in Ny-Ålesund.

**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **The Norwegian University of Science and Technology (NTNU)**.

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**Journal Reference**:

1. A. O. Steen, T. Berg, A. P. Dastoor, D. A. Durnford, L. R. Hole, K. A. Pfaffhuber. **Natural and anthropogenic atmospheric mercury in the European Arctic: a speciation study**. *Atmospheric Chemistry and Physics Discussions*, 2010; 10 (11): 27255 DOI: 10.5194/acpd-10-27255-2010

http://www.sciencedaily.com/releases/2011/02/110201083924.htm

**Sleep Selectively Stores Useful Memories: Brain Evaluates Information Based on Future Expectations, Study Suggests**

*New research suggests that the brain evaluates memories during sleep and preferentially retains the ones that are most relevant. (Credit: iStockphoto/Diane Diederich)*

ScienceDaily (Feb. 1, 2011) — After a good night's sleep, people remember information better when they know it will be useful in the future, according to a new study in the Feb. 2 issue of *The Journal of Neuroscience*. The findings suggest that the brain evaluates memories during sleep and preferentially retains the ones that are most relevant.

Humans take in large amounts of information every day. Most is encoded into memories by the brain and initially stored, but the majority of information is quickly forgotten. In this study, a team of researchers led by Jan Born, PhD, of the University of Lübeck in Germany set out to determine how the brain decides what to keep and what to forget.

"Our results show that memory consolidation during sleep indeed involves a basic selection process that determines which of the many pieces of the day's information is sent to long-term storage," Born said. "Our findings also indicate that information relevant for future demands is selected foremost for storage."

The researchers set up two experiments to test memory retrieval in a total of 191 volunteers. In the first experiment, people were asked to learn 40 pairs of words. Participants in the second experiment played a card game where they matched pictures of animals and objects -- similar to the game Concentration -- and also practiced sequences of finger taps.

In both groups, half the volunteers were told immediately following the tasks that they would be tested in 10 hours. In fact, all participants were later tested on how well they recalled their tasks.

Some, but not all, of the volunteers were allowed to sleep between the time they learned the tasks and the tests. As the authors expected, the people who slept performed better than those who didn't. But more importantly, only the people who slept and knew a test was coming had substantially improved memory recall.

The researchers also recorded electroencephalograms (EEG) from the individuals who were allowed to sleep. They found an increase in brain activity during deep or "slow wave" sleep when the volunteers knew they would be tested for memory recall.

"The more slow wave activity the sleeping participants had, the better their memory was during the recall test 10 hours later," Born said. Scientists have long thought that sleep is important in memory consolidation. The authors suggest that the brain's prefrontal cortex "tags" memories deemed relevant while awake and the hippocampus consolidates these memories during sleep.

Gilles Einstein, PhD, an expert in memory at Furman University, said the new findings help explain why you are more likely to remember a conversation about impending road construction than chitchat about yesterday's weather. "These results suggest that sleep is critical to this memory enhancement," said Einstein, who was unaffiliated with the study. "This benefit extends to both declarative memories (memory for a road detour) and procedural memories (memory for a new dance step)."

The research was supported by the German Research Foundation.

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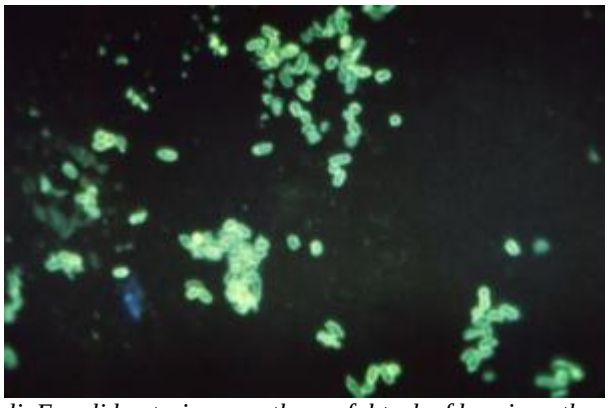
**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Society for Neuroscience**, via EurekAlert!, a service of AAAS.

http://www.sciencedaily.com/releases/2011/02/110201172603.htm

**Bacteria in the Gut May Influence Brain Development**



*One type of bacteria normally found in the gut is E. coli. E. coli bacteria serve the useful task of keeping other bacterial organisms in check (however, the O157:H7 E. coli strain produces a potent toxin). (Credit: CDC/ Berenice Thomason)*

ScienceDaily (Feb. 1, 2011) — A team of scientists from around the globe have found that gut bacteria may influence mammalian brain development and adult behavior. The study is published in the scientific journal *PNAS*, and is the result of an ongoing collaboration between scientists at Karolinska Institutet in Sweden and the Genome Institute of Singapore.

The research team compared behavior and gene expression in two groups of mice -- those raised with normal microorganisms, and those raised in the absence of microorganisms (or germ-free mice). The scientists observed that adult germ-free mice displayed different behavior from mice with normal microbiota, suggesting that gut bacteria may have a significant effect on the development of the brain in mammals.

The adult germ-free mice were observed to be more active and engaged in more 'risky' behavior than mice raised with normal microorganisms. When germ-free mice were exposed to normal microorganisms very early in life, as adults they developed the behavioral characteristics of those exposed to microorganisms from birth. In contrast, colonizing adult germ-free mice with bacteria did not influence their behavior.

Subsequent gene profiling in the brain identified genes and signaling pathways involved in learning, memory and motor control that were affected by the absence of gut bacteria, highlighting the profound changes in the mice that developed in the absence of microorganisms. This suggests that, over the course of evolution, colonization of the gut by microorganisms (in total 1.5 kilograms) in early infancy became integrated into early brain development.

"The data suggests that there is a critical period early in life when gut microorganisms affect the brain and change the behavior in later life," says Dr. Rochellys Diaz Heijtz, first author of the study.

"Not only are signal substances like serotonin and dopamine subject to regulation by bacteria, synapse function also appears to be regulated by colonizing bacteria," continues Prof. Sven Pettersson, coordinator of the study. "However, it is important to note that this new knowledge can be applied only to mice, and that it is too early to say anything about the effect of gut bacteria on the human brain."

In addition to Sven Pettersson and Rochellys Diaz Heijtz, Prof. Hans Forssberg at Stockholm Brain Institute (SBI) and Karolinska Institutet, and Dr. Martin Hibberd from the Genome Institute of Singapore (GIS) where involved in the research project. The findings presented are a result of a long-standing and ongoing

collaboration between Karolinska Institutet and the GIS in Singapore aimed at exploring host-microbe interactions in a systematic manner.

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Karolinska Institutet**.

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**Journal Reference**:

1. R. D. Heijtz, S. Wang, F. Anuar, Y. Qian, B. Bjorkholm, A. Samuelsson, M. L. Hibberd, H. Forssberg, S. Pettersson. **Normal gut microbiota modulates brain development and behavior**. *Proceedings of the National Academy of Sciences*, 2011; DOI: 10.1073/pnas.1010529108

http://www.sciencedaily.com/releases/2011/02/110201083928.htm

**Cluster Encounters 'Natural Particle Accelerator' Above Earth's Atmosphere: How Northern and Southern Lights Are Generated**

*In the auroral acceleration region electrons gain speed and therefore energy. They spiral down and finally hit Earth's atmosphere. When they collide with the particles of the upper atmosphere they make them fluoresce and produce red and green curtains of light that illuminate long winter nights. (Credit: ESA/G. Marklund)*

ScienceDaily (Feb. 1, 2011) — The European Space Agency's Cluster satellites have flown through a natural particle accelerator just above Earth's atmosphere. The data they collected are unlocking how most of the dramatic displays of the northern and southern lights are generated.

Two of Cluster's four satellites found themselves in a natural particle accelerator above the northern hemisphere on 5 June 2009. The first to cross was satellite C3 at an altitude of 6400 km, followed five minutes later by C1 at 9000 km.

This is the first time that scientists have measured such a region simultaneously using more than one satellite. The readings allow the electrical landscape of the acceleration region to be mapped.

"This is like geography, only instead of the contours being the height of a landscape, they are the electrical potentials that span the region," says Göran Marklund from the Royal Institute of Technology, Stockholm, Sweden.

These electrical potentials act in both uphill and downhill directions, accelerating particles towards and away from Earth, according to their charges.

When particles strike the atmosphere, they create the shimmering curtains of light known as the aurora, or more commonly the northern and southern lights. About two-thirds of the bright auroras are estimated to be produced in this way.

Since 2006, the Cluster satellites have been drifting away from their initial orbits because they are being constantly nudged by the gravity of the Moon and the Sun. Fortuitously, the current orbit occasionally passes through the Auroral Acceleration Region, which spans 4000 km to 12000 km above our planet.

The satellites do not encounter a natural particle accelerator on every orbit. Those responsible for the bright auroras are temporary alignments of the electrical fields around Earth. They are highly variable in altitude and so not always present.

This first encounter with a natural particle accelerator associated with a large-scale aurora has proved that they may be stable for at least five minutes. A few more encounters are expected in the near future before Cluster's orbit drifts back out of the region.

"Cluster has now shown us the very heart of the acceleration process responsible for most bright auroras. It has given us our first look at the electrical structure and stability of such an accelerator," says Prof. Marklund.

Such natural particle accelerators pop up ubiquitously throughout the Solar System, especially in the strong magnetic fields of the gas giants Jupiter and Saturn.

The new results from Cluster allow theoreticians to place much tighter constraints on their models of exactly how such accelerators work and give greater insight into the workings of space plasma.

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **European Space Agency**.

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**Journal Reference**:

1. Göran Marklund, Soheil Sadeghi, Tomas Karlsson, Per-Arne Lindqvist, Hans Nilsson, Colin Forsyth, Andrew Fazakerley, Elizabeth Lucek, Jolene Pickett. **Altitude Distribution of the Auroral Acceleration Potential Determined from Cluster Satellite Data at Different Heights**. *Physical Review Letters*, 2011; 106 (5) DOI: 10.1103/PhysRevLett.106.055002

http://www.sciencedaily.com/releases/2011/02/110201122540.htm

**Newly Discovered Dinosaur Likely Father of Triceratops**


*The skull on the left is the Titanoceratops skull, the missing parts of which were reconstructed to look like a Pentaceratops. The illustration on the right shows the missing parts of the frill (shaded). (Credit: Image courtesy of Yale University)*

ScienceDaily (Feb. 1, 2011) — *Triceratops* and *Torosaurus* have long been considered the kings of the horned dinosaurs. But a new discovery traces the giants' family tree further back in time, when a newly discovered species appears to have reigned long before its more well-known descendants, making it the earliest known member of its family.

The new species, called *Titanoceratops* after the Greek myth of the Titans, rivaled *Triceratops* in size, with an estimated weight of nearly 15,000 pounds and a massive eight-foot-long skull.

*Titanoceratops*, which lived in the American southwest during the late Cretaceous period around 74 million years ago, is the earliest known triceratopsin, suggesting the group evolved its large size more than five million years earlier than previously thought, according to Nicholas Longrich, the paleontologist at Yale who made the discovery. The finding, which will appear in an upcoming issue of the journal Cretaceous Research, helps shed light on the poorly understood origins of these giant horned dinosaurs.

Longrich was searching through scientific papers when he came across a description of a partial skeleton of a dinosaur discovered in New Mexico in 1941. The skeleton went untouched until 1995, when it was finally prepared and identified incorrectly as *Pentaceratops*, a species common to the area. When the missing part of its frill -- the signature feature of the horned dinosaurs -- was reconstructed for display in the Oklahoma Museum of Natural History, it was modeled after *Pentaceratops.*

"When I looked at the skeleton more closely, I realized it was just too different from the other known *Pentaceratops* to be a member of the species," Longrich said, adding that the specimen's size indicated that it likely weighed about twice as much as adult *Pentaceratops*. The new species is very similar to *Triceratops*, but with a thinner frill, longer nose and slightly bigger horns, Longrich said.

Instead, Longrich believes that *Titanoceratops* is the ancestor of both *Triceratops* and *Torosaurus*, and that the latter two split several millions years after *Titanoceratops* evolved. "This skeleton is exactly what you would expect their ancestor to look like," he said.

*Titanoceratops* was probably only around for about a million years, according to Longrich, while the triceratopsian family existed for a total of about 10 million years and roamed beyond the American southwest into other parts of the country and as far north as Canada.

In order to confirm the discovery beyond any trace of a doubt, Longrich hopes paleontologists will find other fossil skeletons that include intact frills, which would help confirm the differences between *Titanoceratops* and *Pentaceratops*.

"There have got to be more of them out there," Longrich said.

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Yale University**.

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**Journal Reference**:

1. Nicholas R. Longrich. **Titanoceratops ouranous, a giant horned dinosaur from the Late Campanian of New Mexico**. *Cretaceous Research*, 2010; DOI: 10.1016/j.cretres.2010.12.007

http://www.sciencedaily.com/releases/2011/01/110131133404.htm

**Argentine Ant Genome Sheds Light on a Successful Pest**

*Argentine ant nest. (Credit: iStockphoto/Paul Erickson)*

ScienceDaily (Feb. 1, 2011) — A research team led by scientists at the University of California, Berkeley, and San Francisco State University has unlocked the genetic code of the highly invasive Argentine ant, providing clues as to why this species has been so successful.

The draft genome of the Argentine ant (*Linepithema humile*) -- the tiny brown insect that homeowners so frequently find marching en masse through their kitchens -- is among a trio of ant genomes being published the week of Jan. 31 in the journal *Proceedings of the National Academy of Sciences*. The other two ant species are the red harvester ant (*Pogonomyrmex barbatus*) and the red imported fire ant (*Solenopsis invicta*).

In addition, the genome sequence of a fourth ant, the leaf-cutter ant (*Atta cephalotes*), is scheduled for publication in the Feb. 10 issue of the journal *PLoS Genetics*.

Among the four ant genomes being reported, the Argentine ant and the fire ant, both native to South America, have established themselves in regions throughout the world, wreaking havoc with the native biodiversity along the way.

"The Argentine ant is a species of special concern because of its enormous ecological impact," said Neil D. Tsutsui, associate professor at UC Berkeley's Department of Environmental Science, Policy & Management, corresponding author on the Argentine ant paper and co-author on the red harvester and leaf-cutter ant papers. "When the Argentine ants invade, they devastate the native insect communities while promoting the population growth of agricultural pests. This genome map will provide a huge resource for people interested in finding effective, targeted ways of controlling the Argentine ant."

Tsutsui joined forces with bioinformatics expert Christopher D. Smith, assistant professor of biology at San Francisco State University and lead author of the study, and 48 other co-authors for the Argentine ant genome project. In all, the researchers mapped 216 out of 251 million base pairs and 16,344 genes in the Argentine ant. The human genome has about 3 billion base pairs and about 23,000 genes.

Colonies of Argentine ants in their native habitat are territorial and aggressive, helping to keep their populations in check. In contrast, previous research by Tsutsui and others reveal that invasive populations of Argentine ants are genetically similar, considering each other friends rather than foes. In the United States, this has allowed groups to form one enormous "super-colony," stretching hundreds of miles along the coast of California. Instead of fighting each other, the invasive ants focus their energies on conquering other insect species, including native ants.

In 2009, Tsutsui published a study in which he turned normally friendly ants into hostile combatants by coating them with chemicals known to trigger aggressive behavior. That line of research could be aided by the new genome map, according to Tsutsui, helping researchers understand and manipulate genes to interfere with mating, break up the super-colony, develop repellants or simply attract ants to a trap.

The genome sequence revealed that Argentine ants have a huge number of genes for sensory receptors, including 367 for odor and 116 for taste.

"Ants are ground-dwellers, walking along trails, and for many, living most of their lives in the dark, so it makes sense that they would have developed keen senses of smell and taste," said Tsutsui. By comparison, the honeybee has 174 genes for odor and 10 for taste, and the mosquito has 79 genes for odor and 76 for taste.

The Argentine ant genome also possesses a large number of cytochrome P450 genes, which are important in detoxifying harmful substances. Argentine ants have 111 such genes, while European honeybees, in comparison, have 46.

The researchers attribute the relatively high number of cytochrome P450 genes in the Argentine ant to the larger variety of toxins the species encounters in its broad and varied diet. Studying these genes could also help researchers determine if the ants are evolving resistance to pesticides, they said.

When the researchers looked at a family of genes associated with immunity, the Argentine ant genome had a relatively modest count of 90 genes compared with 152 for the fruit fly. This was surprising, they said, given how Argentine ants are packed into crowded, close quarters, and in the case of invasive populations, have a fairly homogeneous gene profile. Such factors are typically conducive to the spread of pathogens, yet the Argentine ant populations have remained robust.

It may be that the Argentine ant has mechanisms to prevent disease that are similar to those of honeybees -- which have only 78 comparable immune genes -- such as frequent grooming and the quick removal of dead bodies from the colony, the researchers said. They added that genes for anti-microbial chemicals may yet be identified.

While the sequenced genome provides hope for an effective weapon against the Argentine ant, Smith at San Francisco State University cautions against the expectation of a quick or easy fix.

"In biology, the idea is that once we know the genome of a pest species, we can come up with a magic bullet or smarter bullet to defeat it," said Smith. "In reality, the genome is really just information; we now have to put that into action, and in order to do that, we must genetically manipulate ants to confirm if a target gene does what we think it does. Having a genome is like being handed a big book with a bunch of words we don't understand. Now we have to figure out the grammar and syntax."

But the genetic code provides value beyond the effort to counter the Argentine ant. The addition of more ants to the genome library also helps evolutionary biologists and geneticists understand the special caste system of social insects. Ants, like the European honeybee whose genome was sequenced in 2006, thrive in a caste system in which the workers in a colony live to serve the queen, who is the only individual that can reproduce.

"The idea that there are female workers in ant societies that don't reproduce was hard for Darwin to understand," said Smith. "Is that destiny somehow encoded in the ant's genome? Now that we're able to compare the genomes of ants and bees, species that are evolutionarily distant, we can show that caste is not genetically determined and focus on how different expression of the same genome can result in either workers or queens."

The most recent quartet of ant genome papers follows the August 2010 sequencing of the first two ant genomes: the Jerdon's jumping ant (*Harpegnathos saltator*) and the Florida carpenter ant (*Camponotus floridanus*). The Argentine ant and fire ant papers are the first genome sequences of globally invasive ant species.

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of California - Berkeley**, via EurekAlert!, a service of AAAS. The original article was written by Sarah Yang.

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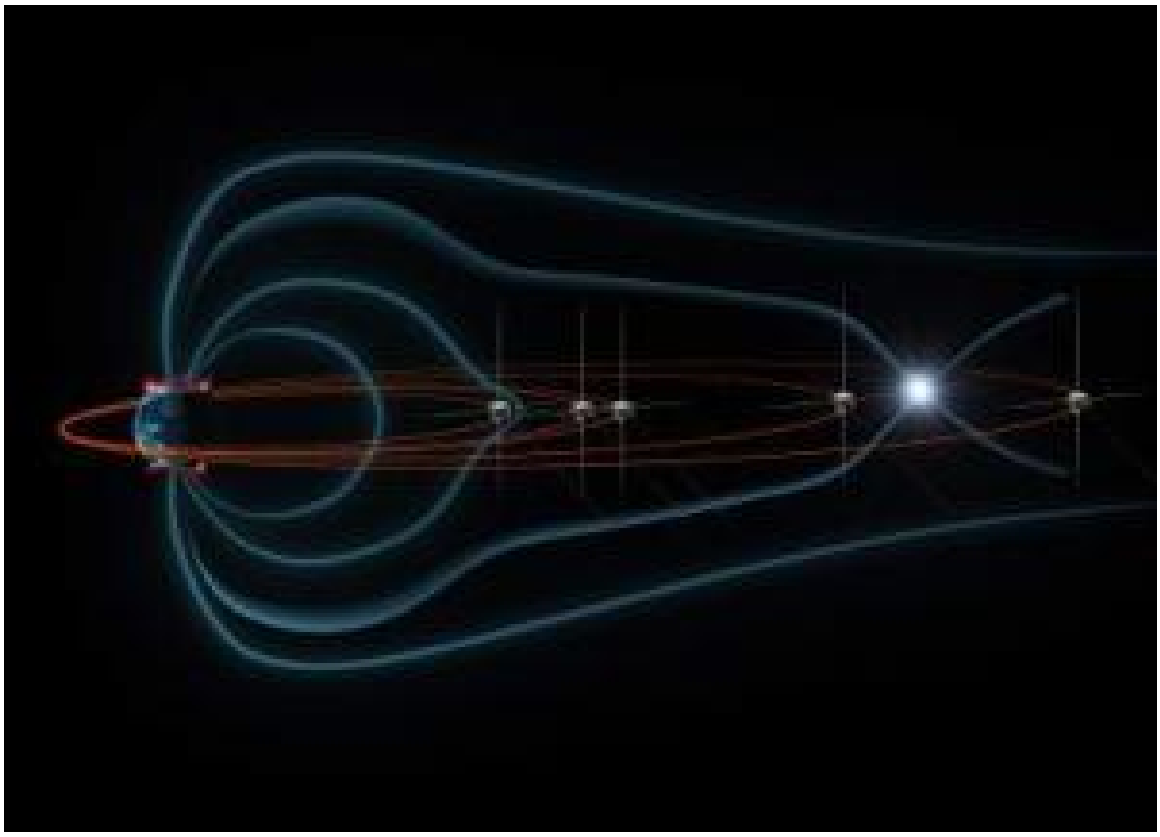
1. Christopher D. Smith, Aleksey Zimin, Carson Holt, Ehab Abouheif, Richard Benton, Elizabeth Cash, Vincent Croset, Cameron R. Currie, Eran Elhaik, Christine G. Elsik, Marie-Julie Fave, Vilaiwan Fernandes, Jürgen Gadau, Joshua D. Gibson, Dan Graur, Kirk J. Grubbs, Darren E. Hagen, Martin Helmkampf, Jo-Anne Holley, Hao Hu, Ana Sofia Ibarraran Viniegra, Brian R. Johnson, Reed M. Johnson, Abderrahman Khila, Jay W. Kim, Joseph Laird, Kaitlyn A. Mathis, Joseph A. Moeller, Monica C. Muñoz-Torres, Marguerite C. Murphy, Rin Nakamura, Surabhi Nigam, Rick P. Overson, Jennifer E. Placek, Rajendhran Rajakumar, Justin T. Reese, Hugh M. Robertson, Chris R. Smith, Andrew V. Suarez, Garret Suen, Elissa L. Suhr, Shu Tao, Candice W. Torres, Ellen Van Wilgenburg, Lumi Viljakainen, Kimberly K. O. Walden, Alexander L. Wild, Mark Yandell, James A. Yorke, and Neil D. Tsutsui. **Draft genome of the globally widespread and invasive Argentine ant (Linepithema humile)**. *PNAS*, January 31, 2011 DOI: 10.1073/pnas.1008617108

http://www.sciencedaily.com/releases/2011/01/110131153252.htm

**Tracking the Origins of Speedy Space Particles**



*This is an artist's rendition of the five THEMIS space spacecraft traveling through the magnetic field lines around Earth. (Credit: NASA)*

ScienceDaily (Feb. 1, 2011) — NASA's Time History of Events and Macroscale Interaction during Substorms (THEMIS) spacecraft combined with computer models have helped track the origin of the energetic particles in Earth's magnetic atmosphere that appear during a kind of space weather called a substorm. Understanding the source of such particles and how they are shuttled through Earth's atmosphere is crucial to better understanding the Sun's complex space weather system and thus protect satellites or even humans in space.

The results show that these speedy electrons gain extra energy from changing magnetic fields far from the origin of the substorm that causes them. THEMIS, which consists of five orbiting satellites, helped provide these insights when three of the spacecraft traveled through a large substorm on February 15, 2008. This allowed scientists to track changes in particle energy over a large distance. The observations were consistent with numerical models showing an increase in energy due to changing magnetic fields, a process known as betatron acceleration.

"The origin of fast electrons in substorms has been a puzzle," says Maha Ashour-Abdalla, the lead author of a *Nature Physics* paper that appeared online on January 30, 2011 on the subject and a physicist at the University of California, Los Angeles. "It hasn't been clear until now if they got their burst of speed in the middle of the storm, or from some place further away."

Substorms originate opposite the sun on Earth's "night side," at a point about a third of the distance to the moon. At this point in space, energy and particles from the solar wind store up over time. This is also a point where the more orderly field lines near Earth -- where they look like two giant ears on either side of the globe,

a shape known as a dipole since the lines bow down to touch Earth at the two poles -- can distort into long lines and sometimes pull apart and "reconnect." During reconnection, the stored energy is released in explosions that send particles out in all directions. But reconnection is a magnetic phenomenon and scientists don't know the exact mechanism that creates speeding particles from that phenomenon.

"For thirty years, one of the questions about the magnetic environment around Earth has been, 'how do magnetic fields give rise to moving, energetic particles?'" says NASA scientist Melvyn Goldstein, chief of the Geospace Physics Laboratory at NASA's Goddard Space Flight Center in Greenbelt, Md., and another author on the paper. "We need to know such things to help plan the next generation of reconnection research instruments such as the Magnetospheric MultiScale mission (MMS) due to launch in 2014. MMS needs to look in the right place and for the correct signatures of particle energization."

In the early 1980s, scientists hypothesized that the quick, high-energy particles might get their speed from rapidly changing magnetic fields. Changing magnetic fields can cause electrons to zoom along a corkscrew path by the betatron effect.

Indeed, electrons moving toward Earth from a substorm will naturally cross a host of changing magnetic fields as those long, stretched field lines far away from Earth relax back to the more familiar dipole field lines closer to Earth, a process called dipolarization. Betatron acceleration causes the particles to gain energy and speed much farther away from the initial reconnection site. But in the absence of observations that could simultaneously measure data near the reconnection site and closer to Earth, the hypothesis was hard to prove or contradict.

THEMIS, however, was specifically designed to study the formation of substorms. It launched with five spacecraft, which can be spread out over some 44,000 miles -- a perfect tool for examining different areas of Earth's magnetic environment at the same time. Near midnight, on February 15, 2008, three of the satellites moving through Earth's magnetic tail, about 36,000 miles from Earth, traveled through a large substorm.

"I looked at the THEMIS data for that substorm," says Ashour-Abdalla, "and saw there was a direct correlation of the increased particle energy at the origin with the region of dipolarization nearer to Earth."

To examine the data, Ashour-Abdalla and a team of researchers from UCLA, Nanchang University in China, NASA Goddard Space Flight Center, and the University of Maryland, Baltimore, used their expertise with computer modeling to simulate the complex dynamics that occur in space. The team began with spacecraft data from an ESA mission called Cluster that was in the solar wind at the time of the substorm. Using these observations of the solar environment, they modeled large scale electric and magnetic fields in space around Earth. Then they modeled the future fate of the various particles observed.

When the team looked at their models they saw that electrons near the reconnection sites didn't gain much energy. But as they looked closer to Earth, where the THEMIS satellites were located, their model showed particles that had some ten times as much energy -- just as THEMIS had in fact observed.

This is consistent with the betatron acceleration model. The electrons gain a small amount of energy from the reconnection and then travel toward Earth, crossing many changing magnetic field lines. These fields produce betatronic acceleration just as Kivelson predicted in the early 1980s, speeding the electrons up substantially.

"This research shows the great science that can be accomplished when modelers, theorists and observationalists join forces," says astrophysicist Larry Kepko, who is a deputy project scientist for the THEMIS mission at Goddard. "THEMIS continues to yield critical insights into the dynamic processes that produce the space weather that affects Earth."

**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **NASA/Goddard Space Flight Center**.

**Journal Reference**:

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**'Air Laser' May Sniff Bombs, Pollutants from a Distance**

*The research team from Princeton's Department of Mechanical and Aerospace Engineering that developed the "air laser" technology includes James Michael (left), a doctoral student, and Arthur Dogariu, a research scholar. (Credit: Photo by Frank Wojciechowski)*

ScienceDaily (Jan. 28, 2011) — Princeton University engineers have developed a new laser sensing technology that may allow soldiers to detect hidden bombs from a distance and scientists to better measure airborne environmental pollutants and greenhouse gasses.

"We are able to send a laser pulse out and get another pulse back from the air itself," said Richard Miles, a professor of mechanical and aerospace engineering at Princeton, the research group leader and co-author on the paper. "The returning beam interacts with the molecules in the air and carries their finger prints."

The new technique differs from previous remote laser-sensing methods in that the returning beam of light is not just a reflection or scattering of the outgoing beam. It is an entirely new laser beam generated by oxygen atoms whose electrons have been "excited" to high energy levels. This "air laser" is a much more powerful tool than previously existed for remote measurements of trace amounts of chemicals in the air.

The researchers, whose work is funded by the Office of Naval Research's basic research program on Sciences Addressing Asymmetric Explosive Threats, published their new method Jan. 28 in the journal *Science*.

Miles collaborated with three other researchers: Arthur Dogariu, the lead author on the paper, and James Michael of Princeton, and Marlan Scully, a professor with joint appointments at Princeton and Texas A&M University.

The new laser sensing method uses an ultraviolet laser pulse that is focused on a tiny patch of air, similar to the way a magnifying glass focuses sunlight into a hot spot. Within this hot spot -- a cylinder-shaped region just 1 millimeter long -- oxygen atoms become "excited" as their electrons get pumped up to high energy levels. When the pulse ends, the electrons fall back down and emit infrared light. Some of this light travels along the length of the excited cylinder region and, as it does so, it stimulates more electrons to fall, amplifying and organizing the light into a coherent laser beam aimed right back at the original laser.

Researchers plan to use a sensor to receive the returning beam and determine what contaminants it encountered on the way back.

"In general, when you want to determine if there are contaminants in the air you need to collect a sample of that air and test it," Miles said. "But with remote sensing you don't need to do that. If there's a bomb buried on the road ahead of you, you'd like to detect it by sampling the surrounding air, much like bomb-sniffing dogs can do, except from far away. That way you're out of the blast zone if it explodes. It's the same thing with

hazardous gases -- you don't want to be there yourself. Greenhouse gases and pollutants are up in the atmosphere, so sampling is difficult."

The most commonly used remote laser-sensing method, LIDAR -- short for light detection and ranging -- measures the scattering of a beam of light as it reflects off a distant object and returns back to a sensor. It is commonly used for measuring the density of clouds and pollution in the air, but can't determine the actual identity of the particles or gases. Variants of this approach can identify contaminants, but are not sensitive enough to detect trace amounts and cannot determine the location of the gases with much accuracy.

The returning beam is thousands of times stronger in the method developed by the Princeton researchers, which should allow them to determine not just how many contaminants are in the air but also the identity and location of those contaminants.

The stronger signal should also allow for detection of much smaller concentrations of airborne contaminants, a particular concern when trying to detect trace amounts of explosive vapors. Any chemical explosive emits various gases depending on its ingredients, but for many explosives the amount of gas is miniscule.

While the researchers are developing the underlying methods rather than deployable detectors, they envision a device that is small enough to be mounted on, for example, a tank and used to scan a roadway for bombs.

So far, the researchers have demonstrated the process in the laboratory over a distance of about a foot and a half. In the future they plan to increase the distance over which the beams travel, which they note is a straightforward matter of focusing the beam farther way. They also plan to fine-tune the sensitivity of the technique to identify small amounts of airborne contaminants.

In addition, the research group is developing other approaches to remote detection involving a combination of lasers and radar.

"We'd like to be able to detect contaminants that are below a few parts per billion of the air molecules," Miles said. "That's an incredibly small number of molecules to find among the huge number of benign air molecules."

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Princeton University, Engineering School**. The original article was written by Chris Emery.

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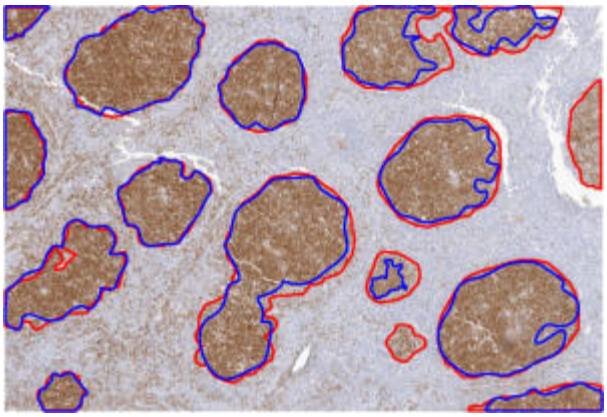
http://www.sciencedaily.com/releases/2011/01/110129081528.htm

**Computer-Assisted Diagnosis Tools to Aid Pathologists**



*Advances in scanning technology allow researchers to automate the identification of potentially malignant regions (red boundaries) in tissue samples. The computer-aided process developed by Metin Gurcan, Ph.D., and his collaborators delivers very accurate, highly consistent results in an efficient way (blue boundaries). (Credit: Image courtesy of Ohio Supercomputer Center)*

ScienceDaily (Jan. 31, 2011) — Researchers are leveraging Ohio Supercomputer Center resources to develop computer-assisted diagnosis tools that will provide pathologists grading Follicular Lymphoma samples with quicker, more consistently accurate diagnoses.

"The advent of digital whole-slide scanners in recent years has spurred a revolution in imaging technology for histopathology," according to Metin N. Gurcan, Ph.D., an associate professor of Biomedical Informatics at The Ohio State University Medical Center. "The large multi-gigapixel images produced by these scanners contain a wealth of information potentially useful for computer-assisted disease diagnosis, grading and prognosis."

Follicular Lymphoma (FL) is one of the most common forms of non-Hodgkin Lymphoma occurring in the United States. FL is a cancer of the human lymph system that usually spreads into the blood, bone marrow and, eventually, internal organs.

A World Health Organization pathological grading system is applied to biopsy samples; doctors usually avoid prescribing severe therapies for lower grades, while they usually recommend radiation and chemotherapy regimens for more aggressive grades.

Accurate grading of the pathological samples generally leads to a promising prognosis, but diagnosis depends solely upon a labor-intensive process that can be affected by human factors such as fatigue, reader variation and bias. Pathologists must visually examine and grade the specimens through high-powered microscopes.

Processing and analysis of such high-resolution images, Gurcan points out, remain non-trivial tasks, not just because of the sheer size of the images, but also due to complexities of underlying factors involving differences in staining, illumination, instrumentation and goals. To overcome many of these obstacles to automation, Gurcan and medical center colleagues, Dr. Gerard Lozanski and Dr. Arwa Shana'ah, turned to the Ohio Supercomputer Center.

Ashok Krishnamurthy, Ph.D., interim co-executive director of the center, and Siddharth Samsi, a computational science researcher there and an OSU graduate student in Electrical and Computer Engineering, put the power of a supercomputer behind the process.

"Our group has been developing tools for grading of follicular lymphoma with promising results," said Samsi. "We developed a new automated method for detecting lymph follicles using stained tissue by analyzing the morphological and textural features of the images, mimicking the process that a human expert might use to identify follicle regions. Using these results, we developed models to describe tissue histology for classification of FL grades."

Histological grading of FL is based on the number of large malignant cells counted in within tissue samples measuring just 0.159 square millimeters and taken from ten different locations. Based on these findings, FL is assigned to one of three increasing grades of malignancy: Grade I (0-5 cells), Grade II (6-15 cells) and Grade III (more than 15 cells).

"The first step involves identifying potentially malignant regions by combining color and texture features," Samsi explained. "The second step applies an iterative watershed algorithm to separate merged regions and the final step involves eliminating false positives."

The large data sizes and complexity of the algorithms led Gurcan and Samsi to leverage the parallel computing resources of OSC's Glenn Cluster in order to reduce the time required to process the images. They used MATLAB® and the Parallel Computing Toolbox™ to achieve significant speed-ups. Speed is the goal of the National Cancer Institute-FUNDED research project, but accuracy is essential. Gurcan and Samsi compared their computer segmentation results with manual segmentation and found an average similarity score of 87.11 percent.

"This algorithm is the first crucial step in a computer-aided grading system for Follicular Lymphoma," Gurcan said. "By identifying all the follicles in a digitized image, we can use the entire tissue section for grading of the disease, thus providing experts with another tool that can help improve the accuracy and speed of the diagnosis."

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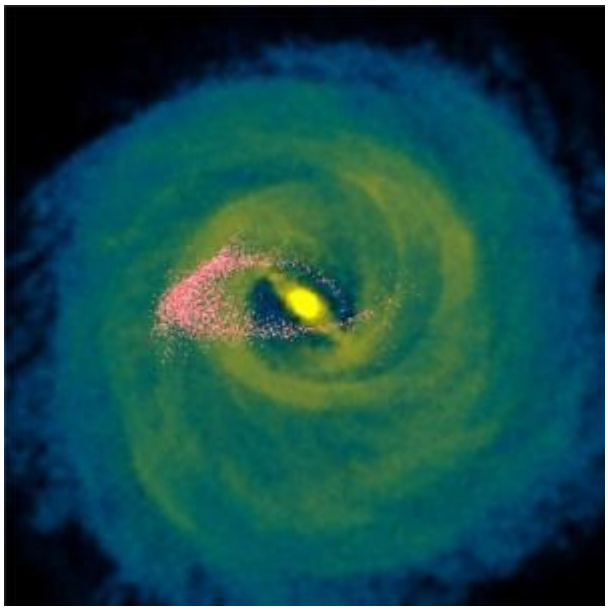
**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Ohio Supercomputer Center**.

http://www.sciencedaily.com/releases/2011/01/110131153524.htm

**Small Snack for Milky Way: Astrophysicists Find New Remnants of Neighboring Galaxy in Our Own**



*Visualization of the Aquarius stream and its location in the Milky Way. (Credit: Arman Khalatyan, AIP)*

ScienceDaily (Feb. 2, 2011) — An international team of astronomers led by Mary Williams from the Astrophysical Institute Potsdam (AIP) has discovered a new stream of stars in our Milky Way: the "Aquarius Stream," named after the constellation of Aquarius. The stream of stars is a remnant of a smaller galaxy in our cosmic neighbourhood, which has been pulled apart by the gravitational pull of the Milky Way about 700 million years ago. The discovery is a result of the measurement of the velocities of 250,000 stars with the RAVE Survey based at the Australian Astronomical Observatory's UK Schmidt Telescope at Siding Spring Observatory, NSW, Australia.

"I have a stream": with these words the 33-year old scientist from New Zealand enthusiastically presented her discovery to the audience of an international conference. The Aquarius stream was indeed hard to find. Contrary to practically all known streams of stars it is located within the galactic disk. Within the disk, the high concentration of stars of the Milky Way are blocking our way and the stream is indistinguishable from the rest of the stars in its shape. "It was right on our doorstep" Williams says, "but we just couldn't see it."

Using RAVE data, the astronomer has now measured the radial velocity of 12,000 stars in that region for the first time. In this way she found that 15 stars show a different velocity pattern than the others, moving at relative speeds of up to 15,000 km/h through the rotating disk of the Milky Way. The comparison of the star parameters with simulations showed that those stars form part of a larger stream of stars originating from a smaller neighbouring galaxy which was attracted by the Milky Way. This galaxy finally met the Milky Way and was pulled apart by it about 700 million of years ago, when the stream of stars formed dynamically. This makes the Aquarius stream a special and exceptionally young stream. Other known streams of stars are billions of years old and they are located in the outskirts of our galaxy.

Considering the special method of the RAVE survey which has led to the discovery of this stream, astronomers are optimistic to see many more discoveries of this kind in the future. RAVE is planned to measure the characteristics of up to a million of stars of our Milky Way until 2012. Williams has been part of the project from the very start and is managing the data processing at AIP since 2007.

"With RAVE, we want to understand the formation history of our Milky Way," Matthias Steinmetz, project leader of the multinational RAVE collaboration at the Astrophysical Institute Potsdam explains. "We want to find out how frequent those merging events with neighbouring galaxies have happened in the past and how many we are to expect in the future."

What is certain: in about three billion years the Milky Way will see its next huge collision with the Andromeda galaxy -- if none of the dwarf galaxies which have been discovered during the past years in our direct cosmic neighbourhood arrives first.

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Astrophysikalisches Institut Potsdam**, via AlphaGalileo.

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**Cassini Sends Back Postcards of Saturn's Moons**

*This image of Saturn's moon Helene was obtained by NASA's Cassini spacecraft on Jan. 31, 2011. (Credit: NASA/JPL/SSI)*

ScienceDaily (Feb. 2, 2011) — On Jan. 31, 2011, NASA's Cassini spacecraft passed by several of Saturn's intriguing moons, snapping images along the way. Cassini passed within about 60,000 kilometers (37,282 miles) of Enceladus and 28,000 kilometers (17,398 miles) of Helene. It also caught a glimpse of Mimas in front of Saturn's rings. In one of the images, Cassini is looking at the famous jets erupting from the south polar terrain of Enceladus.

To see more raw images, go to http://saturn.jpl.nasa.gov/photos/raw/ and click on "Search Images."

The Cassini-Huygens mission is a cooperative project of NASA, the European Space Agency and the Italian Space Agency. The Jet Propulsion Laboratory, a division of the California Institute of Technology in Pasadena, manages the Cassini-Huygens mission for NASA's Science Mission Directorate, Washington. The Cassini orbiter and its two onboard cameras were designed, developed and assembled at JPL. The imaging team is based at the Space Science Institute in Boulder, Colo.

For more information about the Cassini-Huygens mission, visit http://www.nasa.gov/cassini and http://saturn.jpl.nasa.gov.

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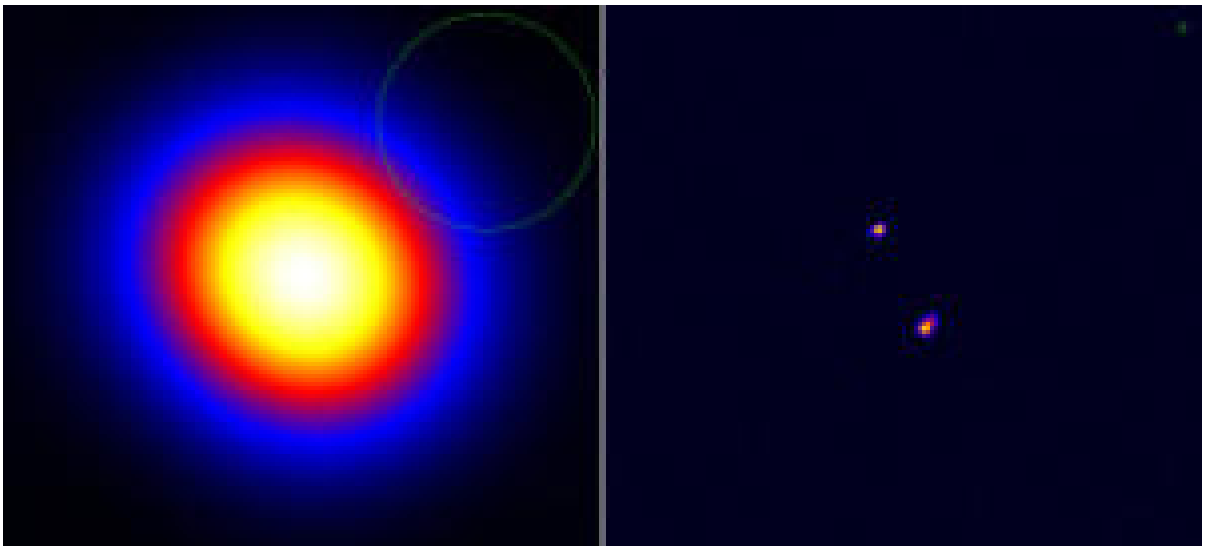
http://www.sciencedaily.com/releases/2011/02/110202001856.htm

**Giant Radio Telescope Goes Multi-National: First Images from LOFAR**



*A close up of the quasar 3C196. Both images show the exact same patch of sky around the quasar. On the left is the image taken by the Dutch LOFAR telescopes; the image on the right was taken by the combined multi-national LOFAR telescopes which together provide a resolution as fine as 0.2 arcseconds, close to 1/10000 of the diameter of the moon. The two bright spots show the locations where two jets from the massive black hole in the centre of the galaxy are hitting other material in the galaxy which hosts the quasar. (Credit: ASTRON and LOFAR commissioning teams led by Olaf Wucknitz (Bonn) and Reinout van Weeren (Leiden Observatory))*

ScienceDaily (Feb. 1, 2011) — In the quest to discover more about our Universe and the birth of stars and galaxies, a new UK telescope connected for the first time to others across Europe has delivered its first 'radio pictures'. The images of the 3C196 quasar (a black hole in a distant galaxy) were taken in January 2011 by the International LOFAR Telescope (ILT). LOFAR (Low Frequency Array), which is co-ordinated by ASTRON in the Netherlands, is a network of radio telescopes designed to study the sky at the lowest radio frequencies accessible from the surface of the Earth with unprecedented resolution.

The UK based telescope at STFC's Chilbolton Observatory in Hampshire, is the western most 'telescope station' in LOFAR. The addition of Chilbolton to other stations in Europe makes the LOFAR array almost 1000 km wide -- ten times as large as the original array in the Netherlands -- and creates the largest telescope in the world.

"This is a very significant event for the LOFAR project and a great demonstration of what the UK is contributing," said Derek McKay-Bukowski, STFC/SEPnet Project Manager at LOFAR Chilbolton. "The new images are three times sharper than has been previously possible with LOFAR. LOFAR works like a giant zoom lens -- the more radio telescopes we add, and the further apart they are, the better the resolution and sensitivity. This means we can see smaller and fainter objects in the sky which will help us to answer exciting questions about cosmology and astrophysics."

"This is fantastic," said Professor Rob Fender, LOFAR-UK Leader from the University of Southampton. "Combining the LOFAR signals together is a very important milestone for this truly international facility. For the first time, the signals from LOFAR radio telescopes in the Netherlands, France, Germany and the United Kingdom have been successfully combined in the LOFAR BlueGene/P supercomputer in the Netherlands. The connection between the Chilbolton telescope and the supercomputer requires an internet speed of 10

gigabits per second -- over 1000 times faster than the typical home broadband speeds," said Professor Fender. "Getting that connection working without a hitch was a great feat requiring close collaboration between STFC, industry, universities around the country, and our international partners."

"The images show a patch of the sky 15 degrees wide (as large as a thousand full moons) centred on the quasar 3C196," said Dr Philip Best, Deputy LOFAR-UK leader from the University of Edinburgh. "In visible light, quasar 3C196 (even through the Hubble Space Telescope) is a single point. By adding the international stations like the one at Chilbolton we reveal two main bright spots. This shows how the International LOFAR Telescope will help us learn about distant objects in much more detail."

LOFAR was designed and built by ASTRON in the Netherlands and is currently being extended across Europe. As well as deep cosmology, LOFAR will be used to monitor the Sun's activity, study planets, and understand more about lightning and geomagnetic storms. LOFAR will also contribute to UK and European preparations for the planned global next generation radio telescope, the Square Kilometre Array (SKA).

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**Story Source:**

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http://www.sciencedaily.com/releases/2011/02/110201132517.htm

**Inhalable Measles Vaccine Tested**

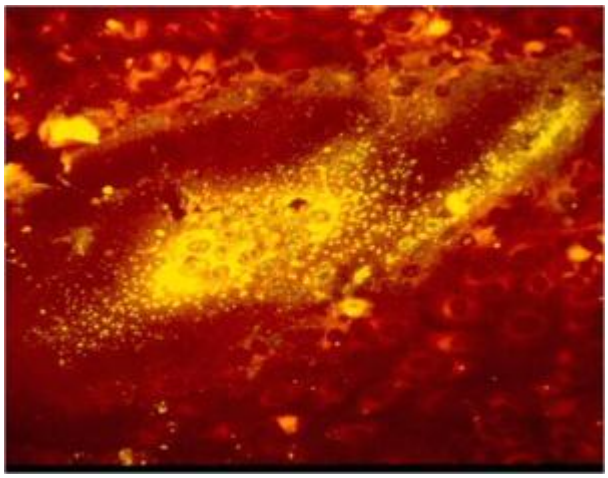


*Image of measles virus-infected cells. (Credit: Image courtesy of Johns Hopkins University Bloomberg School of Public Health)*

ScienceDaily (Feb. 1, 2011) — Sustained high vaccination coverage is key to preventing deaths from measles. Despite the availability of a vaccine, measles remains an important killer of children worldwide, particularly in less-developed regions where vaccination coverage is limited. A team of researchers, led by scientists at the Johns Hopkins Bloomberg School of Public Health and the University of Colorado, developed and successfully tested a dry powder, live-attenuated measles vaccine that can be inhaled. The novel vaccine was studied in rhesus macaques.

Results of the study are published in the January 31 edition of the journal *PNAS*.

The current measles vaccine requires two injections to provide full immunity -- one given at 9 to 12 months of age and another later in childhood. Special training for needle and syringe injections is needed to administer the vaccine, which requires refrigeration and is shipped as a powder that must be reconstituted and kept on ice in the field clinic. Such injections increase the risk of exposure to blood borne diseases.

According to the study, the new dry powder measles vaccine provided the macaques complete protection from measles with a single vaccine dose. The vaccine was delivered by aerosol using either one of two dry powder inhalers, the PuffHaler and the BD Solovent. No adverse effects were observed.

"An effective dry powder vaccine would be tremendously helpful in less developed regions where resources are limited," said Diane E. Griffin, MD, PhD, senior author of the study and chair of the W. Harry Feinstone Department of Molecular Microbiology and Immunology at the Bloomberg School of Public Health. "This vaccine can be shipped as powder and does not require reconstitution or special training to administer, which could greatly increase the ease and safety of measles vaccination worldwide."

Before a vaccine was developed in 1963, there were 130 million cases of measles each year resulting in more than 7 million deaths annually. Measles deaths were estimated to be 164,000 in 2008. Human trials for the dry powder measles vaccine are in development in India.

"The tests of inhalable dry powder vaccine at Johns Hopkins provide confidence that it can safely be tested in human volunteers after regulatory permission is given by Indian authorities," said Robert Sievers, professor at the CU Boulder and a Fellow of the Cooperative Institute of Research in Environmental Sciences. He is also CEO of Aktiv-Dry LLC and co-inventor of the PuffHaler and the new vaccine microparticles.

The research was supported by grants from the Bill & Melinda Gates Foundation and the Foundation for National Institutes of Health. Additional support was provided by the Marjorie Gilbert Scholarship Fund.

**Story Source:**

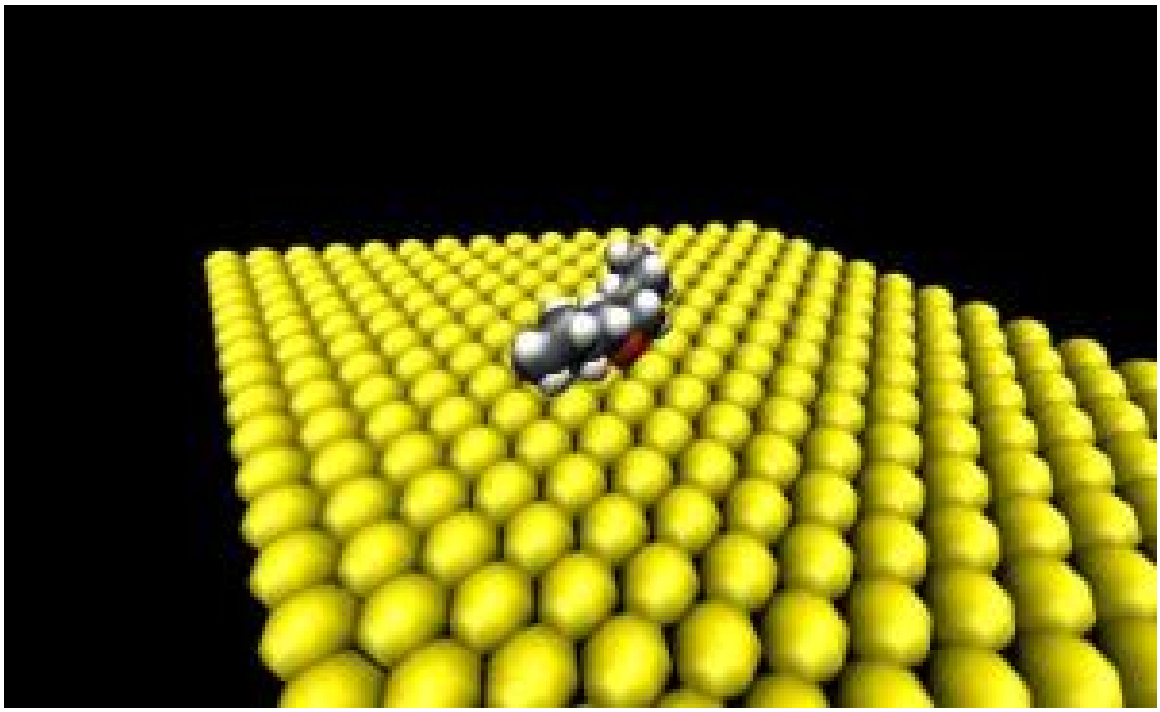
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Johns Hopkins University Bloomberg School of Public Health**.

**Journal Reference**:

1. W.-H. Lin, D. E. Griffin, P. A. Rota, M. Papania, S. P. Cape, D. Bennett, B. Quinn, R. E. Sievers, C. Shermer, K. Powell, R. J. Adams, S. Godin, S. Winston. **Successful respiratory immunization with dry powder live-attenuated measles virus vaccine in rhesus macaques**. *Proceedings of the National Academy of Sciences*, 2011; DOI: 10.1073/pnas.1017334108

http://www.sciencedaily.com/releases/2011/02/110201122236.htm

**Scientists Model Tiny Rotors, Key to Future Nanomachines**



*"This is no cartoon. It's a real molecule, with all the interactions taking place correctly," said Anatoly Kolomeisky as he showed an animation of atoms twisting and turning about a central hub like a carnival ride gone mad. (Credit: Jeff Fitlow/Rice University)*

ScienceDaily (Feb. 1, 2011) — "This is no cartoon. It's a real molecule, with all the interactions taking place correctly," said Anatoly Kolomeisky as he showed an animation of atoms twisting and turning about a central hub like a carnival ride gone mad.

Kolomeisky, a Rice University associate professor of chemistry, was offering a peek into a molecular midway where atoms dip, dive and soar according to a set of rules he is determined to decode.

Kolomeisky and Rice graduate student Alexey Akimov have taken a large step toward defining the behavior of these molecular whirligigs with a new paper in the American Chemical Society's *Journal of Physical Chemistry C*. Through molecular dynamics simulations, they defined the ground rules for the rotor motion of molecules attached to a gold surface.

It's an extension of their work on Rice's famed nanocars, developed primarily in the lab of James Tour, Rice's T.T. and W.F. Chao Chair in Chemistry as well as a professor of mechanical engineering and materials science and of computer science, but for which Kolomeisky has also constructed molecular models.

Striking out in a different direction, the team has decoded several key characteristics of these tiny rotors, which could harbor clues to the ways in which molecular motors in human bodies work.

The motion they described is found everywhere in nature, Kolomeisky said. The most visible example is in the flagella of bacteria, which use a simple rotor motion to move. "When the flagella turn clockwise, the bacteria move forward. When they turn counterclockwise, they tumble." On an even smaller level, ATP-

synthase, which is an enzyme important to the transfer of energy in the cells of all living things, exhibits similar rotor behavior -- a Nobel Prize-winning discovery.

Understanding how to build and control molecular rotors, especially in multiples, could lead to some interesting new materials in the continuing development of machines able to work at the nanoscale, he said. Kolomeisky foresees, for instance, radio filters that would let only a very finely tuned signal pass, depending on the nanorotors' frequency.

"It would be an extremely important, though expensive, material to make," he said. "But if I can create hundreds of rotors that move simultaneously under my control, I will be very happy."

The professor and his student cut the number of parameters in their computer simulation to a subset of those that most interested them, Kolomeisky said. The basic-model molecule had a sulfur atom in the middle, tightly bound to a pair of alkyl chains, like wings, that were able to spin freely when heated. The sulfur anchored the molecule to the gold surface.

While working on a previous paper with researchers at Tufts University, Kolomeisky and Akimov saw photographic evidence of rotor motion by scanning tunneling microscope images of sulfur/alkyl molecules heated on a gold surface. As the heat rose, the image went from linear to rectangular to hexagonal, indicating motion. What the pictures didn't indicate was why.

That's where computer modeling was invaluable, both on the Kolomeisky lab's own systems and through Rice's SUG@R platform, a shared supercomputer cluster. By testing various theoretical configurations -- some with two symmetrical chains, some asymmetrical, some with only one chain -- they were able to determine a set of interlocking characteristics that control the behavior of single-molecule rotors.

First, he said, the symmetry and structure of the gold surface material (of which several types were tested) has a lot of influence on a rotor's ability to overcome the energy barrier that keeps it from spinning all the time. When both arms are close to surface molecules (which repel), the barrier is large. But if one arm is over a space -- or hollow -- between gold atoms, the barrier is significantly smaller.

Second, symmetric rotors spin faster than asymmetric ones. The longer chain in an asymmetric pair takes more energy to get moving, and this causes an imbalance. In symmetric rotors, the chains, like rigid wings, compensate for each other as one wing dips into a hollow while the other rises over a surface molecule.

Third, Kolomeisky said, the nature of the chemical bond between the anchor and the chains determines the rotor's freedom to spin.

Finally, the chemical nature of rotating groups is also an important factor.

Kolomeisky said the research opens a path for simulating more complex rotor molecules. The chains in ATP-synthase are far too large for a simulation to wrangle, "but as computers get more powerful and our methods improve, we may someday be able to analyze such long molecules," he said.

The Welch Foundation, the National Science Foundation and the National Institutes of Health funded the research.

An animation of a rotor simulation: http://www.youtube.com/watch?v=GJJxSs6AkeM

**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Rice University**.

**Journal Reference**:

1. Alexey Akimov, Anatoly B. Kolomeisky. **Dynamics of Single-Molecule Rotations on Surfaces that Depend on Symmetry, Interactions, and Molecular Sizes**. *The Journal of Physical Chemistry C*, 2011; 115 (1): 125 DOI: 10.1021/jp108062p

http://www.sciencedaily.com/releases/2011/02/110201110913.htm

**Clean Streets and Intact Road Surfaces Help to Keep the Air Clean**

*Empa's Traffic Load Simulator during field trials. (Credit: Image courtesy of Empa)*

ScienceDaily (Feb. 1, 2011) — Road traffic is one of the main sources of fine particulate matter in the atmosphere, above all when the weather situation favors the creation of winter smog. Vehicle tailpipe emissions are responsible for just less than half of the fine particles, however. The majority of this pollutant is produced by mechanical wear and resuspension of dust due to air turbulence from passing vehicles, as a study by atmospheric specialists from Empa and PSI has shown.

**Winter smog and fine particulates**

The quality of our air has significantly improved over the past decades. However, the high level of pollutants in the air during episodes of winter smog remains a problem. Favorable conditions for winter smog episodes occur during so-called temperature inversions. In these typically windless high-pressure zones, a layer of warm air lies above cold air near to the ground with no mixing between the two. The fine particle matter released by combustion processes, and mechanical wear, and that thrown up again swirling air can no longer move into the higher layers of the atmosphere, with the result that the concentration at ground level increases.

**Fine particles from road wear and turbulence**

In towns, wear debris from vehicle brakes, tires, and the road surface itself, as well as the resuspension of "normal" dust, are responsible for more than half the fine particle emissions due to road traffic. Scientists from Empa's Air Pollution & Environmental Technology Laboratory had already shown this in an earlier research project. What remained unclear, though, was how much the individual processes contributed to the total emissions, since road surface wear debris and road dust have similar chemical compositions, consisting primarily of mineral particles with diameters between 2.5 and 10 micrometers. The researchers therefore first had to find a way of assigning emissions to their sources.

In solving this problem, the interdisciplinary nature of Empa's activities proved to be a trump card. Working together with the Road Engineering / Sealing Components Laboratory, the atmospheric specialists developed a new measuring method using Empa's Traffic Load Simulator. This machine is normally used to investigate the time-accelerated resistance to wear of road surfaces under extreme load conditions.

**Road wear: the quality of the surface is decisive**

The results of a recently completed project, which was financially supported by the Swiss Federal Offices for Roads (FEDRO) and for the Environment (FOEN), show that in urban areas wear debris from vehicle brakes contributes about 20% of the fine particle emissions from road traffic because of the stop and go nature of traffic flow. Particulate matter due to tire wear, on the other hand, was hardly significant.

In this situation the state of repair of the road plays a decisive role. If the road surface is intact, then emissions due to direct road wear remain at low levels. Damaged roads surfaces, on the other hand, can result in quite high fine particle emission levels. As far as the resuspension of fine particulate matter due to air turbulence is concerned, the level is determined primarily by how dirty the road surface is -- if it is dirty, then this becomes the dominating factor. And finally, the characteristics of the road surface also have an influence on fine particle emissions. With the porous road surfaces which are often used today (because they reduce noise and have favorable properties in rainy conditions) the quantity of resuspended particle matter was significantly less than that encountered on compact road surfaces. Whether this is also true when porous surfaces age and their pores may become blocked remains an open question.

What this means is that keeping roads as clean as possible and in good repair makes a significant contribution to reducing the problem of fine particulate emissions.

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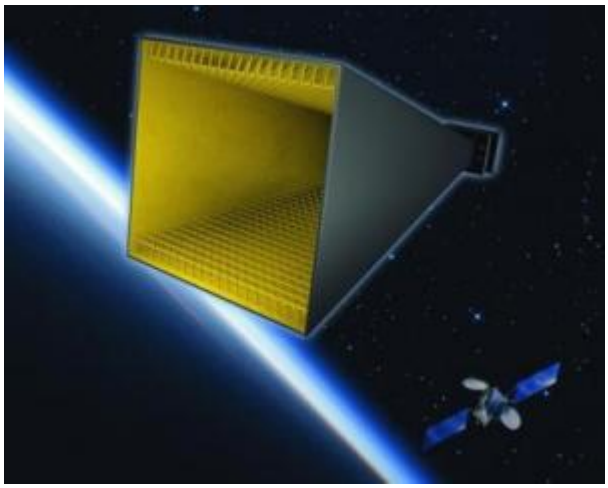
**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Empa**.

http://www.sciencedaily.com/releases/2011/02/110201101734.htm

**Metamaterials Approach Makes Better Satellite Antennas**



*This is a 3-D rendering of a metamaterial-lined feed horn antenna with low loss, low weight and over an octave bandwidth for satellite communications shown with satellite. (Credit: Penn State)*

ScienceDaily (Feb. 1, 2011) — Cheaper, lighter and more energy-efficient broadband devices on communications satellites may be possible using metamaterials to modify horn antennas, according to engineers from Penn State and Lockheed Martin Corp.

"Existing horn antennas have adequate performance, but have undergone little change over several decades except for advances in more accurate modeling techniques," said Erik Lier, technical Fellow, Lockheed Martin Space Systems Co. "Modifications enabled by metamaterials can either enhance performance, or they can lower the mass and thus lower the cost of putting the antenna in space."

Lighter antennas cost less to boost into space and more energy-efficient antennas can reduce the size of storage batteries and solar cells, which also reduces the mass.

Metamaterials derive their unusual properties from structure rather than composition and possess exotic properties not usually found in nature.

"Working with Penn State, we decided that the first year we were going focus on applications for radio frequency antennas, where we thought we had a reasonable chance to succeed," said Lier.

According to Douglas H. Werner, professor of electrical engineering, Penn State, this is one of the first practical implementations of electromagnetic metamaterials that makes a real world device better.

"These results also help lay to rest the widely held viewpoint that metamaterials are primarily an academic curiosity and, due to their narrow bandwidth and relatively high loss, will never find their way into real-world devices," the researchers report in the current issue of *Nature Materials*.

They specifically designed their electromagnetic metamaterials to avoid previous limitations of narrow bandwidth and high intrinsic material loss, which results in signal loss. Their aim was not to design theoretical metamaterial-enhanced antennas, but to build a working prototype.

"We have developed design optimization tools that can be employed to meet real device requirements," said Werner. "We can optimize the metamaterial to get the best device performance by tailoring its properties across a desired bandwidth to meet the specific needs of the horn antenna."

The researchers wanted an antenna that could work over a broad band of frequencies -- at least an octave -- and improve upon existing antennas. An octave in the radio frequency spectrum is a stretch of bandwidth where the upper frequency is twice the lower frequency -- 3.5 to 7 gigahertz for example, which is wider than the standard C-band.

Horn antennas are part of communications satellites that relay television and radio signals, telephone calls and data around the world. Two commonly used microwave bands on satellites are C-band -- used for long-distance radio and telecommunications -- and Ku-band -- used for broadcast television and remote television uplinks.

The researchers, who also included Qi Wu and Jeremy A. Bossard, postdoctoral fellows in electrical engineering, and Clinton P. Scarborough, graduate student, electrical engineering, all from Penn State, designed horn antenna liners from metamaterials with special low-index electromagnetic properties -- effective refractive index between zero and one -- which do not physically exist in natural materials. To increase bandwidth and decrease loss, the antenna liners needed to have repetitive structure considerably smaller than the wavelengths the antenna is designed to transmit.

Ku-band -- 12 to 18 gigahertz -- antennas require small structural intervals that are easily fabricated using conventional printed circuit board manufacturing techniques, while super extended C-band -- 3.4 to 6.725 gigahertz -- could be achieved with a simple wire grid structure that is easily manufactured with an interval of about a quarter of an inch between wires. The researchers chose to convert the C-band application into a prototype.

"This is just an example of what we can do," said Lier. "It opens up the way for a broader range of other applications and is proof of the new metamaterial technology and an example of how it can be used."

The Lockheed Martin University Research Initiative program funded this project.

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Penn State**.

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**Journal Reference**:

1. Erik Lier, Douglas H. Werner, Clinton P. Scarborough, Qi Wu, Jeremy A. Bossard. **An octave-bandwidth negligible-loss radiofrequency metamaterial**. *Nature Materials*, 2011; DOI: 10.1038/nmat2950

http://www.sciencedaily.com/releases/2011/01/110131133408.htm

**Bugs Might Convert Biodiesel Waste Into New Fuel**

*UAHuntsville graduate student Keerthi Venkataramanan. (Credit: UAHuntsville)*

ScienceDaily (Feb. 1, 2011) — A strain of bacteria found in soil is being studied for its ability to convert waste from a promising alternative fuel into several useful materials, including another alternative fuel.

A graduate student at The University of Alabama in Huntsville is developing biological tools to make products from crude glycerol -- a waste material from the production of biodiesel. The research is being funded by the National Science Foundation.

Disposing of glycerol has been a problem for the biodiesel industry, according to Keerthi Venkataramanan, a student in UAHuntsville's biotechnology Ph.D. program. "Many companies have had problems disposing of it. The glycerol you get as a byproduct isn't pure, so it can't be used in cosmetics or animal feeds. And purifying it costs three times as much as the glycerol is worth."

The volume of glycerol produced is also daunting: About 100,000 gallons of glycerol is produced with every million gallons of biodiesel manufactured from animal fats or vegetable oils. (In 2009 more than 500 million gallons of biodiesel were produced in the U.S. while more than 2.75 billion gallons were produced in Europe.)

Two major American companies "were made to close biodiesel plants in Europe because they couldn't dispose of their crude glycerol," Venkataramanan said. He is working with the *Clostridium pasteurianum* bacteria, which "eats" glycerol and produces several potentially useful byproducts.

"This strain is found deep in the soil," he said. "It was originally studied for its ability to 'fix' nitrogen from the air."

The bacteria uses glycerol as a carbohydrate source. From that they produce three alcohol byproducts -- butanol, propanediol and ethanol -- plus acetic acid and butyric acid. Butanol is a particularly interesting byproduct.

"Butanol is a big alcohol molecule, twice as big as ethanol," Venkataramanan said. "You can use it as an industrial solvent and it can be used in cars, replacing gasoline with no modifications. It doesn't have some of the problems you have with ethanol, such as rapid evaporation. And ethanol is a two-carbon molecule, but butanol is a four-carbon molecule so its energy value is much higher. In fact, there are plans to use it for jet fuel.

"You can also get butanol from crude oil, but this biological process is less polluting."

In their present form, the bacteria convert about 30 to 35 percent of their gylcerol meals into butanol and another 25 to 30 percent into a chemical used to make plastics.

Venkataramanan is looking at different strategies to improve that yield. He is also studying the bacteria's genes to see if a more productive strain can be bioengineered.

Other groups in the U.S. and abroad are studying a variety of fungi, bacteria and algae for glycerol conversion, but Venkataramanan says his strain has several advantages. Some of the bacteria being studied are dangerous pathogens, while Clostidium pasteurianum "is a completely non-pathogenic strain," he said. "An accidental release is not a big deal. You get it from the soil, so if you spill any you're putting it back in the soil."

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Alabama Huntsville**.

http://www.sciencedaily.com/releases/2011/01/110128150230.htm

**Single Molecule Controlled at Room Temperature: Tiny Magnetic Switch Discovered**

*Professor Rainer Herges (left) and Marcel Dommaschk irradiate a solution of the molecular magnet switch with blue-green and blue-violet light. The researchers can change the magnetic state of the molecule using the light waves. (Credit: CAU/Torsten Winkler)*

ScienceDaily (Feb. 1, 2011) — A Kiel research group headed by the chemist, Professor Rainer Herges, has succeeded for the first time in directly controlling the magnetic state of a single molecule at room temperature. The paper was recently published in the journal *Science.* The switchable molecule, which is the result of a sub-project of the Collaborative Research Centre 677 "Function by Switching," could be used both in the construction of tiny electromagnetic storage units and in the medical imaging.

The scientists at the Kiel University developed a molecular machine constructed in a similar way to a record player. The molecule consists of a nickel ion surrounded by a pigment ring (porphyrin), and a nitrogen atom which hovers above the ring like the tone arm on a record player. "When we irradiate this molecule with blue-green light, the nitrogen atom is placed exactly vertically to the nickel ion like a needle," Rainer Herges explains. "This causes the nickel ion to become magnetic, because the pairing of two electrons is cancelled out," says the chemistry professor. The counter effect is blue-violet light: The nitrogen atom is raised, the electrons form a pair and the nickel ion is no longer magnetic. "We can repeat this switching of the magnetic state over 10,000 times by varied irradiation with the two different wavelengths of light, without wearing out the molecular machine or encountering side reactions," Herges enthuses.

The switch which has been discovered, with its diameter of only 1.2 nanometres, could be used as a tiny magnetic reservoir in molecular electronics. Most of all, hard disk manufacturers may be interested in this, as a higher storage capacity can be achieved by reducing the size of the magnetic particles on the surface of the disks. Professor Herges also believes the use of the magnetic switch in the medical field is feasible: "The record player molecule can be used intravenously as a contrast agent in MRT (magnetic resonance tomography) in order to search for tumours or constricted blood vessels. Initial tests in the University Medical Center Schleswig-Holstein's neuroradiology department were successful."

As the signal-to-noise ratio is improved by the switching process, a smaller amount of the contrast agent is required than for the magnetic salts currently being used. In addition, according to Herges, the molecular machine could also serve as a basis for developing new contrast agents to depict such features as temperature, pH value or even certain biochemical markers in the body in a three-dimensional form. Rainer Herges lists the possible fields of application: "Using contrast agents such as these, it could be possible to localise centres of inflammation, detect tumours and visualise many metabolic processes."

**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Christian-Albrechts-Universitaet zu Kiel**, via AlphaGalileo.

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**Journal Reference**:

1. S. Venkataramani, U. Jana, M. Dommaschk, F. D. Sonnichsen, F. Tuczek, R. Herges. **Magnetic Bistability of Molecules in Homogeneous Solution at Room Temperature**. *Science*, 2011; 331 (6016): 445 DOI: 10.1126/science.1201180

http://www.sciencedaily.com/releases/2011/01/110128075718.htm

**Low-Energy Remediation With Patented Microbes: Naturally Occurring Microbes Break Down Chlorinated Solvents**

*Savannah River National Laboratory personnel take readings at the site of the demonstration of MicroCED microbial consortium for natural cleanup of chlorinated solvents. (Credit: Savannah River National Laboratory)*

ScienceDaily (Feb. 1, 2011) — Using funding provided under the American Reinvestment and Recovery Act, the U.S. Department of Energy's Savannah River National Laboratory has launched a demonstration project near one of the Savannah River Site's former production reactor sites to clean up chemically contaminated groundwater, naturally.

A portion of the subsurface at the Site's P Area has become contaminated with chlorinated volatile organic compounds that are essentially like dry-cleaning fluid. SRNL and Clemson University have patented a consortium of microbes that have an appetite for that kind of material.

"If they are as effective as we expect in cleaning up the chemical contamination in the groundwater, it will be far cheaper than energy-intensive types of cleanup, such as pump-and-treat techniques or soil heating," said Mark Amidon, SRNL's project manager for the demonstration.

The mixture of microbes was found occurring naturally at SRS, where they were feeding on the same kind of chemical that was in groundwater seeping into an SRS creek. SRNL and Clemson University worked together on the discovery and characterization of the microbes. The mixture is called MicroCED, for "microbiological-

based chlorinated ethene destruction," and when injected into the subsurface can completely transform lethal chlorinated ethenes to safe, nontoxic end products.

In P Area, the first step was to make groundwater conditions better for the microbes. "In late summer we injected more than 5,000 gallons of emulsified soybean oil, buffering agents and amendments and 108,000 gallons of water to get the dissolved oxygen and acidity right," Amidon said. "Once the conditions were right, we started injecting the store of microbes we've been culturing." An initial application of 18 gallons of the microbes was recently injected to get things started. By the end of the demonstration, approximately 1,500 gallons of the microbes could be injected into the demonstration site.

Amidon estimated that it would take a year or more to see appreciable results. "You can't rush Mother Nature." The current test site is about 100 by 120 feet at the surface and 85 to 100 feet below ground, and will be used to determine whether this approach should be used for full-scale treatment of the area. "If we were to go full-scale, there would be a 'biowall' about 1,000 feet long and between 50 and 145 feet below ground," Amidon said.

SRNL has been working in bioremediation for many years, using existing microorganisms as part of the strategy. The difference here is the culturing and injection of quantities of a specific mixture of microbes for use on chlorinated solvents. (Another SRNL invention, BioTiger™, is a consortium of microbes used on petroleum contamination.)

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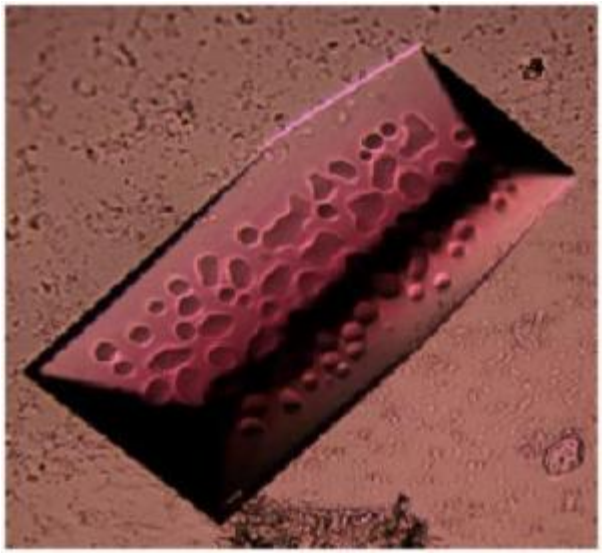
**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **DOE/Savannah River National Laboratory**, via EurekAlert!, a service of AAAS.

http://www.sciencedaily.com/releases/2011/01/110131133001.htm

**Key Step in the Development of a Norovirus Treatment**



*This is a protein crystal of the Southampton norovirus protease bound to the inhibitor. (Credit: University of Southampton)*

ScienceDaily (Feb. 1, 2011) — With the number of norovirus infection cases rising across the country, scientists from the University of Southampton have successfully crystallised a key norovirus enzyme, which could help in the development of a norovirus treatment.

Noroviruses are recognised world-wide as the most important cause of epidemic nonbacterial gastroenteritis (stomach bugs) and pose a significant public health burden, with an estimated one million cases per year in the UK. In the past, noroviruses have also been called 'winter vomiting viruses'.

By crystallising the key protease enzyme, the research team from the University has been able to design an inhibitor that interacts with the enzyme from the 'Southampton' norovirus. The inhibitor works by preventing the enzyme in the norovirus from working, stopping the spread of infection.

The virus is called the Southampton virus because this particular virus was first found in an outbreak that came from a family in Southampton. Traditionally, individual noroviruses are named after the place from which the virus was first found, so for example the very first norovirus is known as Norwalk virus because it discovered in Norwalk in Ohio, America.

University of Southampton virologist Professor Ian Clarke says:

"Noroviruses place a huge burden on the NHS. This is an important step forward in the rational design of new drugs to treat norovirus infections. Now we know the drug works in the test tube, the next step is to see whether we can modify and deliver it to the site where the virus grows."

The research team hopes to translate their laboratory findings into an antiviral treatment for norovirus infection.

The work was performed by research student Rob Hussey in collaboration with University Professor Shoolingin-Jordan, the norovirus research group at Southampton General Hospital and Professor Jon Cooper

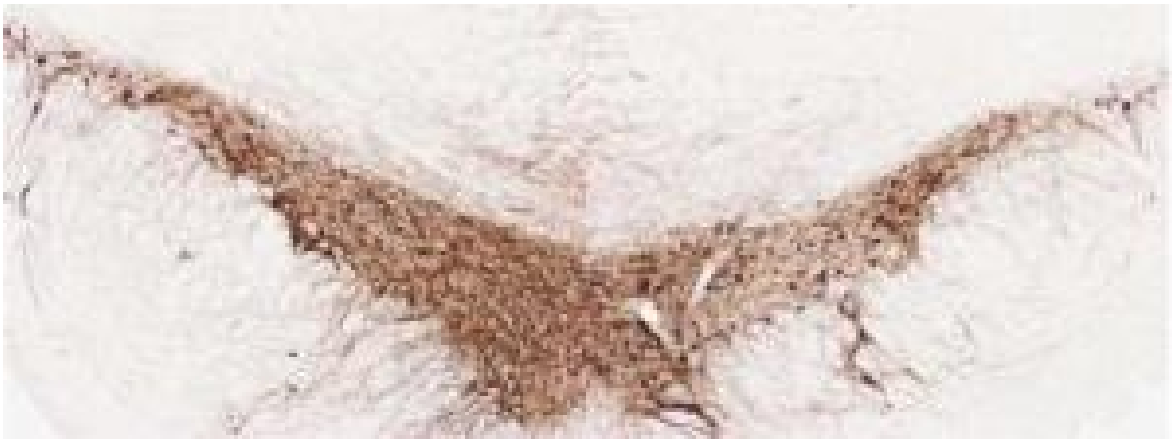
at University College London. The project was part funded by the University of Southampton, the Hope Charity and the Wellcome Trust.

**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Southampton**.

http://www.sciencedaily.com/releases/2011/02/110201084024.htm

**New Model for Studying Parkinson's: Swiss Researchers Develop New, Working Mammalian Model to Combat Genetic Causes of the Disease**



*This is a cervical slice showing the healthy left-hand side of the brain and the damaged, Parkinson's disease side with lesions provoked by the LKKR2 gene mutation. (Credit: EPFL)*

ScienceDaily (Feb. 1, 2011) — Evidence is steadily mounting that genetic factors play an important role in many cases of Parkinson's disease (PD). In a study published February 2, 2011, online in the *Journal of Neuroscience*, researchers from the Ecole Polytechnique Fédérale de Lausanne (EPFL) in Switzerland report a new mammalian model for studying a specific gene mutation commonly found in PD sufferers, opening the door to new drugs to fight the malady.

"This is a great step forward toward a more comprehensive understanding of how the disease works, and how it can be diagnosed and treated," explains neuroscientist and EPFL President Patrick Aebischer, lead author of the study.

PD is a common neurodegenerative disease that greatly reduces quality of life and costs the United States around 23 billion dollars a year. Until now, researchers have encountered difficulty in reproducing PD pathology in animals because of an incomplete understanding of the disease.

Recently, a mutation of the gene coding for LRRK2, a large enzyme in the brain, has emerged as the most prevalent genetic cause of PD (genetics are implicated in about 10 percent of all PD cases). When the enzyme is mutated, it becomes hyperactive, causing the death of vulnerable neurons and leading to a reduction in levels of the brain neurotransmistter dopamine. This decrease in dopamine eventually triggers the symptoms characteristic of Parkinson's, such as tremors, instability, impaired movement, and later stage dementia.

Now, with funding from the Michael J. Fox Foundation for Parkinson's Research, Aebischer and his team in the Neurodegenerative Studies Laboratory at EPFL, have successfully introduced mutant LRRK2 enzyme into one hemisphere of a rat brain, resulting in the same PD manifestations that occur in humans in one side of the rodent's body. To do this, the researchers spent two years producing and optimizing a viral vector to deliver mutated, LRRK2 coding DNA into the rat brain. LRRK2 is a large and complicated enzyme and designing a vector capable of transporting its extremely long genetic code was no small feat.

The new animal model developed by EPFL is sure to benefit future Parkinson's research. The fact that LRRK2 is an enzyme -- a catalyzing protein involved in chemical reactions -- makes it drug accessible and therefore of specific interest to researchers looking for neuroprotective strategies, or pharmaceutical treatments that halt or slow disease progression by protecting vulnerable neurons. Armed with the LRRK2

model, new pharmaceuticals that inhibit the hyper-activity of the enzyme could one day prevent the destructive chain of events that leads to neurodegeneration and devastation in many with PD.

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**Story Source:**

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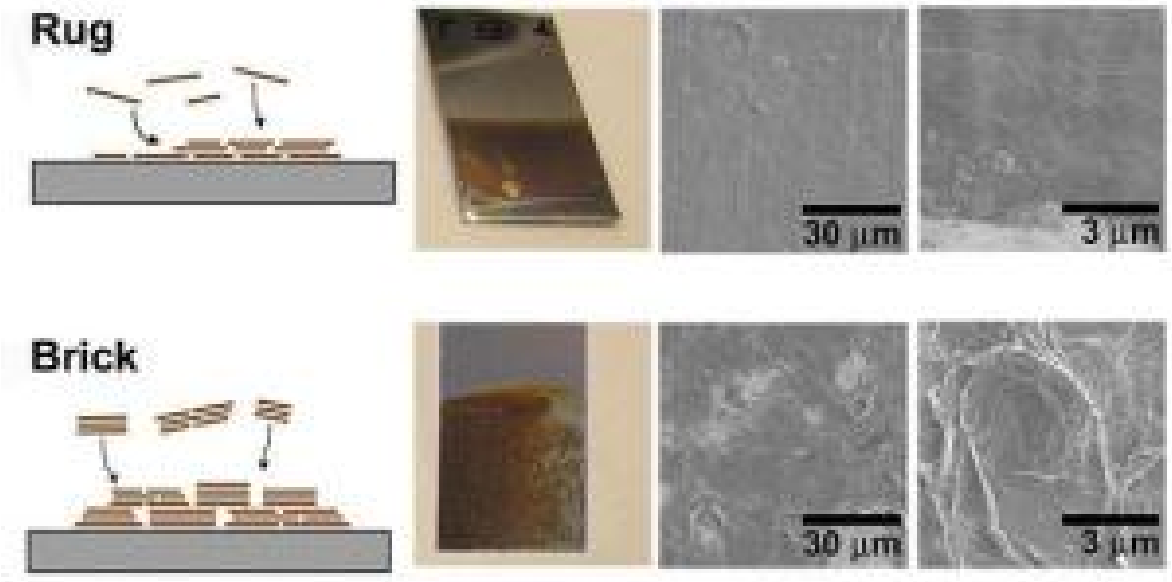
http://www.sciencedaily.com/releases/2011/02/110201172609.htm

**Tuning Graphene Film So It Sheds Water**




*Dickerson can tweak the process for creating films of graphene oxide so they are formed by "rug" process, above, that is extreme smooth and "water loving" or by a "brick" process, below, that is rough and "water hating." (Credit: Image courtesy of James Dickerson)*

ScienceDaily (Feb. 1, 2011) — Windshields that shed water so effectively that they don't need wipers. Ship hulls so slippery that they glide through the water more efficiently than ordinary hulls.

These are some of the potential applications for graphene, one of the hottest new materials in the field of nanotechnology, raised by the research of James Dickerson, assistant professor of physics at Vanderbilt.

Dickerson and his colleagues have figured out how to create a freestanding film of graphene oxide and alter its surface roughness so that it either causes water to bead up and run off or causes it to spread out in a thin layer.

"Graphene films are transparent and, because they are made of carbon, they are very inexpensive to make," Dickerson said. "The technique that we use can be rapidly scaled up to produce it in commercial quantities."

His approach is documented in an article published online by the journal *ACS Nano* on Nov. 26.

Graphene is made up of sheets of carbon atoms arranged in rings -- something like molecular chicken wire. Not only is this one of the thinnest materials possible, but it is 10 times stronger than steel and conducts electricity better at room temperature than any other known material. Graphene's exotic properties have attracted widespread scientific interest, but Dickerson is one of the first to investigate how it interacts with water.

Many scientists studying graphene make it using a dry method, called "mechanical cleavage," that involves rubbing or scraping graphite against a hard surface. The technique produces sheets that are both extremely thin and extremely fragile. Dickerson's method can produce sheets equally as thin but considerable stronger than those made by other techniques. It is already used commercially to produce a variety of different

coatings and ceramics. Known as electrophoretic deposition, this "wet" technique combines an electric field within a liquid medium to create nanoparticle films that can be transferred to another surface.

Dickerson and his colleagues found that they could change the manner in which the graphene oxide particles assemble into a film by varying the pH of the liquid medium and the electric voltage used in the process. One pair of settings lay down the particles in a "rug" arrangement that creates a nearly atomically smooth surface. A different pair of settings causes the particles to clump into tiny "bricks" forming a bumpy and uneven surface. The researchers determined that the rug surface causes water to spread out in a thin layer, while the brick surface causes water to bead up and run off.

Dickerson is pursuing an approach that could create film that enhances these water-associated properties, making them even more effective at either spreading out water or causing it to bead up and run off. There is considerable academic and commercial interest in the development of coatings with these enhanced properties, called super-hydrophobic and super-hydrophilic. Potential applications range from self-cleaning glasses and clothes to antifogging surfaces to corrosion protection and snow-load protection on buildings. However, effective, low-cost and durable coatings have yet to make it out of the laboratory.

Dickerson's idea is to apply his basic procedure to "fluorographene" -- a fluorinated version of graphene that is a two-dimensional version of Teflon -- recently produced by Kostya S. Novoselov and Andre K. Geim at the University of Manchester, who received the 2010 Nobel Prize for the discovery of graphene. Normal fluorographene under tension should be considerably more effective in repelling water than graphene oxide. So there is a good chance a "brick" version and a "rug" version would have extreme water-associated effects, Dickerson figures.

Graduate students Saad Hasan, John Rigueur, Robert Harl and Alex Krejci, postdoctoral research scientist Isabel Gonzalo-Juan and Associate Professor of Chemical and Biomolecular Engineering Bridget R. Rogers contributed to the research, which was funded by a Vanderbilt Discovery grant and by the National Science Foundation.

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Vanderbilt University**. The original article was written by David Salisbury.

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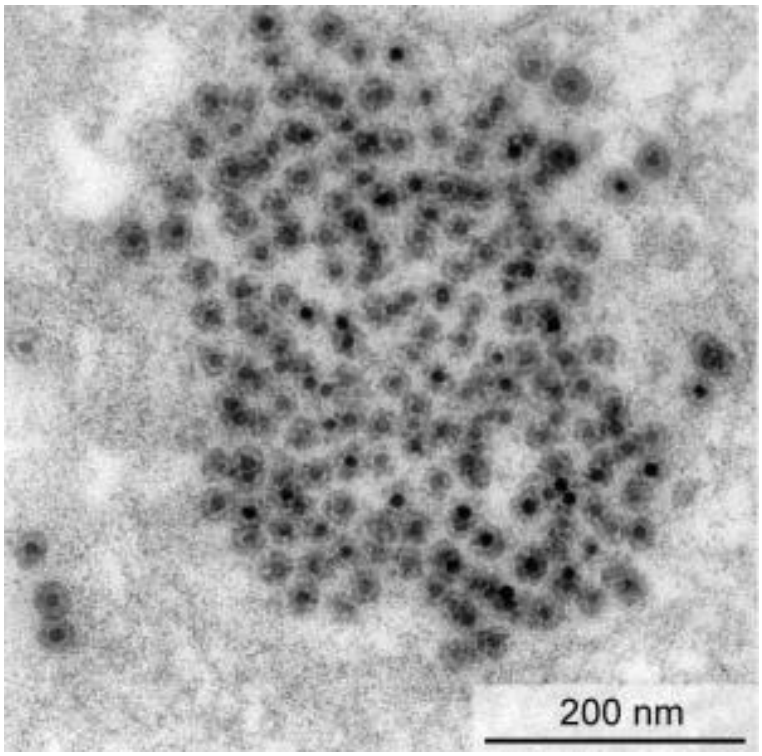
**Journal Reference**:

1. Saad A. Hasan, John L. Rigueur, Robert R. Harl, Alex J. Krejci, Isabel Gonzalo-Juan, Bridget R. Rogers, James H. Dickerson. **Transferable Graphene Oxide Films with Tunable Microstructures**. *ACS Nano*, 2010; 4 (12): 7367 DOI: 10.1021/nn102152x

http://www.sciencedaily.com/releases/2011/02/110201155628.htm

**How Safe Is Nano? Nanotoxicology: An Interdisciplinary Challenge**




*The rapid development of nanotechnology has increased fears about the health risks of nano-objects. (Credit: Image courtesy of Empa)*

ScienceDaily (Feb. 1, 2011) — The rapid development of nanotechnology has increased fears about the health risks of nano-objects. Are these fears justified? Do we need a new discipline, nanotoxicology, to evaluate the risks? Empa scientists Harald F. Krug and Peter Wick discuss these questions in the new edition of the journal *Angewandte Chemie*.

"Research into the safety of nanotechnology combines biology, chemistry, and physics with workplace hygiene, materials science, and engineering to create a truly interdisciplinary research field," explain Krug and Wick. "There are several factors to take into account in the interaction of nano-objects with organisms," they add. The term nanotoxicology is fully justified. "Nanoscale particles can enter into cells by other means of transport than larger particles."

Another critical feature is the large surface area of nano-objects relative to their volume. If a similar amount of substance is absorbed, an organism comes into contact with a significantly larger number of molecules with nanoparticles than with larger particles. Dose-effect relationships cannot therefore be assumed to be the same. Furthermore, chemical and physical effects that do not occur with larger particles may arise. "Whether the larger or smaller particle is more toxic in any given case cannot be predicted," according to the authors. "Clearly, the type of chemical compound involved and its conformation in a specific case can also not be ignored." Carbon in the form of diamond nanoparticles is harmless, whereas in the form of nanotubes -- depending on length and degree of aggregation -- it may cause health problems. It is also thus impossible to avoid considering each nanomaterial in turn.

For a risk assessment, it is also necessary to keep in mind what dosage would be considered realistic and that not every observed biological effect automatically equates to a health risk.

Krug and Wick indicate that a large amount of data about the biological effects of nanomaterials is available, but not all studies are reliable. Sometimes it is not possible to reproduce the specific material tested or the conditions. "By pointing out methodological inadequacies and making concrete recommendations for avoiding them, we are hoping to contribute to a lasting improvement in the data," state Krug and Wick.

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Empa**.

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**Journal Reference**:

1. Harald F. Krug, Peter Wick. **Nanotoxikologie - eine interdisziplinäre Herausforderung**. *Angewandte Chemie*, 2011; DOI: 10.1002/ange.201001037

http://www.sciencedaily.com/releases/2011/02/110201132521.htm

**An Ice-Bar Made from Pure Ice**

*Construction of the Ice Dome with a 10 meter diameter. (Credit: Image courtesy of Vienna University of Technology)*

ScienceDaily (Feb. 1, 2011) — A team of civil engineers from the Vienna University of Technology (TU Vienna) built an ice dome with 10 m diameter in Obergurgl using an ingenious construction method.

Building structures from ice and snow is probably something everyone has tried in their youth. Today, using ice as a building material is also something which is being discussed by scientists. The research group supervised by Prof. Kollegger of the Institute of Structural Engineering is looking into ways of building large-scale, stable domes made of ice. Following a thorough preparatory and research phase, a new ice dome construction method is now being put to the test in Obergurgl -- a world first. This structure, showing more than 10 metres free span, is now home to a bar -- for as long as the temperatures are low enough.

Using ice as a building material has actually been done before: entire ice hotels have been built in e.g. Scandinavia. "In most cases though the spans of the structures are small or the ice is not a load-bearing component and merely acts as cladding for the actual construction," explains Prof. Kollegger. The team of Vienna University of Technology has developed an ice dome which presents a stable and free-standing safe structure, and does not require additional support using other building materials. Theoretical calculations and several experiments have been carried out in this area over the past few years and, thanks to the latest technology, ice structures which are large and stable enough to actually be used as serviceable buildings can now be built.

**Slow deformation process - like a glacier**

First, a 20 cm-thick plate of ice is cut into 16 segments. These two-dimensional segments have then to be transformed into a three-dimensional structure. The University research team takes advantage of one property of ice, known as "creep behaviour." If pressure is applied to the ice, it can slowly change its shape without breaking. Glacial creep functions similarly. "The segments of ice are placed on stacks of wood. Then, under the load of its own weight, the ice begins to change shape all by itself, resulting in a curved dome segment," explains Sonja Dallinger, research assistant at the Institute of Structural Engineering and on-site manager of the Obergurgl construction experiment.

The greatest challenge that had to be faced was the prevention of any breakage of the individually curved segments when assembling the dome. To solve this issue, a wooden tower was erected and the dome segments

were held together by means of steel chains. The wooden tower could only be removed once all the segments had been positioned correctly and the ice dome stood on its own.

**Austria's coolest bar**

The ice dome was constructed in front of the spa area of the Hotel Alpina in Obergurgl and is presently being used as an ice bar. The drinks are definitely pretty cool -- and of course it's up to you whether or not to wear a cocktail dress!

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Vienna University of Technology**.

http://www.sciencedaily.com/releases/2011/02/110201101732.htm

**Major Ecological Study on Borneo's Deforested Landscapes Launched**

*Photo showing the juxtaposition of oil palm with forest, the focus of SAFE Project in Malaysian Borneo. (Credit: Rob Ewers)*

ScienceDaily (Feb. 1, 2011) — A giant-scale experiment on deforestation, biodiversity and carbon cycling has got underway in the spectacular forests of Sabah, a Malaysian state on the tropical southeast Asian island of Borneo. Scientists hope the results will help guide the management and conservation of remaining rainforests in tropical Asia.

One of the largest ecological studies in the world, encompassing 8000 hectares (an area larger than Manhattan), the Stability of Altered Forest Ecosystems (SAFE) Project is led by researchers at Imperial College London and was officially launched this week by the Prime Minister of Malaysia.

Over the next ten years, scientists from Malaysia and the UK will be studying how deforestation and forest fragmentation alter the ability of this tropical landscape to support a unique diversity of life. They will also be investigating the impact of agricultural development on the ecosystem's ability to absorb carbon dioxide, an important greenhouse gas. This is the first time an experiment of this magnitude, nature and influence has been attempted, more than doubling the size of previous experiments conducted over the last 30 years.

The SAFE Project involves distinguished researchers from Imperial, the University of Cambridge and the University of Oxford. It is supported by the UK Royal Society's South East Asia Rainforest Research Programme (SEARRP) and a generous donation of 30 million Malaysian ringgit (about £6.1 million) from the Sime Darby Foundation in Malaysia.

Project leader, Dr Robert Ewers, from the Department of Life Sciences at Imperial College London said: "The potential impact of the SAFE Project is global and far-reaching. The findings of this study will help scientists to design landscapes that maintain agricultural production at least cost to biodiversity."

In an area that has been gazetted for conversion to plantation for the last 20 years, the scientists will take advantage of a planned and government-approved oil palm conversion to make experimental changes to the forest, among the world's most biodiverse tropical ecosystems, to create a fragmented forest that closely resembles recently developed land.

Professor Andrew Balmford from the Department of Zoology at the University of Cambridge said: "The end goal we are aiming for is to understand how a tropical rainforest functions, and how that functioning changes when you place the forest under pressure from humans. We can get answers to these questions by controlling how exactly the forest is disturbed, under experimental conditions. Careful observation of how the ecosystem

becomes disrupted when it is damaged will tell us a tremendous amount about how it functions when it is left alone."

The SAFE Project consists of four interconnected projects. The first of these will scrutinise differences in ecosystem function and species' persistence in the forest as it is incrementally damaged by light and heavy logging, becomes fragmented, and is eventually converted into an oil palm plantation.

The second will investigate how managed deforestation, which often leaves isolated fragments of forest of different sizes and in different locations within a plantation, can be designed to minimise the ecological damage caused by converting forests to agriculture.

A third is focussed on the role of forest fragments in protecting water supplies and biodiversity in the streams that pass through forests and plantations.

And the fourth project will quantify how the carbon cycle of the forest changes as it is converted and fragmented, and how the resilience of this carbon cycle to climate change can be maximised.

Professor Yadvinder Malhi, Director of the Centre for Tropical Forests at the University of Oxford said: "The concept of a 'natural ecosystem' is fast disappearing in many regions of the tropics as humans modify the world at an ever-accelerating rate, meaning much of the forest biodiversity and ecosystem services must now persist and be protected in human-modified landscapes. The SAFE Project is conducting one of the world's largest ecological experiments to understand the myriad ways in which logging, deforestation and forest fragmentation cause release of greenhouse gases, and modify the functioning and climate sensitivity of remaining tropical rainforest. How can we maximise the carbon retention and climate benefits of remaining tropical forests in a human-modified landscape, benefits we urgently need to maintain in our struggle to avoid dangerous climate change?"

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Imperial College London**, via AlphaGalileo.

http://www.sciencedaily.com/releases/2011/02/110201084240.htm

**Basking in the Sun: How Large Mammals Survive Winter in the Mountains**

*A group of Alpine ibex. (Credit: Claudio Signer)*

ScienceDaily (Feb. 1, 2011) — Sunbathing in sub-zero temperatures may not be everybody's idea of fun but it forms an important part of the strategy of Alpine ibex for surviving the winter. This surprising finding comes from recent research in the group of Walter Arnold at the Research Institute of Wildlife Ecology, University of Veterinary Medicine, Vienna. The results have recently been published online by the journal *Functional Ecology*.

Animals that live in mountainous areas face a large problem. While food may be plentiful in summer, the winters are generally long and harsh. Winter temperatures are extremely low, which means that the animals need to expend energy on keeping warm at a time when food is very hard to come by. Small mammals may hibernate but large animals generally do not, presumably because doing so would make them too vulnerable to predators. So how do they cope in winter?

This question has been addressed by Claudio Signer, Thomas Ruf and Walter Arnold of the Research Institute of Wildlife Ecology, University of Veterinary Medicine, Vienna, in collaboration with the Hunting and Fishing Services of Grisons, Chur, Switzerland. The researchers equipped a number of wild Alpine ibex with sensors for measuring heart rate (a good indicator of energy expenditure), temperature in the stomach (i.e. body temperature) and locomotor activity and monitored the results for a period of two years. At the same time, various climatic factors were recorded.

The first finding was that the ibex lowered their heart rate significantly during the winter. It seems, then, that the animals do not respond to lower temperatures by generating more heat (to keep warm) but instead by somehow reducing their energy needs. Furthermore, the decrease in heart rate was found to be greater than could be explained by lower activity and lower body temperature, indicating that ibex have another mechanism for conserving energy.

Interestingly, the body temperature was found to fluctuate in a daily manner, with lowest temperatures around sunrise and highest temperatures in the late afternoon. The fluctuations were almost twice as large in winter as in summer. Of course, the surrounding temperature and level of solar radiation also vary over the course of the day. The scientists noticed a relationship between the daily patterns of stomach temperature and "black bulb temperature" (which combines surrounding temperature and solar radiation and thus gives a good indication of the temperature perceived by the animals). It seemed as though the animals "bask," or sunbathe, until noon to help increase their body temperature. Normal locomotor activity is not resumed until body temperature peaks in the early afternoon. In the early morning, there is almost no locomotor activity. This

begins to increase just before sunrise, indicating that the animals move from their night shelter towards the nearest sunny spot.

Basking is well known for reptiles and had previously been observed in some small mammals, such as the rock hyrax, but was not thought to be used to such an extent by large animals. As Arnold says, "the ability to take advantage of external sources of heat may be common to all mammals. It may form part of our heritage from reptiles, enabling us to conserve body reserves during periods when food is scarce."

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Veterinärmedizinische Universität Wien**.

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**Journal Reference**:

1. Claudio Signer, Thomas Ruf, Walter Arnold. **Hypometabolism and basking: the strategies of Alpine ibex to endure harsh over-wintering conditions**. *Functional Ecology*, 2010; DOI: 10.1111/j.1365-2435.2010.01806.x

http://www.sciencedaily.com/releases/2011/02/110201083936.htm

**Home and Away: How Do Invasive Plant Species Dominate Native Species?**

*Fencing in Boulder, Colorado, marks the location of a Nutrient Network site. (Credit: Brett Melbourne, University of Colorado-Boulder)*

ScienceDaily (Feb. 1, 2011) — Invasive plant species present a serious environmental, economic and social problem worldwide as their abundance can lead to lost native biodiversity and ecosystem functions, such as nutrient cycling. Despite substantial research, little is known about why some species can dominate new habitats over native plants that technically should have the advantage.

A common but rarely tested assumption is that these plants are more abundant in introduced versus native communities, because they are behaving in special way. If this true and introduced species are behaving in a special way it means biosecurity screening procedures need to speculate on how species will behave once introduced, a very difficult task to get right.

A global collaboration called the Nutrient Network tested this 'abundance assumption' for 26 herbaceous species at 39 sites on four continents in a recent publication in the journal *Ecology Letters*. The lead author of 36, Jennifer Firn from the Queensland University of Technology and CSIRO, Australia found that the 'abundance assumption' did not hold for the majority of species with 20 of the 26 species examined having either a similar or lower abundance at introduced versus native sites.

"Our results suggest that invasive plant species have a similar or lower abundance at introduced and native range and that increases in species abundance are unusual. Instead, we found abundance at native sites can predict abundance at introduced sites, a criterion not currently used included in biosecurity screening programs. We also found sites in New Zealand and Switzerland for example were similar in species composition sharing in some cases more than 10 species, all with similar abundances" Dr. Firn said.

This study is the first to be published from a cooperative global experiment the Nutrient Network. The Nutrient Network is led at the site-level by individual researchers and coordinated through funding from NSF to Dr. Elizabeth Borer and Dr. Eric Seabloom from the University of Minnesota.

"The Nutrient Network is the only collaboration of its kind, where individual researchers have set-up the same experiment at sites around the world. For three years, we have been collecting population, community, and ecosystem-scale vegetation data, including species-specific distribution and abundance data, with standardized protocols across more than 60 sites around the world. The experimental design used is simple, but one that provides a new, global-scale approach for us to address many critical ecological issues such as invasive species and changing climates," Associate Prof. Borer said.

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Wiley - Blackwell**, via AlphaGalileo.

http://www.sciencedaily.com/releases/2011/02/110201083932.htm

**New Appreciation of the Ecology-Evolution Dynamic**

*Ecology drives evolution. Experts now describe growing evidence that the reverse is also true, and explores what that might mean to our understanding of how environmental change affects species and vice-versa. (Credit: Copyright Michele Hogan)*

ScienceDaily (Jan. 31, 2011) — Ecology drives evolution. In the Jan 28 issue of the journal *Science*, UC Davis expert Thomas Schoener describes growing evidence that the reverse is also true, and explores what that might mean to our understanding of how environmental change affects species and vice-versa.

A classic example of ecology influencing evolution is seen in a Galápagos ground finch, *Geospiza fortis*. In this species, larger beaks dominated the population after dry years when large seeds were more abundant. After wet years, the direction of natural selection reversed, favoring smaller beaks that better handled the small seeds produced in the wet environment.

Environmental factors had given birds with certain genes a survival advantage.

But does evolution affect ecology over similar time scales? Scientists are increasingly thinking that the answer is yes, says Schoener, who points toward numerous examples of organisms evolving rapidly. This sets the stage for the possibility that evolutionary dynamics routinely interact with ecological dynamics.

Schoener writes: "If ecology affects evolution (long supported) and evolution affects ecology (becoming increasingly supported), then what? The transformed ecology might affect evolution, and so on, back and forth in a feedback loop."

Still to be discovered in this emerging field of "eco-evolutionary dynamics," he concludes, is just how much evolutionary changes substantially affect ecological traits such as species populations and community structure. Schoener calls for a major research effort to find out.

The study was supported by grants from the National Science Foundation.

In an unusual occurrence, Schoener is a co-author of a second paper in the same issue of *Science*. His former doctoral student, Jonah Piovia-Scott, is that paper's lead author.

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of California - Davis**, via EurekAlert!, a service of AAAS.

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**Journal Reference**:

1. T. W. Schoener. **The Newest Synthesis: Understanding the Interplay of Evolutionary and Ecological Dynamics**. *Science*, 2011; 331 (6016): 426 DOI: 10.1126/science.1193954

http://www.sciencedaily.com/releases/2011/01/110129081543.htm

**Secrets in Stone: Rare Archaeological Find in Norway**

*These unusual petroglyphs were found in a burial mound in Stjørdal, central Norway. (Credit: Anne Haug, NTNU Museum of Natural History and Archaeology)*

ScienceDaily (Jan. 31, 2011) — It looked to be a routine excavation of what was thought to be a burial mound. But beneath the mound, archaeologists from the Norwegian University of Science and Technology's Museum of Natural History and Archaeology found something more: unusual Bronze Age petroglyphs. "We believe these are very special in a Norwegian context," says museum researcher and project manager Anne Haug.

The excavation in Stjørdal, just north of Trondheim, was necessitated by the expansion of a gravel pit. Given that project archaeologists didn't anticipate that the dig would be very complicated, the museum researchers dedicated just three weeks to the effort.

**Petroglyphs under a cremation site**

Then came the surprises. First, it turned out that mound builders had used an existing hill as a starting point -- which of course saved them time and effort. The hill itself made the burial mound even larger and more monumental than it might have otherwise been.

But researchers suspected there might be another reason for the choice of the hilltop when they uncovered the remains of two cremations, or rather a fire layer that also contained bits of bone. Underneath they found many petroglyphs, including eight drawings showing the soles of feet, with cross hatching. There were also five shallow depressions, Haug says.

Two boat drawings and several other drawings of feet soles with toes were also found just south of the burial mound.

LInk between burial mound and drawings unclear

"This is a very special discovery, and we are not aware of other similar findings from Trøndelag County," she says. "The tomb might have been deliberately constructed over the petroglyphs, probably as part of funeral ritual. Based on the type of characters and especially the drawings of the foot soles, we have dated the artwork to the Bronze Age, about 1800 -- 500 BC."

"Why there are foot sole drawings beneath the tomb is a puzzle. But if we interpret the find in terms of a fertility cult, it may be that the soles represent God and life-giving power. That means that you can have both life and death represented in one place," she says.

**Unique in a Norwegian context**

Haug says that there was a similar discovery in Østlandet County, an area called Jong in Bærum, where petroglyphs illustrating foot soles were found under a tomb that dates back to the Bronze Age. In a Nordic context, this phenomenon is more common, and there are several examples where burials were combined with rock art, particularly petroglyphs of foot soles from Bohuslän, a World Heritage site in Sweden.

It's not yet clear if the grave was put in place the same time as the petroglyphs, Haug says. The dig began in September, 2010 and extended through the end of October, but the analysis is ongoing.

The scientists have found about 900 grams of burned bone, probably from one or more individuals; they hope to be able to carry out C-14 dating of the material and conduct more analyses so they can determine more about the gender and the age of the individuals in the grave.

"Currently, we have found several human teeth, as well as what may be remains of human ribs. We also found an animal tooth that suggests that one or more animals may have been laid in the tomb along with whoever is buried there," she says. There were very few objects found in the tomb, but a flat corroded metal object was found in the burnt layer. It's hard to say what this was, but the object will be X-rayed for analysis.

**Remains of a larger burial ground?**

It is unclear whether the original burial site contained two grave mounds, or whether there was just one large burial area.

A burial ground in the area was first described in 1818 by Lorentz D. Klüwer, and archaeologist Karl Rygh also described the site in 1879. It is likely that the graves that have been excavated in the most recent dig are the last remains of this burial ground.

The rock art found at the site is a type called South Scandinadivan agriculture carving and is dated to the Bronze Age, from 1800 -- 500 BC. The tomb probably dates to the transition between the Bronze Age and Iron Age, from 500 BC up to the year 1.

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **The Norwegian University of Science and Technology (NTNU)**.

http://www.sciencedaily.com/releases/2011/01/110131073133.htm

**Plasma Stability Made to Measure**

*Incorporation of control coils in the plasma vessel of the ASDEX Upgrade fusion device. (Credit: IPP; Volker Rohde)*

ScienceDaily (Jan. 31, 2011) — The compensation of edge instabilities in the ASDEX Upgrade are successfully pointing the way for the International Thermonuclear Experimental Reactor (ITER).

After barely a year of modification work the first experiments conducted have already proved successful. Eight magnetic control coils on the wall of the plasma vessel of the ASDEX Upgrade fusion device have now succeeded in reducing perturbing instabilities of the plasma, so-called ELMs, to the level required. If these outbursts of the edge plasma become too severe, they can cause major damage to the plasma vessel in devices of the ITER class. The results now achieved go a long way towards solving this important problem for ITER.

The research objective of Max Planck Institute for Plasma Physics (IPP) at Garching is to develop a power plant that, like the sun, derives energy from fusion of atomic nuclei. Whether this is feasible is to be demonstrated with a fusion power of 500 megawatts by the ITER (Latin for "the way") experimental fusion reactor, now being built at Cadarache, France, as an international cooperation. This requires that the fuel, an ionized low-density hydrogen gas -- a plasma -- be confined in a magnetic field cage without touching the wall of the plasma vessel and heated to ignition temperatures of over 100 million degrees.

The complex interaction between the charged plasma particles and the confining magnetic field can cause all kinds of perturbations of the plasma confinement. Edge Localized Modes (ELMS) are very much under discussion at present in relation to ITER. These cause the edge plasma to briefly lose its confinement and periodically hurl bundled plasma particles and energies outwards to the vessel wall. Up to one-tenth of the total energy content is thus ejected. Whereas the present generation of medium-sized fusion devices can easily cope with this, it might cause overloading in large-scale devices such as ITER of, in particular, the divertor -- specially equipped collector plates at the bottom of the vessel, to which the plasma edge layer is magnetically diverted. This would make continuous operation inconceivable.

This ELM instability is, however, not altogether unwelcome, because it expels undesirable impurities from the plasma. Instead of the usual hefty impacts the aim is therefore to achieve weaker but more frequent ELMs. The 300-million-euro decision, originally scheduled for last year, on how to achieve this tailor-made solution for ITER was postponed by the ITER team, pending incorporation of the control coils in ASDEX Upgrade. This was because other fusion devices using similar coils -- DIII-D at San Diego being the first -- came up with conflicting results.

The experiments on ASDEX Upgrade now pave the way to clarification: Shortly after the power in the new control coils is switched on, the ELM impacts decline to a harmless level. But they occur often enough to

prevent the accumulation of impurities in the plasma. The good confinement of the main plasma is also maintained. The ELMs do not regain their original intensity till the coil field is switched of. This experimental result goes a long way to answering the question how the energy produced in the ITER plasma can be properly extracted.

But the goal has not quite been attained: This is because the plasma edge of ITER cannot be completely simulated in smaller devices such as ASDEX Upgrade. It is therefore all the more important to understand exactly the processes underlying the suppression of ELMs; this calls for sophisticated measuring facilities for observation and a powerful theory group for clarification. The physical theory hitherto acquired at IPP does fit the present results, but has yet to be checked and expanded. Till the decision on ITER scheduled for 2012 there is time for solving the problem for the test reactor -- and for a future power plant.

The possibilities afforded by control coils on ASDEX Upgrade are then still far from being exhausted: Another eight coils as of 2012 are to make lots of new investigations possible.

**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Max-Planck-Institut fuer Plasmaphysik**.

http://www.sciencedaily.com/releases/2011/01/110128083706.htm

**Deficiency of Dietary Omega-3 May Explain Depressive Behaviors**

*Salmon is high in omega 3 fatty acids. How maternal essential fatty acid deficiency impact on its progeny is poorly understood. Dietary insufficiency in omega-3 fatty acid has been implicated in many disorders. Researchers have now studied mice fed on a diet low in omega-3 fatty acid. They discovered that reduced levels of omega-3 had deleterious consequences on synaptic functions and emotional behaviours. (Credit: iStockphoto)*

ScienceDaily (Jan. 31, 2011) — How maternal essential fatty acid deficiency impact on its progeny is poorly understood. Dietary insufficiency in omega-3 fatty acid has been implicated in many disorders. Researchers from Inserm and INRA and their collaborators in Spain collaboration, have studied mice fed on a diet low in omega-3 fatty acid. They discovered that reduced levels of omega-3 had deleterious consequences on synaptic functions and emotional behaviours.

Details of this work are available in the online version of the journal *Nature Neuroscience.*

In industrialized nations, diets have been impoverished in essential fatty acids since the beginning of the 20th century. The dietary ratio between omega-6 polyunsaturated fatty acid and omega-3 polyunsaturated fatty acid omega-3 increased continuously over the course of the 20th century. These fatty acids are "essential" lipids because the body cannot synthesize them from new. They must therefore be provided through food and their dietary balance is essential to maintain optimal brain functions.

Olivier Manzoni (Head of Research Inserm Unit 862, "Neurocentre Magendie," in Bordeaux and Unit 901 "Institut de Neurobiologie de la Méditerranée" in Marseille), and Sophie Layé (Head of Research at INRA Unit 1286, "Nutrition et Neurobiologie Intégrative" in Bordeaux) and their co-workers hypothesized that chronic malnutrition during intra-uterine development, may later influence synaptic activity involved in emotional behaviour (e.g. depression, anxiety) in adulthood.

To verify their hypotheses, the researchers studied mice fed a life-long diet imbalanced in omega-3 and omega-6 fatty acids. They found that omega-3 deficiency disturbed neuronal communication specifically. The researchers observed that only the cannabinoid receptors, which play a strategic role in neurotransmission, suffer a complete loss of function. This neuronal dysfunction was accompanied by depressive behaviours among the malnourished mice.

Among omega-3 deficient mice, the usual effects produced by cannabinoid receptor activation, on both the synaptic and behavioural levels, no longer appear. Thus, the CB1R receptors lose their synaptic activity and the antioxidant effect of the cannabinoids disappears.

Consequently, the researchers discovered that among mice subjected to an omega-3 deficient dietary regime, synaptic plasticity, which is dependent on the CB1R cannabinoid receptors, is disturbed in at least two structures involved with reward, motivation and emotional regulation: the prefrontal cortex and the nucleus accumbens. These parts of the brain contain a large number of CB1R cannabinoid receptors and have important functional connections with each other.

"Our results can now corroborate clinical and epidemiological studies which have revealed associations between an omega-3/omega-6 imbalance and mood disorders," explain Olivier Manzoni and Sophie Layé. "To determine if the omega-3 deficiency is responsible for these neuropsychiatric disorders additional studies are, of course, required."

In conclusion, the authors estimate that their results provide the first biological components of an explanation for the observed correlation between omega-3 poor diets, which are very widespread in the industrialized world, and mood disorders such as depression.

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **INSERM (Institut national de la santé et de la recherche médicale)**, via EurekAlert!, a service of AAAS.

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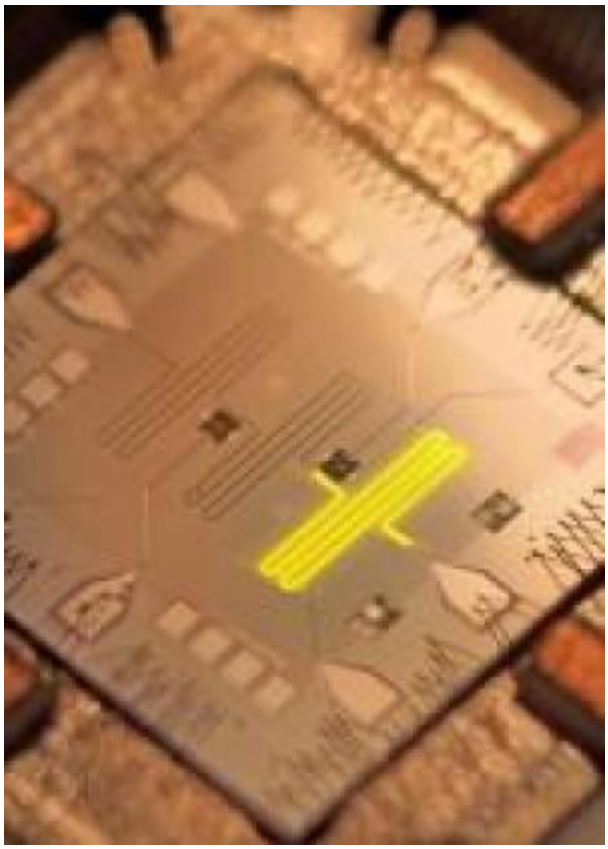
**Journal Reference**:

1. Mathieu Lafourcade, Thomas Larrieu, Susana Mato, Anais Duffaud, Marja Sepers, Isabelle Matias, Veronique De Smedt-Peyrusse, Virginie F Labrousse, Lionel Bretillon, Carlos Matute, Rafael Rodríguez-Puertas, Sophie Layé, Olivier J Manzoni. **Nutritional omega-3 deficiency abolishes endocannabinoid-mediated neuronal functions**. *Nature Neuroscience*, 2011; DOI: 10.1038/nn.2736

http://www.sciencedaily.com/releases/2011/01/110130194143.htm

**Physicists Challenge Classical World With Quantum-Mechanical Implementation of 'Shell Game'**



*The photon shell game architecture: Two superconducting phase qubits (squares in the center of the image) are connected to three microwave resonators (three meander lines). (Credit: Erik Lucero, Matteo Mariantoni, Dario Mariantoni)*

ScienceDaily (Jan. 31, 2011) — Inspired by the popular confidence trick known as "shell game," researchers at UC Santa Barbara have demonstrated the ability to hide and shuffle "quantum-mechanical peas" -- microwave single photons -- under and between three microwave resonators, or "quantized shells."

In a paper published in the Jan. 30 issue of the journal *Nature Physics*, UCSB researchers show the first demonstration of the coherent control of a multi-resonator architecture. This topic has been a holy grail among physicists studying photons at the quantum-mechanical level for more than a decade.

The UCSB researchers are Matteo Mariantoni, postdoctoral fellow in the Department of Physics; Haohua Wang, postdoctoral fellow in physics; John Martinis, professor of physics; and Andrew Cleland, professor of physics.

According to the paper, the "shell man," the researcher, makes use of two superconducting quantum bits (qubits) to move the photons -- particles of light -- between the resonators. The qubits -- the quantum-mechanical equivalent of the classical bits used in a common PC -- are studied at UCSB for the development of a quantum super computer. They constitute one of the key elements for playing the photon shell game.

"This is an important milestone toward the realization of a large-scale quantum register," said Mariantoni. "It opens up an entirely new dimension in the realm of on-chip microwave photonics and quantum-optics in general."

The researchers fabricated a chip where three resonators of a few millimeters in length are coupled to two qubits. "The architecture studied in this work resembles a quantum railroad," said Mariantoni. "Two quantum stations -- two of the three resonators -- are interconnected through the third resonator which acts as a quantum bus. The qubits control the traffic and allow the shuffling of photons among the resonators."

In a related experiment, the researchers played a more complex game that was inspired by an ancient mathematical puzzle developed in an Indian temple called the Towers of Hanoi, according to legend.

The Towers of Hanoi puzzle consists of three posts and a pile of disks of different diameter, which can slide onto any post. The puzzle starts with the disks in a stack in ascending order of size on one post, with the smallest disk at the top. The aim of the puzzle is to move the entire stack to another post, with only one disk being moved at a time, and with no disk being placed on top of a smaller disk.

In the quantum-mechanical version of the Towers of Hanoi, the three posts are represented by the resonators and the disks by quanta of light with different energy. "This game demonstrates that a truly Bosonic excitation can be shuffled among resonators -- an interesting example of the quantum-mechanical nature of light," said Mariantoni.

Mariantoni was supported in this work by an Elings Prize Fellowship in Experimental Science from UCSB's California NanoSystems Institute.

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of California - Santa Barbara**, via EurekAlert!, a service of AAAS.

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**Journal Reference**:

1. Matteo Mariantoni, H. Wang, Radoslaw C. Bialczak, M. Lenander, Erik Lucero, M. Neeley, A. D. O'Connell, D. Sank, M. Weides, J. Wenner, T. Yamamoto, Y. Yin, J. Zhao, John M. Martinis, A. N. Cleland. **Photon shell game in three-resonator circuit quantum electrodynamics**. *Nature Physics*, 2011; DOI: 10.1038/nphys1885

http://www.sciencedaily.com/releases/2011/01/110131153530.htm

**Children's Genetic Potentials Are Subdued by Poverty: Effects Show by Age 2**

*New research suggests that something about the environment of children from poor families is keeping them from realizing their genetic potentials. (Credit: iStockphoto)*

ScienceDaily (Jan. 31, 2011) — Children from poorer families do worse in school, are less likely to graduate from high school, and are less likely to go to college. A new study published in *Psychological Science*, a journal of the Association for Psychological Science, finds that these differences appear surprisingly early: by the age of 2. It's not a genetic difference. Instead, something about the poorer children's environment is keeping them from realizing their genetic potentials.

Past research has found that a gap between poor children and children from wealthier families opens up early in life, even before children enter formal education. "Poor kids aren't even doing as well in terms of school readiness -- sounding out letters and doing other things that you would expect to be relevant to early learning," says Elliot M. Tucker-Drob of the University of Texas at Austin, lead author of the paper. He and his colleagues, Mijke Rhemtulla and K. Paige Harden of the University of Texas at Austin and Eric Turkheimer and David Fask of the University of Virginia, wanted to look even earlier -- to see if they could find these differences in infants.

The researchers used data on about 750 pairs of fraternal and identical twins, from all over the country. The children's mental abilities were tested at 10 months of age and again when they were 2 years old, with tasks like pulling a string to ring a bell, placing three cubes in a cup, matching pictures, and sorting pegs by color. The children's socioeconomic status was determined based on parents' educational attainment, occupations, and family income.

At 10 months of age, children from poor families performed just as well as children from wealthier families. It was over the next 14 months that a gap emerged. By 2 years of age, children from wealthier families were scoring consistently higher than the children from poorer families.

The researchers went on to examine the extent to which genes were involved in the test scores. Among the 2-year-olds from wealthier families, identical twins, who share all of their genes, had much more similar tests scores than fraternal twins, who share only half of their genes, thus indicating that genes were influencing their tests scores. However, among 2-year-olds from poorer families, identical twins scored no more similar to one another than fraternal twins, suggesting that genes were not influencing their test scores. The researchers

concluded that something about the poor children's home life was suppressing their potentials for cognitive development.

This study didn't look specifically into why wealthy children improve more. It could be that poorer parents may not have the time or resources to spend playing with their children in stimulating ways. A common goal of education policy is to decrease the achievement gap between poorer and wealthier children, says Tucker-Drob. "And I think the first step to achieving this goal is understanding the basis of these disparities." He's working now on understanding exactly what it is that parents are doing differently -- analyzing videos of poorer and wealthier parents interacting with their children, for example, to see if he can find differences.

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**Story Source:**

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Association for Psychological Science**.

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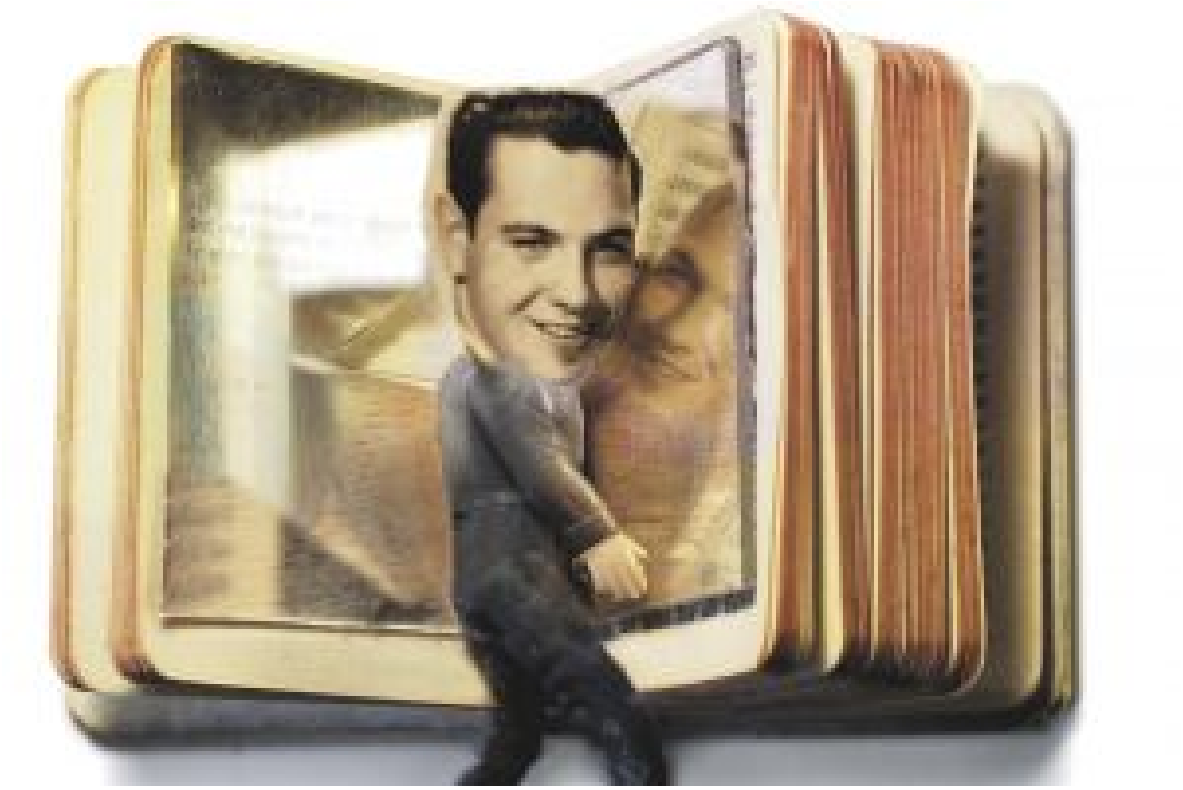
**Journal Reference**:

1. E. M. Tucker-Drob, M. Rhemtulla, K. P. Harden, E. Turkheimer, D. Fask. **Emergence of a Gene x Socioeconomic Status Interaction on Infant Mental Ability Between 10 Months and 2 Years**. *Psychological Science*, 2010; 22 (1): 125 DOI: 10.1177/0956797610392926

http://www.sciencedaily.com/releases/2011/01/110131153532.htm

**Narcissus Regards a Book**



Polly Becker for The Chronicle Review

By Mark Edmundson

Who is the common reader now? I do not think there is any way to evade a simple answer to this question. Common readers—which is to say the great majority of people who continue to read—read for one purpose and one purpose only. They read for pleasure. They read to be entertained. They read to be diverted, assuaged, comforted, and tickled.

The evidence for this phenomenon is not far to seek. Check out the best-seller lists, even in the exalted *New York Times.* See what Oprah's reading. Glance at the Amazon top 100. Look around on the airplane. The common reader—by which I don't mean the figure evoked by Dr. Johnson and Virginia Woolf, but the person toting a book on the train or loading one into his iPad or Kindle—the contemporary common reader reads for pleasure, and easy pleasure at that. Reading, where it exists at all, has largely become an unprofitable wing of the diversion industry.

Life in America now is usually one of two things. Often it is work. People work hard indeed—often it takes two incomes to support a family, and few are the full-time professional jobs that require only 40 hours a week. And when life is not work, it is play. That's not hard to understand. People are tired, stressed, drained: They want to kick back a little. That something done in the rare off hours should be strenuous seems rather unfair. Robert Frost talked about making his vocation and his avocation one, and about his work being play for mortal stakes. For that sort of thing, assuming it was ever possible, there is no longer the time.

But it's not only the division of experience between hard labor and empty leisure that now makes reading for something like mortal stakes a very remote possibility. Not much more than 20 years ago, students paraded through the campuses and through the quads, chanting variations on a theme. Hey, hey, ho, ho—they jingled—Western culture's got to go. The marches and the chants and the general skepticism about something called the canon seemed to some an affront to all civilized values.

But maybe not. Maybe this was a moment of real inquiry on the kids' part. What was this thing called Western culture? Who created it? Who sanctioned it? Most important: What was so valuable about it? Why did it matter to study a poem by Blake, or ponder a Picasso, or comprehend the poetry latent in the religions of the world?

I'm not sure that teachers and scholars ever offered a good answer. The conservatives, protected by tenure, immersed in the minutiae of their fields, slammed the windows closed when the parade passed by. They went on with what they were doing. Those who concurred with the students bought mikes and drums and joined the march. They were much in demand in the news media—figures of great interest. *The Washington Post* was calling; the *Times* was on the other line. Was it true? Were the professors actually repudiating the works that they had purportedly been retained to preserve?

It was true—and there was more, the rebels yelled. They thought they would have the microphones in their hand all day and all of the night. They imagined that teaching Milton with an earring in one ear would never cease to fascinate the world.

But it did. The media—most inconstant of lovers—came and the media went, and the academy was left with its cultural authority in tatters. How could it be otherwise? The news outlets sell one thing above all else, and that is not so much the news as it is newness. What one buys when one buys a daily paper, what one purchases when one purchases a magazine, is the hypothesis that what is going on right now is amazing, unprecedented, stunning. Or at least worthy of intense concentration. What has happened in the past is of correspondingly less interest. In fact, it may be of barely any interest at all. Those who represented the claims of the past should never have imagined that the apostles of newness would give them a fair hearing, or a fair rendering, either.

Now the kids who were kids when the Western canon went on trial and received summary justice are working the levers of culture. They are the editors and the reviewers and the arts writers and the ones who interview the novelists and the poets (to the degree that anyone interviews the poets). Though the arts interest them, though they read this and they read that—there is one thing that makes them very nervous indeed about what they do. They are not comfortable with judgments of quality. They are not at ease with "the whole evaluation thing."

They may sense that Blake's *Songs of Innocence and Experience* are in some manner more valuable, more worth pondering, more worth preserving than *The Simpsons.* They may sense as much. But they do not have the terminology to explain why. They never heard the arguments. The professors who should have been providing the arguments when the No More Western Culture marches were going on never made a significant peep. They never quoted Matthew Arnold on the best that's been thought and said—that would have been embarrassing. They never quoted Emerson on the right use of reading—that might have been silly. (It's to inspire.) They never told their students how Wordsworth had saved Mill's life by restoring to him his ability to feel. They never showed why difficult pleasures might be superior to easy ones. They never even cited Wilde on the value of pure and simple literary pleasure.

The academy failed and continues to fail to answer the question of value, or even to echo the best of the existing answers. But entertainment culture suffers no such difficulty. Its rationale is simple, clear, potent: The products of the culture industry are good because they make you feel good. They produce immediate and readily perceptible pleasure. Beat that, Alfred Lord Tennyson. Touch it if you can, Emily Dickinson.

So the arbiters of culture—our former students—went the logical way. They said: If it makes you feel good, it must be good. If Stephen King and John Grisham bring pleasure, why then, let us applaud them. Let's give them awards. Let's break down the walls of the old clubs and colleges and give them entry forthwith. The only really important question to pose about a novel by Stephen King, we now know, is whether it offers a vintage draught of the Stephen King experience. Does it deliver the spine-shaking chills of great King efforts past? Is the mayhem cranked to the desirable degree? Do homebody sadist and ordinary masochist get what they want and need from the product?

What's not asked in the review and the interview and the profile is whether a King book is worth writing or worth reading. It seems that no one anymore has the wherewithal to say that reading a King novel is a major waste of time. No chance. If people want to read it, if they get pleasure from it, then it must be good. What other standard is there?

Media no longer seek to shape taste. They do not try to educate the public. And this is so in part because no one seems to know what literary and cultural education would consist of. What does make a book great, anyway? And the media have another reason for not trying to shape taste: It pisses off the readers. They feel insulted, condescended to; they feel dumb. And no one will pay you for making him feel dumb. Public entertainment generally works in just the opposite way—by making the consumer feel like a genius. Even the most august publications and broadcasts no longer attempt to shape taste. They merely seek to reflect it. They hold the cultural mirror up to the reader—what the reader likes, the writer and the editor like. They hold the mirror up and the reader and—what else can he do?—the reader falls in love. The common reader today is someone who has fallen in love, with himself.

Narcissus looks into the book review and finds it good. Narcissus peers into Amazon's top 100 and, lo, he feels the love. Nothing insults him; nothing pulls him away from that gorgeous smooth watery image below. The editor sells it to him cheap; the professor who might—coming on like the Miltonic voice does to Eve gazing lovingly on herself in the pool: "What thou seest / What there thou seest ... is thyself," it says—the professor has other things to do.

The intervening voice in Milton (and in Ovid, Milton's original in this) is a source of influence. Is it possible that in the world now there are people who might suffer not from an anxiety that they might be influenced but rather from an anxiety that they might never be? Perhaps not everyone loves himself with complete conviction and full abandon. Maybe there remain those who look into the shimmering flattering glass of current culture and do not quite like what they see. Maybe life isn't working for them as well as it is supposed to be for all in this immeasurably rich and unprecedentedly free country.

Reading in pursuit of influence—that, I think, is the desired thing. It takes a strange mixture of humility and confidence to do as much. Suppose one reads anxious about not being influenced. To do so is to admit that one is imperfect, searching, unfinished. It's difficult to do when one is young, at least at present: Some of the oldest individuals I meet lately are under the age of 21. It is difficult to do when one is in middle age, for that is the time of commitments. One has a husband or a wife, a family and job—or, who knows, a career. Having second thoughts then looks like a form of weakness: It makes everyone around you insecure. One must stand steady, and sometimes one must pretend. And in old age—early or late—how can one still be a work in progress? That's the time, surely, to have assumed one's permanent form. That's the time to have balanced accounts, gained traction, become the proper statue to commemorate one's proper life.

Of his attempts at works of art one writer observed: Finished? They are never finished. At a certain point someone comes and takes them away. (At a certain point, something comes and takes us away, whence we do not know.) We, too, are never truly finished. What Narcissus wanted was completion, wholeness; he wanted to be that image in the water and have done with it. There would be no more time, no more change, no more revision. To be willing to be influenced, even up to the last, is tantamount to declaring that we'll never be

perfect, never see as gods see—even that we don't know who and what we are, or why (if for any reason) we are here, or where we'll go.

The desire to be influenced is always bound up with some measure of self-dislike, or at least with a dose of discontent. While the culture tells us to love ourselves as we are—or as we will be after we've acquired the proper products and services—the true common reader does not find himself adequate at all. He looks in the mirror of his own consciousness, and he is anything but pleased. That is not what he had in mind at all. That is not what she was dreaming of.

But where is this common reader—this impossible, possible man or woman who is both confident and humble, both ready to change and skeptical of all easy remedies?

In our classrooms, in our offices, before the pages of our prose and poems, watching and wondering and hoping to be brought, by our best ministrations and our love, into being.

Mark Edmundson is a professor of English at the University of Virginia.

http://chronicle.com/article/Narcissus-Regards-a-Book/126060/

**Absent Students Want to Attend Traditional Classes via Webcam**

***Professors already welcome their guest speakers using this same technology***

Lissa Gotwals for The Chronicle

Paul Jones takes frequent advantage of Skype videoconferencing to invite guest speakers to his mass-communications classes at the U. of North Carolina at Chapel Hill. Among them are (below) Danah Boyd, a fellow at Harvard U.'s Berkman Center for Internet and Society; Fred Turner, an associate professor of communication at Stanford U.; and Howard Rheingold, author of several books on virtual communities.

Paul Jones takes frequent advantage of Skype videoconferencing to invite guest speakers to his mass-communications classes at the U. of North Carolina at Chapel Hill. Among them are (below) Danah Boyd, a fellow at Harvard U.'s Berkman Center for Internet and Society; Fred Turner, an associate professor of communication at Stanford U.; and Howard Rheingold, author of several books on virtual communities.

By Jeffrey R. Young

It was just 30 minutes before class when Thomas Nelson Laird, an assistant professor of higher education at Indiana University at Bloomington, got the e-mail from a student: "I can't make it to class. Can you beam me in by Webcam?"

"I thought, I don't know if I can do that," the professor says. He looked at the clock and thought about the time it would take to rig up a link via Skype or some other video-chat system. He had used the technology before, though, so he figured, Why not?

Professors across the country are facing similar questions. Webcams are ubiquitous, and students are accustomed to using popular services like Skype to make what are essentially video phone calls to friends and family. Recognizing the trend, this month Skype unveiled a service for educators to trade tips and tricks, called "Skype in the classroom."

Professors also frequently bring in guest speakers using the technology, letting students interact with experts they otherwise would only read about in textbooks.

Mr. Nelson Laird's course, on diversity in education, has about 20 students in a circle. So on one seat, he set a laptop with a built-in Webcam for the missing student, who could not make it because of a snowstorm. It worked—the student even gave a five-minute presentation, her face displayed on the laptop screen and

projected on a screen at the front of the room. But the professor noted that he had squandered five to 10 minutes of class time in setting up the connection, with a program called Adobe Connect.

The scenario was a first for Mr. Nelson Laird, and he says he hasn't yet thought out what his policy will be should a flurry of such requests occur. "Am I willing to do this occasionally? Sure," he told me this month. "But I'm not going to set this up every week."

Exactly how often professors fire up Webcams in their classrooms is hard to figure. The most recent data from the Faculty Survey of Student Engagement shows that about 12 percent of professors said they had used videoconferencing in their teaching. Mr. Nelson Laird helps lead the annual survey, which was conducted in the spring of 2009, of about 4,600 faculty members at 50 American colleges and universities.

As that number grows, will videoconferencing change the dynamics of traditional classrooms?

**Talking Heads**

Perhaps no classroom professor has experimented more with videoconferencing in a single course than Paul Jones, an associate professor of journalism and mass communication at the University of North Carolina at Chapel Hill.

In his fall 2009 course on virtual communities, he brought in a guest speaker via Skype nearly every week. That let his students interact with some of the leading scholars and authors on the topic—including Fred Turner, an associate professor of communication at Stanford University, and Howard Rheingold, who has written many books on Internet culture—who would have been unlikely to make the trip down to speak in person.

The guest speakers did not have to offer prepared remarks. Instead they were asked to simply make themselves available for questions from students during their Webcam appearances. In advance, students were required to use their Webcams to record short videos about the visitors' ideas. The guests would view the responses ahead of time, on YouTube or some other video-sharing site, to see what the students were most interested in.

"It's a bargain for these guys," says Mr. Jones, referring to the guest speakers. "They don't have to prepare a talk, and they get to interact with really smart students who are familiar with their work—and they don't have to travel."

Mr. Jones chose not to record the guests' video appearances themselves, or open them to the public. "I wanted the speaker to feel free to say whatever the hell they wanted," he says.

When I visited the University of Virginia last year, I saw a Skype guest speaker in action. Siva Vaidhyanathan, a professor of media studies there who frequently explores new educational technology, had agreed to give a half-hour talk via Skype to a friend's class at the University of Wisconsin at Madison's library school, and he let me sit in. A few minutes before he was to appear, he headed to his faculty office, logged onto Skype, and donned a headset. A Webcam built into his monitor broadcast his image, and thanks to a camera on the other end, he could see the classroom full of eager students. He spent a few minutes on prepared remarks, and then took questions. Afterward, he joked that his friend now owed him a beer, or else a guest lecture in return.

In his own courses, Mr. Vaidhyanathan cashes in on those favors. During one recent class session he linked in Jeff Jarvis, an associate professor of journalism at the City University of New York. "I get to talk to students I

wouldn't have otherwise talked to," Mr. Jarvis told me. "I've done this probably a dozen times at least. You're in for 30 minutes, and you're out. The obligation is so minimal that it makes it easier to say, What the heck?"

**New Chore for Professors**

There are some downsides to classroom videoconferencing.

The technology does not always work, although it is far more reliable than it was just a few years ago.

The first time Katherine D. Harris, an assistant professor of English literature at San Jose State University, tried inviting a guest speaker via Skype, she could not get the video to work, despite help from one of the university's tech-support staff members. Students in the course, "Digital Literature: the Death of Print Culture?" could hear the guest but not see him. Sometimes the audio would cut out as well, which made it harder for them to concentrate.

Would she do it again? Only if she knew technical help was close at hand. "It's almost easier to do it in person because you don't have the technology mediating everything," she says. "There's just so much to handle and take care of rather than just going to pick someone up."

Even letting students participate via videoconference has its drawbacks.

"I want to throw out this caution," says Scott Johnson, director of Illinois Online Network, the online division of the University of Illinois. "Unless the professor is committed to personally supporting and facilitating these ad hoc accommodations and provisions, and willing to carve out class time to set up and maintain the provisions, this is a moderately dangerous road.

"My issue is that the creation of an on-demand condition of readiness for any technology is not feasible for the majority of the faculty of many institutions. If the institution has educational technologists on staff, it is critical to enlist their assistance for the present and future if this technology-friendly teaching climate is going to be sustainable."

The concern reminds me of a scene in the 1985 film *Real Genius.* A series of scenes shows a classroom at an elite university. Early in the semester, all the students are in their seats, attentively taking notes. As the term wears on, more and more students have left tape recorders in their seats, since they're too busy to make it. Finally, recorders fill every desk, and the professor, too, is absent—replaced by a reel-to-reel machine playing his recorded lecture. On the board reads the message: "Math on Tape Is Hard to Follow: Please Listen Carefully."

Some level of phoning it in might be helpful, but professors will have to decide how far to go in accommodating their students' desire for convenience—and their own.

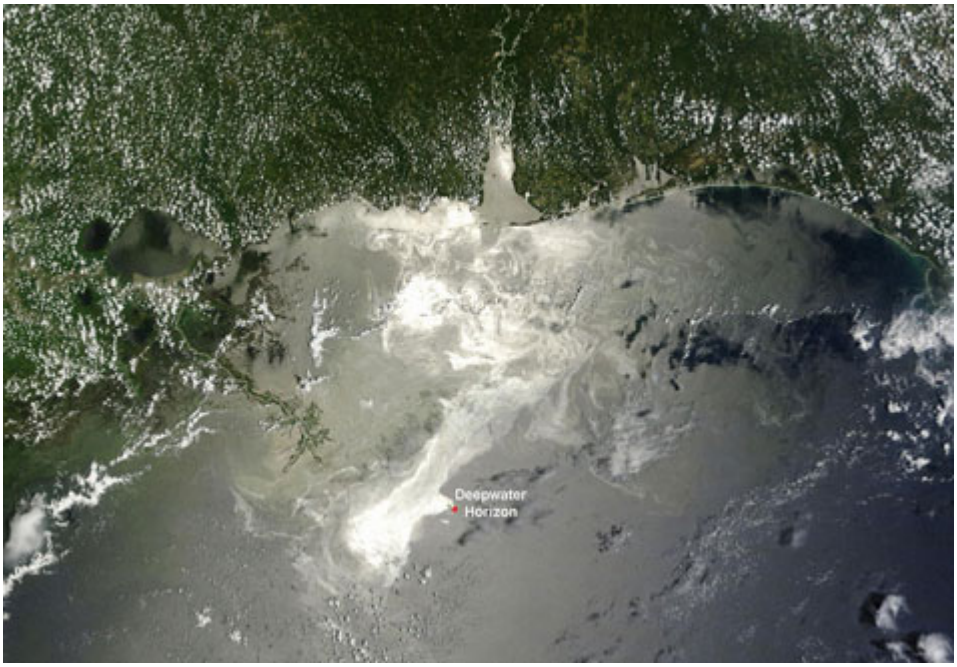
College 2.0 covers how new technologies are changing colleges. Please send ideas to jeff.young@chronicle.com or @jryoung on Twitter.

http://chronicle.com/article/New-Question-for-Professors-/126073/

**The Human Causes of Unnatural Disaster**

**"Blowout in the Gulf," a new book by the late William Freudenburg and co-author Robert Gramling, exposes the arrogance of risk-taking in the oil business.**

By Enrique Gili




*A new book by the late William Freudenburg and co-author Robert Gramling, exposes the hubris in the oil business and the resulting disasters. (Wikipedia.org)*

*Blowout in the Gulf*, a new book on Deepwater Horizon, opens with the observation that the ruined oil platform was dubbed Macondo, after the setting for the novel *One Hundred Years Of Solitude*.
Written by the Nobel Prize-winning Colombian writer Gabriel García Márquez, the novel is an apocryphal tale of a prosperous town cut off from civilization, too self-involved to notice the signs of its own corruption. Ultimately, it is wiped off the face of the Earth in a deluge. The parallels were too thematically powerful for the authors of *Blowout* to ignore in their account of the BP Gulf oil spill disaster.
Like characters in a novel, most of us have a hard time envisioning what can happen when oil and hubris mix. But that nexus was often the home for the late William Freudenburg, who wrote *Blowout* in the last few months of his life as a conscious attempt to engage nonacademic readers. And it may be his defining work. The book "took 60 days to write and 60 years to research," he said, noting the combined number of years he and his co-author, Robert Gramling, had worked together.
A professor of environmental studies at the University of California, Santa Barbara, Freudenburg died of cancer on Dec. 28, 2010. His life work, as Wikipedia phrased it, "emphasized the socially structured sources of environmental impacts" — like, say, Macondo.
**Freudenberg speaks**
View a lecture by William Freudenburg on learning lessons from the BP spill here.
"Bill's work made major contributions to the study of human/environmental relations," said Gramling, a professor of sociology at the University of Louisiana. "Environmental 'problems' do not come about because some law of nature has become broken, but because humans have altered the environment that they live, work and play in. These alterations then affect humans in ways that they define as undesirable. So to fix environmental problems we must understand the relation between the two."

In an interview with *Miller-McCune* late last year, Freudenburg, 59, put it this way: "It's not what Nature does to us but what we do Nature. Problems we define as environmental, such as global warming and holes in the ozone, have their origins in human behavior."

Freudenburg and Gramling place the events leading up to the BP oil spill firmly within the context of the 2008 Republican campaign slogan, "Drill, Baby Drill," the lax safety standards of the oil industry and the industry's aversion to second-guessing itself.

A series of cost-cutting maneuvers had catastrophic consequences, the authors conclude, and BP engineers downplayed the risks even amid the ominous signs of a potential blowout. It's a phenomenon Freudenburg called the "atrophy of vigilance." It describes an organization's diminished ability to accurately calculate risk after successfully avoiding accidents over an extended period of time.

Freudenburg compared it to Russian roulette. "You have a gun with six chambers and one bullet." He said. "Your best bet to is pull the trigger once, you have an 83 percent probability to survive. Most people would argue that that's not a rational risk to take."

A sociologist by training, Freudenburg was the Dehlsen professor at UCSB's School of Environmental Studies, a school founded in the wake of what was then the most devastating oil spill in the U.S., the Santa Barbara blowout of 1969.

(The Santa Barbara blowout was also a major impetus for Earth Day, and the fact that the BP spill began on Earth Day 2010 didn't escape Freudenburg's notice. "BP celebrated its own version of Earth Day by having the Deepwater Horizon sink out of sight on the 40th anniversary of the occasion," he said.)

Freudenburg's focus was on environmental sociology — he called it "hardware, humans and society" — an academic discipline that places an emphasis on examining environmental problems within the context of human interactions.

His teaching, though, kept the humanity up front. "Beyond his intellectual and career guidance, I have always admired Bill's amazing wit, self-effacing jokes, well-placed sarcasm, beer-drinking camaraderie, clever tact with those he disagrees with and kindness to graduate students by giving attention to what he thinks has redeeming value, rather than dwelling on criticism," rural economist Naomi Krogman recalled at an environmental sociology conference, charmingly named Freudenfest, held last November. "Ah, there has been so much laughter with him at conferences!"

Early in his career, Freudenberg looked at boomtowns in the American West. He published a series of well-regarded papers on the social impacts of extractive industries on rural communities before expanding his repertoire to include risk analysis and organizations.

"Bill always had a knack of doing good sociological research on important natural resource and environmental issues," recalled Riley Dunlap, a friend and sociologist at Oklahoma State University.

Gramling said, "Bill was very focused on the ways in which projects and policies divert environmental resources to powerful economic and political actors and then — in what he called 'the double diversion' — divert the attention of the public away from what is going on."

In a March 2006 article in the journal *Rural Sociology*, Freudenburg wrote, "Environmental damages are often characterized by high levels of disproportionality, with much or most of the harm being created by the diversion of environmental rights and resources to a surprisingly small fraction of the relevant social actors.

"The disproportionality appears to be made possible in part through the second diversion, namely distraction — the diversion of attention, largely through the taken-for-granted but generally erroneous assumption that the environmental harm 'must' be for the benefit of us all."

This is an academic way of saying that a few bad apples within any given industrial sector often account for a large percentage of the pollution. And they are allowed to continue polluting because the public assumes economic growth is impossible without environmental harm.

Freudenburg contended that regulators should shift their focus from the average polluter to the handful of outliers who were causing most of the damage.

"If you could get the worst 10 percent of the polluters to be no worse than the average or medium polluters in the dirtiest industries in America, you could reduce the total emissions from those entire industries by 70 to 90 percent," he said.

In 2007, the nonprofit Environmental Integrity Project released Dirty Kilowatts, a report ranking coal-burning plants according to their pollution levels. It showed that old, inefficient coal-burning power plants accounted for a disproportionately large share of emissions across four major categories ——sulfur dioxide, mercury,

nitrogen oxide and CO2 — while producing less than 14 percent of the electricity generated in the United States.

Freudenburg, said Dunlap, "was especially creative in analyzing how power was used, often in not-so-obvious ways, to maintain great inequities in access to and use of our natural resources, as well as how industries were able to masquerade their pollution as being in society's best interests."

A *Publishers Weekly* "Pick of the Week," *Blowout in the Gulf* provides a compelling historical perspective of U.S. oil exploration since the latter half of the 19th century.

Prior to 1953, the United States was one of the largest producers of oil in the world — "the OPEC of oil," as Freudenburg put it. Americans came to expect, and even demand, cheap and readily available supplies of gasoline even as the sources of the petroleum moved overseas.

After the OPEC oil shock of the 1970s, every American president started touting the virtues of energy independence. But the industry called for opening oil fields on the North Slope of Alaska and in ever-deeper waters in the Gulf of Mexico at an unsustainable pace.

"We're burning gas through the end of a cars tailpipe as fast as oil companies can extract it," Gramling said.

Perhaps even more damaging is the corrosive effect the oil and gas lobby has had on Capitol Hill. According to Blowout in the Gulf, the oil and gas lobby spent $340 million to lobby Congress between 2008 and 2010. In return, the industry received tax breaks and subsidies that economists estimate will cost the federal treasury $3.6 billion in lost revenue over the next decade.

Oil and gas leasing is second only to taxes collected by the Internal Revenue Service in terms of revenues generated for the U.S. government. But the rate of return on leasing public lands for oil exploitation is a pittance compared to that of other oil-producing countries. Through royalties, leases and taxes, the U.S. government receives a 40 percent return, Norway receives almost double that amount, at 75 percent, and Tunisia, Kazakhstan and Brunei get an 80 percent return.

In an April 2010 article, "Pay, Baby, Pay," in *Miller McCune*, Freudenburg and Gramling reported that since the Reagan era, the cost of leaseholds for oil and gas companies has fallen — plummeted, really — from an average of $2,224.71 to $263.33, despite the soaring price of oil. (At the end of the Reagan administration, the inflation-adjusted price of a barrel of crude was $27.45; last year it sat at $70.84.)

*Miller-McCune staff writer Melinda Burns contributed to this report.*

*http://www.miller-mccune.com/environment/the-human-causes-of-unnatural-disaster-27854/?utm_source=Newsletter147&utm_medium=email&utm_content=0208&utm_campaign=newsletters*

**Can China Avoid Getting Stuck in Traffic?**

**Amid a frenzy of car buying, the Chinese are losing the race for traffic space, but it's not too late for them to take another road.**

By Melinda Burns

*Transportation experts say there's barely enough space on the roads in China's largest cities for the 35 million cars that were bought during the past decade of frenzied consumerism. (Remko Tanis/Flickr.com)*

The new Great Wall of China is the "Great Wall" of cars stuck in city traffic, researchers say, and it will take more than restrictions on new license plates and car registrations to break the gridlock.

The problem is, there's barely enough space on the roads in China's largest cities for the 35 million cars that were bought during the past decade of frenzied consumerism, according to transportation experts at the University of California, Berkeley, and Massachusetts Institute of Technology.

In the ancient capital city of Xi'an, home of the buried armies of terracotta warriors, Lee Schipper said the joke is that if you want to drive in through the North Gate, you call your friend who's leaving through the South Gate, so you can arrange to take his place. Schipper is a senior project scientist at UC Berkeley's Global Metro Studies Center and a co-author of a 2010 study on China's crowded cities.

"The number of cars is going up much faster in China than the length of the roads in the cities," Schipper said. "The greatest 'communist' society ever invented doesn't know what to do. That's what worries me. Cars are not something any kind of government can easily control if they're cheap to buy and cheap to drive."

In Shanghai, a city of more than 20 million where new car registrations are restricted to 6,000 monthly, commuter traffic has slowed to 6 to 10 miles per hour, well under the speed of a bicycle. The traffic's a mess, even though only 20 percent of all daily trips in Shanghai are by car, compared to 80 percent in U.S. cities. For the majority of Shanghaians, who are walking or biking or waiting at the bus stops, it means breathing in a lot of bad air.

"It's what I call hyper-motorization," Schipper said. "China's cities have expanded to make room for cars, but congestion levels have spiraled upward and average speeds downward. Things freeze up regularly."

Building more roads and adding lanes, as China is doing, will not solve the problem, Schipper said. The amount of urbanized land in Beijing has tripled since 1990, but now commutes are longer. China could build more cities, but the new roads would fill up quickly, too.

Schipper and co-authors Wei-Shiuen Ng and Yang Chen, Ph.D. students at UC Berkeley and MIT, respectively, suggest that China has a window of opportunity to solve its traffic woes before car ownership jumps much higher. If China were to hike its fuel tax on gasoline, levy tolls at rush hour, raise parking fees, encourage compact development along bus lines, and give up more road space to cyclists and fast bus routes, it could get the traffic moving and avoid potentially much worse gridlock, the researchers found.

"Every motorist should know what it really costs to bring a car into a zone where land space is scarce," Schipper said.

Most people in China still travel by bus, bike or on foot. There are only 18 private vehicles for every 1,000 Chinese – roughly the level of ownership back in the 1920s in the United States. Today, there are 740 private vehicles for every 1,000 Americans. The average resident of China travels only 600 miles per year by bus, train, car or plane, compared to 15,000 motorized miles per capita for Americans.

But China is now the top auto market in the world, having surpassed the U.S. in sales in 2009. Last year, General Motors Co. sold more cars in China than in the U.S. If current trends continue, the research shows, China can expect 146 million private cars by 2020, or four times the number it has now.

"My role is not telling China what to do," said Schipper, who has traveled to the country 20 times in the past decade to talk to city and transportation planners. "I can point to the consequences of what they do. The present path in China is towards more and more cars. Smaller towns of under 2 million people are not as crowded, but then people flee to the smaller towns and they get gummed up, too."

This month, Beijing officials launched a lottery for new license plates to restrict new cars in the city to 240,000 in 2011. Last year, more than 700,000 cars were sold in the city. But the measure may backfire, Schipper said. Beijing residents rushed to buy 20,000 cars the day before the lottery went into effect; and people will likely drive their cars more now, sharing them with family and friends. Events such as the 10-day, 60-mile traffic jam on the outskirts of Beijing last summer could become more common.

A number of Chinese cities, including Beijing, are building rapid transit systems in which buses can travel in segregated lanes with priority at intersections. But these efforts to boost mass transportation are being overwhelmed.

"The Chinese don't have much time," Schipper said. "The longer they wait or take missteps, the harder it will be to recover. More and more consumers will be used to owning and using cars, and city development will be distorted increasingly towards a car-oriented pattern. The experience from nearby cities in Asia — Bangkok, Jakarta and Manila, to give three notorious examples — suggest that recovering from this pattern will be very, very difficult."

http://www.miller-mccune.com/environment/can-china-avoid-getting-stuck-in-traffic-27997/

**A Hiding Place for Nuclear Waste**

**A new film documenting Finland's effort to seal away nuclear waste for the next 100 millennia asks how one predicts 100,000 years into the future.**

By Lewis Beale


*A scene from "Into Eternity," a documentary that looks at the planet's most unique construction project: underground tunnels in Finland meant to store the country's nuclear waste for 100,000 years. Yep ... 100,000. (Posiva)*

The first documentary that Netflix might slot into their science fiction category, director Michael Madsen's *Into Eternity* is an eerily fascinating look at the planet's most unique construction project.
Known as Onkalo — "hiding place" in Finnish — this massive work in the north of Finland, which began construction in the last century and won't be completed until the next one, is a series of concrete-reinforced underground tunnels meant to store the country's nuclear waste. And it's designed to last until the waste is harmless — a full 100,000 years.
Say it again — 100,000 years. The figure is mind-boggling, and that's one of the points the film — currently playing in New York and soon to be released around the country — sets out to make. How do you plan something that's supposed to last that long? How do you build it? And when it's finished, should you warn future generations what lies 500 feet under the Finnish forest or hope that the project will be forgotten and no one will unintentionally stumble upon it?
Onkalo is, in fact, the first project of its kind, so the engineers and scientists interviewed in the film are definitely pioneers of a sort. "Everyone is waiting to see if Finland can pull this off," said director Madsen (not to be confused with the *Reservoir Dogs* star) during a phone interview. "No one knows the right way to do this, and no one knows if it will work. That means even the nuclear safety authorities don't know what the standards are."

Fact is, something needs to be done with the estimated 250,000 tons of nuclear waste worldwide. Right now, interim storage is available above ground in steel containers submerged in water, but no one seems to know how long this solution will be viable. And as one of the film's talking heads puts it, "The world above ground is unstable."

Which is why the Finns decided to build Onkalo in solid bedrock that's been around for about 1 billion years and is not susceptible to earthquakes. Construction, which began in 2003, will eventually consist of 4 kilometers of tunnels organized in what is described as a "Russian doll" configuration — if the barrier to one tunnel fails, the barrier to another can mitigate any possible consequences. And once construction is finished sometime in the 22nd century, a concrete seal will be cast at the tunnel mouth, and shut for all eternity. Then the land above it will be backfilled and eventually returned to its natural state.

All well and good. The plan seems, on its surface, well thought out. But beyond construction discussions, *Into Eternity* gets into some seriously futuristic issues. For one thing, Madsen films a lot of the tunnel footage in loving tracking shots, including some scenes of construction equipment set to the strains of Jean Sibelius' "Valse Triste." It's like watching a real-life version of that scene in *2001: A Space Odyssey*, where shots of a spinning space station are set to Strauss' "Blue Danube" waltz.

But it is Madsen's questions about future generations, and what they should be told about the project, that really set the film spinning off into the province of writers like William Gibson and Joe Haldeman. Most of the scientists don't seem worried about human intrusion and even question if future generations will understand the purpose of Onkalo or even have advanced enough technology to penetrate it. Who knows, after all, if 100,000 years into the future mankind will have regressed technologically or left the planet for a new home in the stars?

Which is why some experts believe the project should be left untended and forgotten, or, as one scientist puts it, "to remember forever to forget." But others think the site should be marked with warnings, although when they start thinking about exactly how to communicate with future generations, you can almost see the brains of these intellects start to sizzle with frustration. What kind of spoken language will Future Man be using? Will pictograms do the trick? And if so, who knows if today's universal symbol for nuclear danger will have any meaning thousands of years into the future?

It all comes under what one commentator labels "decisions under uncertainty" — what you know you don't know, and what you don't know you don't know.

"I think what is most significant about the project is that these experts, the people building it, are more inclined to talk about the technical aspects rather than the actual problem, which is the time span and should we warn the future or not," said Madsen. "It is possible to understand the argument that it should be forgotten, which the Finnish engineers tend to advocate. But how do you create forgetting? And if you go for that one, you have to be overly confident in what you're building — 'We're giving a 100,000-year warranty on this building' — and that is hubris."

Hubris? Or faith in the future? *Into Eternity* tends to leave the answer up to the viewer, but as far as Madsen is concerned, the answer to those questions is self-evident.

"We have to watch the future," he said. "To assume it is foolproof — that's nonsense."

http://www.miller-mccune.com/media/a-hiding-place-for-nuclear-waste-27791/

**Science Leaches Out of Science Class**

**Political scientists studying U.S. public school biology instructors find a majority of teachers — a "cautious" three out of five — are at best tepid in defense of evolution.**

By Emily Badger


*Researchers looking at U.S. public school biology instructors find a majority of teachers are weak in their defense of evolution. (istockphoto.com/stockxchange.com)*

In his State of the Union address last week, President Obama urged Americans to "win the future" through a new dedication to the science and technology education that could help the United States "out-innovate, out-educate and out-build the rest of the world."

He conjured an America where today's fifth-graders could become the globe's go-to experts in solar engineering, high-speed rail design and supercomputer construction. But in a sign of the distance between that universe and the one Americans really live in, it turns out many public school students aren't even properly exposed to one of the most fundamental principles of science — evolution.

Penn State University political scientists Michael Berkman and Eric Plutzer began thinking about the topic years ago when Berkman's son first entered elementary school.

"One of children asked the teacher, 'Wasn't it true that the continents at one time were connected, many years ago?'" Plutzer recalled. "The teacher said, 'I can't answer that question, it's not appropriate for your grade level.' This got us thinking about a whole host of issues."

One of them was the sensitivity of acknowledging the Earth is billions of years old, a central tenet of the geosciences. Another was the notion of "grade-appropriate" information, generally spelled out in local curriculum standards.

"We thought about this for many years," Plutzer said. "We decided, as political scientists, that we had something new we could say about the evolution–creation battles, and that is to view them through the lens of democracy and to understand that from the very beginning, from the Scopes trial on, the battle has not just been a battle of ideas about the way the world is, but it's been a battle of who should decide what students should learn."

Are career scientists at the National Research Council determining what students should learn about evolution (or any number of other technical scientific issues)? Or state departments of education? Or elected members

of local school boards? Or someone else? Berkman and Plutzer mull the question in a new book, *Evolution, Creationism, and the Battle to Control America's Classrooms*, and they present some of the evidence for their conclusion in the latest issue of *Science*.

"We concluded that, by and large, it was the teachers that were really making policy at street level," Plutzer said. "All of these well-publicized battles in Kansas and Texas and Ohio and elsewhere about what these content standards should include really have very little impact on teachers."

This means students aren't learning about evolution as professional scientific organizations would advise teaching it — and they're probably not even learning about it the way other students down the hall are.

Berkman and Plutzer sent lengthy surveys to 1,900 public school biology teachers across the country. Of the 926 responses that inform their research, 13 percent of biology teachers — hailing from all over the country — advocate creationism or intelligent design despite years of high-profile court cases ruling this unconstitutional.

Only 28 percent of teachers consistently present the evidence for evolution as a unifying theme in biology, as the National Research Council recommends. The rest — Berkman and Plutzer call them the "cautious 60 percent" — should concern advocates of scientific literacy (such as the president) even more than the minority of creationists. Their caution promotes the idea that scientific findings are a matter of opinion, not rigorous research.

"Many of the teachers we classify as advocates for evolutionary biology, they recounted incidents where a student complained, and they calmly sat down with the student, or a parent or principal," Plutzer said.

"They'd be confident enough say, 'That's a controversy that has no real basis in fact.' They could quote particular stats; they were very confident. They told us they went back to the classroom and taught exactly as they had before.

"This cautious 60 percent often don't think they'll come out quite as well in such an encounter."

The teachers who do the best job of defending evolution are, not surprisingly, the ones who have the most command of the subject — they majored in biology in college or took a semester-long college course in evolutionary biology. Plutzer thinks most of the 60 percent would like to do a better job at teaching the subject, if they could. He and Berkman conclude the best place to start may be to bolster what they learn themselves when they're students of evolutionary biology in college.

The American education system by definition, though, resists national control of what students learn (whether in 10th-grade biology or college biology programs), even as federal court cases try to dictate what's out of bounds in public schools. This means that if the president has a national goal for where science education should take America, getting there could be considerably more complicated than he has made it sound.

http://www.miller-mccune.com/blogs/the-idea-lobby/science-leaches-out-of-science-class-27962/