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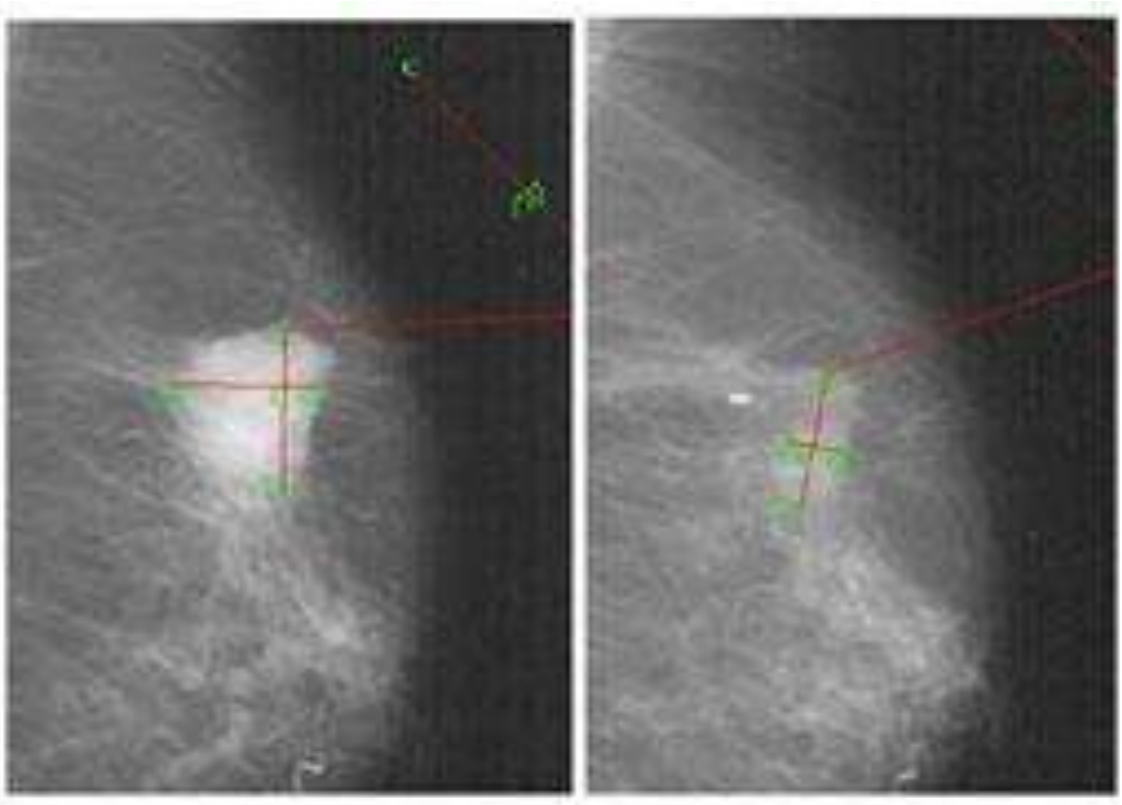
Fifty genome sequences reveal breast cancer's complexity

Decoding of ten trillion bases yields no simple patterns or silver bullets.
Meredith Wadman



Mammograms of a malignant breast tumor before (L) and after (R) 16 weeks of aromatase inhibitor therapy. The more we learn about breast cancer, the more complicated it becomes.Dr. Kim Wiele, Paul K. Commean and Joan Moulton, Electronic Radiology Laboratory, Washington University

The deeper researchers dive into the genetics of breast cancer, the more complicated their discoveries. And the latest, and deepest, dive is no exception.

Scientists led by Matthew Ellis at Washington University in St. Louis, Missouri, have sequenced the whole genomes of 50 patients' breast cancer tumours alongside matching DNA from the same patients' healthy cells in order to identify genomic alterations present only in the cancerous cells. Their findings, presented today at the Annual Meeting of the American Association for Cancer Research in Orlando, Florida, reveal that these cancers' genetic fingerprints are highly diverse; of the 1,700 gene mutations they found in total, most were unique to individual patients' tumours, and only three occurred in 10% or more. The genomic changes were also of all kinds, from single-nucleotide variations and frame shifts to translocations and deletions.

"The results are complex and somewhat alarming, because the problem does make you sit down and rethink what breast cancer is," says Ellis, leader of the breast cancer programme at the university's Siteman Cancer Center.

Nonetheless, he says, there is reason for optimism — not least because careful analysis of the data, combined with what is already known about the functions of the affected genes, yields a wealth of new therapeutic possibilities.

Big science

The sheer volume of the scientists' enterprise is impressive: they sequenced and analysed more than ten trillion bases, using a supercomputer of a power similar to that of the Large Hadron Collider at CERN, Europe's premier physics laboratory in Geneva, Switzerland. The tumours sequenced, with average 30-fold coverage, were from oestrogen-receptor-positive breast cancers. They came from participants of two clinical

trials of oestrogen-lowering drugs known as aromatase inhibitors. Patients with breast cancer who are not responsive to these drugs have significantly worse outcomes, although the molecular basis for this is poorly understood. The scientists hoped that, by comparing the genome sequences of oestrogen-sensitive tumours (26 of the 50) to oestrogen-resistant cancers (24), they might find clues to the pathological basis for the difference.

They did find at least one association — for the breast-cancer-suppressor gene MAP3K1, the protein product of which accelerates programmed cell death. Mutations that disable this gene allow cells that should die to remain living. MAP3K1 mutations were present in about 10% of the tumours, and seemed to be associated with the aromatase inhibitor-sensitive, more favorable, type of disease, particularly when the same cancer carried another, previously described mutation in a gene called PIK3CA.

This was one of two mutations already associated with breast cancer that occurred frequently in the 50 tumours: PIK3CA was found in 43% of samples and the tumour suppressor TP53 turned up in about 15%. All told, about half the cancers carried a combination of these three mutations — leaving half with cancers arising from varying constellations of much rarer mutations.

Ellis says that the complexity of their results indicates that when it comes to developing therapeutics "very clearly the only way forward is the genome-first approach. No single blockbuster drug will answer the problem of endocrine-therapy resistance".

He adds that, because breast cancer is so common, even treatments targeting pathological mechanisms triggered by relatively rare mutations could benefit many thousands of women

"The fact they have sequenced cancers in the context of a clinical trial, that's what's really significant here," says Samuel Aparicio, a breast cancer researcher at the University of British Columbia and the BC Cancer Agency in Vancouver, Canada. This is because clinical trial data allow scientists to relate genomic findings to detailed data on, for instance, patient survival. "One knows exactly what happened to those patients," says Aparicio.

Ellis, for his part, says that he has already begun his next step: to repeat the experiment on at least 1,000 more tumours. "It's complicated and we're going to have to do many many more cases to understand how this all works," he says. "But certainly we have the methodology to begin to sort it out."

http://www.nature.com/news/2011/110402/full/news.2011.203.html

The amazing disappearing antineutrino

A revised calculation suggests that around 3% of particles have gone missing from nuclear reactor experiments.
Eugenie Samuel Reich

Measurements from the Sudbury Neutrino Observatory in Canada were thought to have settled the mysteries of neutrinos - but new calculations have raised new questions.Roy Kaltschmidt / Lawrence Berkeley Nat'l Lab
Neutrinos have long perplexed physicists with their uncanny ability to evade detection, with as many as two-thirds of the ghostly particles apparently going missing en route from the Sun to Earth. Now a refined version of an old calculation is causing a stir by suggesting that researchers have also systematically underestimated the number of the particles' antimatter partners — antineutrinos — produced by nuclear reactor experiments. The deficit could be caused by the antineutrinos turning into so-called 'sterile antineutrinos', which can't be directly detected, and which would be clear evidence for effects beyond the standard model of particle physics.
In the 1960s, physicist Ray Davis, working deep underground in the Homestake gold mine in South Dakota, found that the flux of solar neutrinos hitting Earth was a third of that predicted by calculations of the nuclear reactions in the Sun by theorist John Bahcall. Davis later received a Nobel prize for his contributions to neutrino astrophysics. That puzzle was considered solved in 2001, when the Sudbury Neutrino Observatory (SNO) in Canada found the missing two-thirds through an alternative means of detection. The SNO's results were taken as evidence that neutrinos have a mass, which allows them to oscillate between three flavours: electron, muon and tau. Davis had only detected the electron neutrinos.
Experiments that measure the rate of antineutrino production from the decay of uranium and plutonium isotopes have so far produced results roughly consistent with this theory. But the revised calculation[1] accepted this week by Physical Review D suggests that it's not the whole story. While waiting for the Double Chooz neutrino experiment in France to become fully operational, Thierry Lasserre and his colleagues at the French atomic energy commission(CEA) in Saclay set out to check predictions of the rate of antineutrino production by nuclear reactors. They repeated a calculation first done in the 1980s by Klaus Schreckenbach at the Technical University of Munich, using more modern techniques that allowed them to be much more precise.

Their new estimate of the rate of production is around 3% more than previously predicted. This means that several generations of neutrino and antineutrino experiments have unknowingly missed a small fraction of the particles. "It was completely a surprise for us," says Lasserre.
Double Chooz consists of two detectors measuring the flux of antineutrinos produced by the Chooz nuclear power plant in the French Ardennes, one detector about 400 metres away from the plant and the other 1 kilometre away. The far detector became operational this year.
Stefan Schönert, a neutrino physicist at the Technical University of Munich, says the calculation is solid, and has been checked with Schreckenbach. "They can reproduce each other's results. There's no way around this result. It's very solid."
Art McDonald of Queen's University in Kingston, Canada and the SNO says that people have to look carefully at the calculation, which may itself have a systematic error. But, he adds, "there's no doubt it would have significance as a physics result if it can be shown with more accuracy."

The result may be pointing to evidence of neutrinos and antineutrinos oscillating into a fourth kind of neutrino or antineutrino, a so-called 'sterile' version that doesn't interact with ordinary matter, says Carlo Giunti, a physicist at the University of Turin in Italy. Other experiments have previously seen evidence for sterile particles, including the Liquid Scintillator Neutrino Detector at Los Alamos National Laboratory in New Mexico and the Mini Booster Neutrino Experiment, or MiniBooNE, at Fermilab in Batavia, Illinois, and the search to confirm their existence is a hot area of physics.
Giunti says that the magnitude of the anomaly uncovered by Lasserre is not statistically significant on its own, but that it points promisingly in the same direction as another anomaly found by the SAGE collaboration, which studied neutrinos from a radioactive source at the Baksan Neutrino Observatory in the Caucasus in 2005[2]. "Before this, there used to be a contradiction between [reactor and radioactive source] experiments but now they are in agreement," says Giunti.
Schönert says that one key experiment everyone is waiting for is a measurement showing that the rate of disappearance of antineutrinos from a source increases with the distance from it. "This would be the smoking gun," he says.

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The drying of East Africa

A shift in tropical ocean circulations could explain a historical shift in global climate.
Jeff Tollefson

Tropical ocean circulation seems to be linked with climatic changes in eastern Africa 2 million years ago.Top-Pics TBK / Alamy

Peter deMenocal has been pondering the ancient natural history of eastern Africa for more than a decade, documenting evidence of desiccation as well as the gradual shift toward open savannahs, grass-eating fauna and the rise of the ancestors of modern humans. Now, the marine geologist at Columbia University in New York and his colleagues think they have pinned down a culprit for the shift in climate: the tropical oceans. deMenocal previewed his team's findings at the American Geophysical Union conference in Santa Fe last week.

The breakthrough came after deMenocal analysed the shells of planktonic foraminifera (minute single-celled organisms) in an old sediment core drilled in the Indian Ocean off the west coast of Australia. These calcifying organisms live at the surface of the ocean and increase their uptake of magnesium at a predictable rate as the water temperature rises. He and his team found that the magnesium content of the foraminifera shells began to increase in sediments around 2 million years old, indicating the start of a warming trend on this side of the Indian Ocean. This trend diverged sharply from a significant cooling trend already documented on the other side of the ocean off the east coast of Africa.

This divergence is visible alongside a roughly 20,000-year wet–dry cycle, which is due to variations in solar energy caused by the earth's natural wobble and elliptical orbit. "It's a monster signal," says deMenocal.

This shift in sea surface temperatures in the Indian Ocean came at an important time, coinciding with a rapid uptick in the drying of east Africa, as well as the beginning of modern circulation trends in the Pacific Ocean[1]. deMenocal suggested that the Indian Ocean trends could explain the climate shift over east Africa and joined up with a pair of modellers at Yale University in New Haven to test the theory out. Alexey Fedorov and Chris Brierley ran a series of experiments analyzing the effects of tropical sea surface temperature changes on a global climate model and found that the combination of the estimated Indian and Pacific ocean temperature

trends spurred a 30–80% reduction in rainfall over east Africa, the size of decrease depending on the exact location.

"What we found is that to get the changes in east Africa, you need to know the right conditions both in the Indian Ocean and in the Pacific Ocean," Fedorov says.

Christina Ravelo, a palaeoclimatologist at the University of California, Santa Cruz, calls the results "pretty robust" but says they need to be kept in context. Details are still being worked out, she says, but the climate and oceans experienced a long cooling trend that occurred between 2 and 4 million years ago as the world exited the Pliocene warm period — the most recent analogue to a world warmed by greenhouse gases — and entered the ice ages. "The 2-million-year event is when things started looking like today, but the transition was a long time in the making," she says. "But it could be that it was the establishment of the modern ocean gradients that helped dry out Africa."

Given that the tropical climate drives what happens in the rest of the globe, Fedorov says that this transition is as central to Earth's history as the ice ages themselves. Theories about the cause of the transition range from tectonic shifts that altered ocean circulation to climatic shifts driven by carbon dioxide, but so far none of them has taken hold. "We still don't understand why it happened," Fedorov says.

For deMenocal, it's clear that the east African story is coming together. "At least in terms of the drying climate, I think we've nailed that now," he says. The next question is whether this climatic shift can be tied to some of the major evolutionary changes that seem to arise around the same time, including the appearance of Homo erectus and of animals adapted to living on the grasslands.

"There's a whole bunch of stuff happening around this time, and it's coincident with this huge change in climate," deMenocal says. "But we can't prove it's related."

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China vows to clean up rural environment

Agriculture accounts for half of all pollution in the country.
Jane Qiu

China has made cleaning up rural pollution a priority for the first time in its latest five year plan.REUTERS
Tackling pollution in rural areas, especially pollution from agricultural sources, will be a top priority for China in the coming years, Li Ganjie, vice-minister of environmental protection, said on 28 March at a conference in Beijing on the rural environment.
For decades, the extent of pollution caused by agriculture has not been given much attention with most efforts being focused on industrial pollution, says Zhang Fusuo, a researcher at the China Agricultural University in Beijing. This is the first time that the protection of the rural environment has been included in the country's five-year budget plan.
"This is wonderful news for the course of environmental protection in China," says Zhang.
China's rural areas produce more than 9 billion tonnes of waste water and 280 million tonnes of household rubbish a year. And as most of the country's 600,000 villages have no treatment facilities for rubbish or sewage, much of it is dumped locally untreated. "In many villages I have been, there is rubbish everywhere and it stinks like hell," says Zhang.
The major culprit in rural pollution, however, is agriculture. The first national pollution census, conducted in 2007, showed that agriculture was responsible for 43.7% of the total chemical oxygen demand (COD) — a measure of organic pollutants in water. It also contributed 57.2% and 67.3% of the total 4.7 million tonnes of nitrogen and 0.4 million tonnes of phosphorus effluents, respectively.

Big clean-up

Li said that the ministry aims to clean up 60,000 villages by 2015, focusing on regions important for freshwater resources and where pollution has had a negative impact on health — such as villages with high rates of cancer or endemic diseases.
The ministry is set to promote public awareness and participation in environmental protection in rural areas, and performance in curbing rural pollution will be one of the criteria by which local government officials are evaluated.

The clean-up programme will include new treatment facilities for household rubbish, sewage and animal manure, cleaning up contaminated soil and waterways, and the development of large-scale livestock farms to make it easier to collect and reuse manure. There are also plans to set up long-term monitoring networks to ensure sustained protection.
As most existing environmental laws and guidelines are geared towards industrial pollution, the ministry is drafting new laws on soil protection and the reduction and treatment of livestock pollution.
Although the total investment is unclear, The 21st Century Business Herald, a Chinese-language newspaper, reports that the central government will spend 9.5 billion renminbi (US$1.5 billion) over the next few years to clean up the rural environment.

Down on the farm

While welcoming such initiatives, many agriculture researchers say that they will not be enough to curb rural pollution and should be complemented by significant improvements in agricultural practices, such as better livestock management and cleaner farming.
With a limited labour force but ample subsidized chemical fertilizers available in most rural areas, dumping nutrient-rich animal manure has become an easier and cheaper option than using it to fertilize crops. And animal feed in China is loaded with additives such as antibiotics and heavy metals, making many farmers reluctant to use manure as a replacement for chemical fertilizers.

Consequently, livestock has become the largest contributor to run-off pollution — being responsible for 98%, 38% and 56% of COD, nitrogen and phosphorus, respectively, according to the national pollution census.
The key to reducing livestock pollution is to promote greater integration between farming and livestock rearing, so that animal manure is recycled rather than becoming a source of pollution, says Wu Jinshui, a researcher at the Chinese Academy of Sciences' Institute of Subtropical Agriculture in Changsha, Hunan province. Such a mixed crop and livestock system "could better utilize water, nutrients and animal wastes and reduce pollution", he says. But "a prerequisite of a mixed system is to tighten up regulations on animal-feed production," he adds.
In addition to laws on soil protection and livestock management, regulations on the use of fertilizers, pesticides and herbicides — the use of which is much higher per hectare in China than in developed countries — are urgently needed, says Zhang.

http://www.nature.com/news/archive/date/2011/04.html?start=80&num=40

Developing world: Educating India

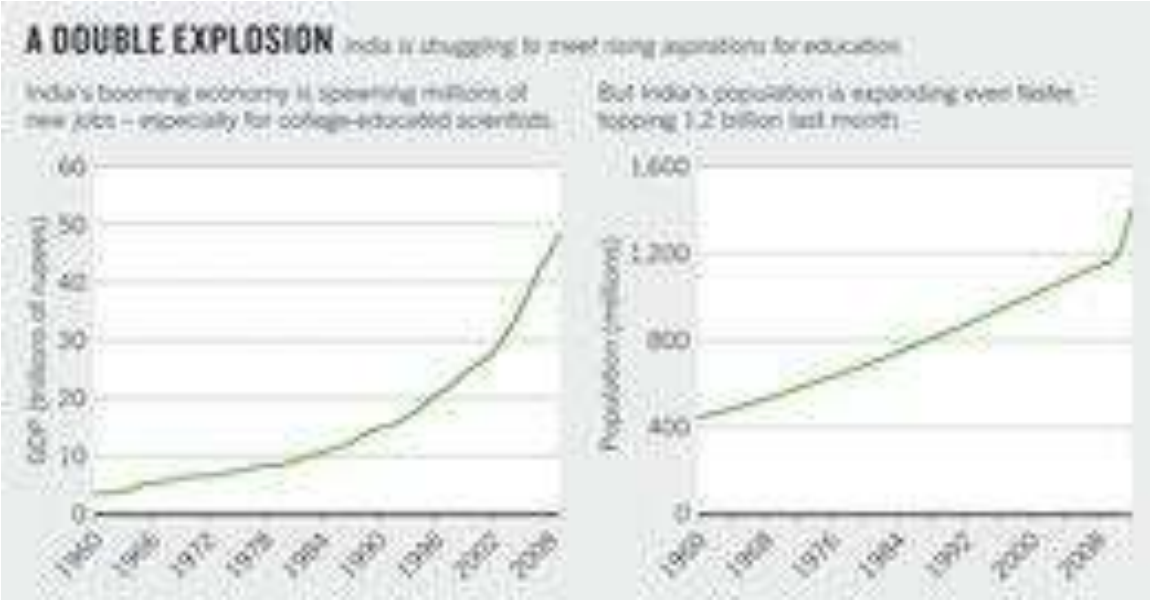
The country's vast, education-hungry population could supply the next generation of the world's scientists — but only if it can teach them.
Anjali Nayar

Subha Chakraborty has hardly left the lab in three months. His master's research in micro-scale systems is running into the early hours almost every morning, and "that is not the right time to go back to your room and sleep", he says. So he bunks on a makeshift bed under his computer and cooks on a toaster in the corner of the lab's common room.
Chakraborty isn't alone: most of the lab's ten postgraduate students follow a similar schedule. "There's some kind of charm here," says one of them, Anindya Roy, who has decided to officially surrender his dormitory room.
These students at the banyan-tree-lined campus of the Indian Institute of Technology (IIT) in Kharagpur are among India's luckiest and best: once they have completed their degrees, they will end up working at top universities and private research hubs in India and around the world. But the optimism and drive are ubiquitous. "When you go to the rural parts of the country you meet extraordinarily bright kids who just have to be given the opportunity," says Chintamani Rao, chief scientific adviser to India's prime minister. There are a lot of them — around 90 million between the college-going ages of 17 and 21, rising to an estimated 150 million by 2025. And they are hungry, starving even, for an education (see 'Technology levels the educational playing field'.

Brain drain

But can India feed that hunger? The government has pledged to make it a priority, but faces tremendous obstacles. Most of the elite science and engineering graduates opt for high-paying jobs in industry rather than independent research. Other students far too often end up in high-priced commercial diploma-mills that deliver little real education. Many, many more young Indians don't even get that far: the country's 500 universities and 26,000 colleges have space for only about 12% of its eligible youth. And the population is growing by 1.34% a year, more than twice the rate of growth in China (see 'A double explosion').

But if India cannot meet this challenge, it could miss out on becoming one of the world's great innovation hubs, says Rao. "There is a very large population out there that is extremely qualified and they end up in



second or third-rate institutions," agrees Pradeep Khosla, dean of engineering at Carnegie Mellon University in Pittsburgh, Pennsylvania, and a graduate of IIT Kharagpur. "A lot of talent gets wasted."

On the surface, India seems to be in the middle of an educational renaissance, thanks largely to its booming economy. After decades of economic stagnation under the socialist policies that followed the country's independence in 1947, Indians enthusiastically embraced a series of business-friendly reforms that began in the early 1990s. The result has been economic growth that currently averages more than 8% a year, with only a slight and temporary slowdown during the global financial crisis that began in 2008. That growth, in turn, has created a flourishing market for qualified graduates in everything from construction to information technology and health care.

"There are a lot of stories of successes — from rags to riches — of Indians who made it just on the basis of good education," says Pawan Agarwal, author of Indian Higher Education: Envisioning the Future (Sage; 2009). "This is creating high aspirations among Indians about higher education."

Those ambitions, along with the population growth, have fuelled an eight-fold increase in science and engineering enrolment at India's colleges and universities over the past decade, with most of the growth occurring in engineering and technology — fields in which jobs are especially plentiful. The low cost of doing business in India and the large crop of English-speaking graduates has made it a global hot spot for investment in research and development (R&D).

"In 2003, 100 foreign companies had established R&D facilities in India," says Thirumalachari Ramasami, head of the government's Department of Science and Technology. "By 2009, the number had grown to 750."

Those companies include technology and communications firms such as IBM, General Electric, Cisco, Motorola, Oracle and Hewlett-Packard, all eager to get a foothold in the fast-growing information-technology hub around Bangalore.

Small wonder, then, that the 15 IIT campuses nationwide have roughly 300,000 applicants every year, or that the students who make it in are very, very good: IIT acceptance rates are about 2% (see 'Only the best'), compared with around 7% at Harvard University in Cambridge, Massachusetts, an emblem of US elitism. "Statistically, out of a billion people there must be a Michael Faraday," says Rao. "There must be a number of talented people."

Look closer, however, and it becomes apparent that there are serious cracks in the system. For example, the vast majority of India's science and technology graduates immediately head for high-paying jobs in industry. Only about 1% of them go on to get PhDs, compared with about 8% in the United States. "Internally the brain

drain is quite high," says Rao. "All the talent goes into sectors that make money but produce very little in terms of creative things for the country."
What makes this problematic, adds Rao, is that the country's rising economic tide is largely the result of its myriad outsourcing centres and the computer industry. If India cannot broaden its economy — and make better use of its brightest scientific minds — it will have little chance of solving its challenges in areas such as poverty, food, energy and water security.

"Everyone's just making computers faster, and our computers are pretty fast already," agrees Manu Prakash, who graduated from the IIT in Kanpur — and who, like many Indians with academic ambitions, elected to pursue his education elsewhere. He earned his PhD from the Massachusetts Institute of Technology in Cambridge, and now runs his own biophysics lab at Stanford University in California.
Prakash says that although the IIT system does attract superb students, it is institutionally broken because it doesn't value creativity. "You have a brilliant mathematician coming into an engineering course and then taking a nine-to-five job with a company," he says. "There is something wrong there."

Quantity versus quality

Whatever its flaws, the IITs remain out of reach for millions of eager, ambitious Indian students. The higher-education system is expanding pell-mell to accommodate them — with the burgeoning private sector filling around 90% of the demand. "We will need another 800–900 universities and 40,000–45,000 colleges within the next 10 years," says Kapil Sibal, India's minister of human resources and development. "And that's not something the government can do on its own."
For-profit colleges and universities are popping up around the country by the day — nearly 4,000 of them in 2010 alone. The road leading out of Chennai in southern India, like many around the country, is crammed with hundreds of private engineering colleges. The government has struggled to maintain any kind of standard. "The big challenge is that when you move to grant more access [to education], that the access must come with quality," says Sibal.
“We are spoon-fed. The teachers dictate and the students write down what they say.”

Many private institutions have only a few hundred students each and offer little in the way of laboratory or practical training, because labs are expensive. Curricula are outdated and there are crippling shortages of teaching staff, thanks to the allure of higher-paying industry jobs. "The younger generation is completely disillusioned with pursuing higher education with the intention of going into teaching," says Agarwal. Sibal estimates that at least 25% of academic posts are vacant and more than half of professors lack a postgraduate education.

Rahul, who prefers that his real name not be used, studies information technology at a private college an hour outside Delhi. "We are spoon-fed," he says. "The teachers dictate and the students literally write down what they say."

Rahul's parents paid hundreds of thousands of rupees up front to get him into the institute after he scored poorly on entrance exams. He says that about 30% of his peers entered in the same way, and at other colleges the informal 'management quota' can be as high as 40–50%.

This year, tuition at the institute cost 85,000 rupees (US$1,900): more than three times that charged by the IIT system. And the payments at many private colleges don't stop there, says Rahul. "A few days before [exams] you can pay 1,000 rupees for a copy of the paper, and you can pay another couple of thousand rupees if you didn't get the right marks," he says. "Then, if you don't attend classes or labs, you can pay 5,000 rupees to fulfil your attendance quota. Education here is based entirely on money. And to think, my institute is one of the best in the area."

There are more than 600 colleges affiliated with one university in his province alone, and every college has 5–6 branches, with 60–120 students each. "That's lakhs [hundreds of thousands] of students passing out of these colleges per year," says Rahul.

Moreover, many of the students are graduating with abysmal literacy and numeracy skills. Employers' surveys suggest that up to 75% are unemployable.

"You can pay to get in, you can pay to get good marks and you can pay for your attendance, but you can't pay to get into a good company," says Rahul. "There are people at my college who don't even know how to say 'how are you?' in English" — the working language of most companies.

Rahul's experience is not unusual. Geeta Kingdon, who studies education, economics and international development at the University of London's Institute of Education, points to allegations of widespread corruption in how Indian institutes and universities are accredited. "Even those who have got the relevant accreditation only got it because they paid the relevant bribe," she says. Many don't bother. A government crackdown on unaccredited institutions in 2010 left more than 40 universities and thousands of colleges in court.

Corruption has even reached the august halls of IIT Kharagpur. Last October, a handful of the institute's top engineering professors were accused of running a fake college called the Institution of Electrical Engineers (India) from the campus. The scheme allegedly involved the use of forged documents bearing the IIT logo to lure in students, who were charged 27,000 rupees for admission, roughly what the IITs charge per year. The IIT Kharagpur has launched an inquiry into the incident. "But there will always be another scandal down the road," says Srinivasan Ramanujam, a mechanical engineer at the institute. "Students are desperate to get into a college and people exploit this mentality."

With all these desperate but half-baked graduates, India's hopes of becoming a global centre of innovation are being compromised. Too often, the corporate R&D model sweeping through India treats science graduates more as grunt workers than true innovators, says Ramasami. "Just availability of scientifically talented people does not provide scientific breakthroughs. For the discovery process you need ambience and creative people."

India's government is working hard to change the trend. In January 2010, for example, it pledged to ramp its investment in R&D up from the current 1% of the gross domestic product to 2%, but this will happen very slowly, says Rao. The government's budget for 2011–12 included a one-third increase in its annual higher-education investment, to a total of 130 billion rupees. And it has approved a new funding agency, the National Science and Engineering Research Board, which is expected to become operational this year, and will have an initial budget of around US$120 million, says Rao.

By 2014, says Ramasami, the hope is that such measures will raise the number of science and technology PhDs awarded each year from the current 8,900 — less than one-third that of the United States or China — to at least 10,000. By the end of the decade, he says, the target is 20,000 PhDs a year.

Overseas input

The government is also counting on an injection of money and expertise from foreign academic institutions. With enrolment rates waning abroad, many universities are looking to India as a new academic market — including US institutions such as the University of California, Berkeley, and Carnegie Mellon University.
US President Barack Obama's trip to India last November highlighted the growing interest: included in his delegation were three presidents of US universities and senior representatives of several more. During the trip, Obama and Indian Prime Minister Manmohan Singh announced that they would hold a US–India summit on higher education this year to help encourage collaborations.
So far, Indian law has restricted foreign universities to forming partnerships with Indian institutions, says Sibal. But a Foreign Educational Institutions Bill being considered in India's parliament would allow them to build full-blown campuses of their own. Sibal takes it as a sign of what India could become. "Top-quality institutions of the United States and around the world are actually knocking at our door," he says. "The India of tomorrow will be an India that provides solutions not just for itself, but also for the rest of the world."
But that is only if India's rising youthful generation can break out of its current job-based mentality — not easy in a developing country.

One evening late last year, Shirsesh Bhaduri, a fourth-year biotechnology student at IIT Kharagpur, visited Tikka — a makeshift café in the shade of a banyan tree, where students and faculty members catch up over cups of 3-rupee tea and samosas. But just over the campus's whitewashed walls is the reality of West Bengal state and most of India: unruly fields, shanty villages, water buffalo and jungle.
"In other countries, people may choose their career according to their interests," says Bhaduri, who has just been to an interview with London-based bank Barclays. "But here the industries that pay the maximum attract the maximum applications. Most people do a master's in business administration after the IIT — and that is the aim of most people out here. Everything is money-oriented."
Anjali Nayar is a freelance writer based in Nairobi.

http://www.nature.com/news/2011/110406/full/472024a.html

Major Step in Improving Forecasts of Weather Extremes Such as Floods and Droughts

Researchers have found that evaporation from the land surface is able to modify summertime rainfall east of the Mississippi and in the monsoonal region in the southern U.S. and Mexico. (Credit: © Demydenko Mykhailo / Fotolia)

ScienceDaily (June 6, 2011) — Moisture and heat fluctuations from the land surface to the atmosphere form a critical nexus between surface hydrology and atmospheric processes, especially those relevant to rainfall. While current theory has suggested that soil moisture has had a positive impact on precipitation, there have been very few large-scale observations of this. A team of researchers from Columbia Engineering, Geophysical Fluid Dynamics Laboratory, and Rutgers University has now demonstrated that evaporation from the land surface is able to modify summertime rainfall east of the Mississippi and in the monsoonal region in the southern U.S. and Mexico. One of their main findings is that evaporation from the land is, however, only able to modify the frequency of summertime rainfall, not its quantity.

"This is a major shift in our understanding of the coupling between the land surface and the atmosphere, and fundamental for our understanding of the prolongation of hydrological extremes like floods and droughts," said Pierre Gentine, Assistant Professor of Applied Mathematics at The Fu Foundation School for Engineering and Applied Science at Columbia University, and co-author of the paper "Probability of Afternoon Precipitation in eastern United States and Mexico Enhanced by High Evaporation," published online June 5 in the journal *Nature Geoscience*. The other co-authors are Kirsten Findell (Geophysical Fluid Dynamics Laboratory), Benjamin Lintner (Rutgers University), and Christopher Kerr (Geophysical Fluid Dynamics Laboratory).

The researchers used data from the National Centers for Environmental Prediction (NCEP) to quantify the impacts of continental evaporation on the frequency and intensity of summertime rainfall over North America. They discovered that higher evaporation increases the probability of afternoon rainfall east of the Mississippi and in Mexico, while it has no influence on rainfall over the Western U.S. The difference is due to the humidity present in the atmosphere. The atmosphere over the western regions is so dry that no matter what the input of moisture via evaporation is from the surface, an added source of moisture will not trigger any rain

since it will instantaneously dissipate into the atmosphere. The atmosphere over the eastern regions is sufficiently wet so that the added moisture from the surface evaporation will make it rain.
"If it starts getting really wet in the east," noted Gentine, "then the surface will trigger more rain so it becomes even moister, and this sets up a vicious cycle for floods and droughts. Nature -- i.e. the land surface and the vegetation -- cannot control the rainfall process in the west but it can in the east and in the south. This is really important in our understanding of the persistence of floods and droughts."
Consequently, once a flood or a drought is triggered by large-scale processes, such as sea surface temperature anomalies, the flood/drought conditions are most likely to persist in the eastern and southern U.S. But in the West, the duration and frequency of floods/droughts are controlled only by oceanic processes: the surface cannot modify the rainfall process. Whether the soil is dry or wet doesn't change subsequent rainfalls: consequently the surface will not help hydrological extremes persist (e.g. floods/droughts).
Gentine is developing a theoretical framework to understand the precipitation and cloud formation over land and says this should be an important breakthrough in our understanding of how soil moisture and vegetation controls cloud formation and the precipitation process. "I find this work fascinating because it's a great blend of theoretical research -- understanding how nature works -- and practical applications that affect our world -- like flood/drought/water management. My lab is right outside: observing clouds and precipitation!"
The study was funded by the National Science Foundation (NSF).

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

Journal Reference:

1. Kirsten L. Findell, Pierre Gentine, Benjamin R. Lintner, Christopher Kerr. **Probability of afternoon precipitation in eastern United States and Mexico enhanced by high evaporation**. *Nature Geoscience*, 2011; DOI: 10.1038/ngeo1174

http://www.sciencedaily.com/releases/2011/06/110605132427.htm

Climate Scientists Forecast Permanently Hotter Summers

A new study finds that the tropics and much of the Northern Hemisphere are likely to experience an irreversible rise in summer temperatures within the next 20 to 60 years if atmospheric greenhouse gas concentrations continue to increase. (Credit: iStockphoto/Tilmann Von Au)

ScienceDaily (June 6, 2011) — The tropics and much of the Northern Hemisphere are likely to experience an irreversible rise in summer temperatures within the next 20 to 60 years if atmospheric greenhouse gas concentrations continue to increase, according to a new climate study by Stanford University scientists.

The results will be published later this month in the journal *Climatic Change*.

In the study, the Stanford team concluded that many tropical regions in Africa, Asia and South America could see "the permanent emergence of unprecedented summer heat" in the next two decades. Middle latitudes of Europe, China and North America -- including the United States -- are likely to undergo extreme summer temperature shifts within 60 years, the researchers found.

"According to our projections, large areas of the globe are likely to warm up so quickly that, by the middle of this century, even the coolest summers will be hotter than the hottest summers of the past 50 years," said the study's lead author, Noah Diffenbaugh, an assistant professor of environmental Earth system science and fellow at the Woods Institute for the Environment at Stanford. The study is co-authored by Stanford research assistant Martin Scherer.

"When scientists talk about global warming causing more heat waves, people often ask if that means that the hottest temperatures will become 'the new normal,'" Diffenbaugh said. "That got us thinking -- at what point can we expect the coolest seasonal temperatures to always be hotter than the historically highest temperatures for that season?"

Climate models, past and future

To determine the seasonal impact of global warming in coming decades, Diffenbaugh and Scherer analyzed more than 50 climate model experiments -including computer simulations of the 21st century when global greenhouse gas concentrations are expected to increase, and simulations of the 20th century that accurately "predicted" Earth's climate during the last 50 years. The analysis revealed that many parts of the planet could experience a permanent spike in seasonal temperatures within 60 years.

"We also analyzed historical data from weather stations around the world to see if the projected emergence of unprecedented heat had already begun," Diffenbaugh said. "It turns out that when we look back in time using temperature records, we find that this extreme heat emergence is occurring now, and that climate models represent the historical patterns remarkably well."

According to both the climate model analysis and the historical weather data, the tropics are heating up the fastest. "We find that the most immediate increase in extreme seasonal heat occurs in the tropics, with up to 70 percent of seasons in the early 21st century (2010-2039) exceeding the late-20th century maximum," the authors wrote.

Tropical regions may see the most dramatic changes first, but wide swaths of North America, China and Mediterranean Europe are also likely to enter into a new heat regime by 2070, according to the study.

Environmental impact

This dramatic shift in seasonal temperatures could have severe consequences for human health, agricultural production and ecosystem productivity, Diffenbaugh said. As an example, he pointed to record heat waves in Europe in 2003 that killed 40,000 people. He also cited studies showing that projected increases in summer temperatures in the Midwestern United States could reduce the harvest of staples, such as corn and soybeans, by more than 30 percent.

Diffenbaugh was surprised to see how quickly the new, potentially destructive heat regimes are likely to emerge, given that the study was based on a relatively moderate forecast of greenhouse gas emissions in the 21st century.

"The fact that we're already seeing these changes in historical weather observations, and that they match climate model simulations so closely, increases our confidence that our projections of permanent escalations in seasonal temperatures within the next few decades are well founded," Diffenbaugh said.

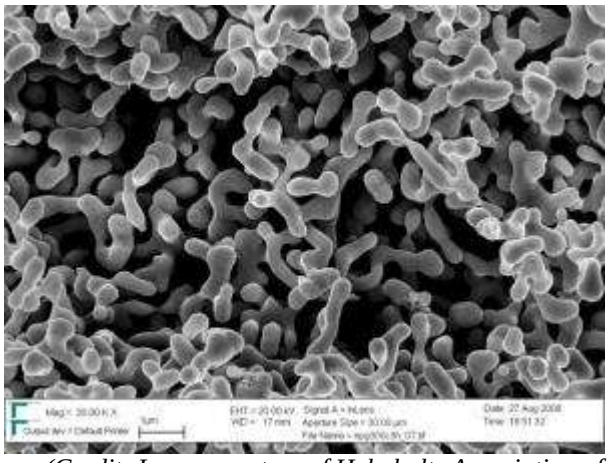
The research was supported by the National Science Foundation, the Department of Energy, the National Institutes of Health and the World Bank.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Stanford University**. The original article was written by Donna Hesterman, science-writer intern at the Woods Institute for the Environment.

http://www.sciencedaily.com/releases/2011/06/110606113405.htm

Material Turns Hard or Soft at the Touch of a Button



The nanomaterial under a scanning electron microscope. (Credit: Image courtesy of Helmholtz Association of German Research Centres)

ScienceDaily (June 6, 2011) — A world premiere: a material which changes its strength, virtually at the touch of a button. This transformation can be achieved in a matter of seconds through changes in the electron structure of a material; thus hard and brittle matter, for example, can become soft and malleable. What makes this development revolutionary, is that the transformation can be controlled by electric signals.

This world-first has its origins in Hamburg. Jörg Weißmüller, a materials scientist at both the Technical University of Hamburg and the Helmholtz Center Geesthacht, has carried out research on this groundbreaking development, working in cooperation with colleagues from the Institute for Metal Research in Shenyang, China.

The 51-year-old researcher from the Saarland referred to his fundamental research, which opens the door to a multitude of diverse applications, as "a breakthrough in the material sciences." The new metallic high-performance material is described by Prof. Dr. Jörg Weißmüller and the Chinese research scientist Hai-Jun Jin in the latest issue of the scientific journal *Science*. Their research findings could, for example, make future intelligent materials with the ability of self healing, smoothing out flaws autonomously.

The firmness of a boiled egg can be adjusted at will through the cooking time. Some decisions are, however, irrevocable -- a hard-boiled egg can never be reconverted into a soft-boiled one. There would be less annoyance at the breakfast table if we could simply switch back and forth between the different degrees of firmness of the egg.

Similar issues arise in the making of structural materials such as metals and alloys. The materials properties are set once and for all during production. This forces engineers to make compromises in the selection of the mechanical properties of a material. Greater strength is inevitably accompanied by increased brittleness and a reduction of the damage tolerance.

Professor Weißmüller, head of the Institute of Materials Physics and Technology at the Technical University of Hamburg and also of the department for Hybrid Material Systems at the Helmholtz Center Geesthacht, stated: "This is a point where significant progress is being made. For the first time we have succeeded in producing a material which, while in service, can switch back and forth between a state of strong and brittle behavior and one of soft and malleable. We are still at the fundamental research stage but our discovery may bring significant progress in the development of so-called smart materials."

A Marriage of Metal and Water

In order to produce this innovative material, material scientists employ a comparatively simple process: corrosion. The metals, typically precious metals such as gold or platinum, are placed in an acidic solution. As a consequence of the onset of the corrosion process, minute ducts and holes are formed in the metal. The emerging nanostructured material is pervaded by a network of pore channels.

The pores are impregnated with a conductive liquid, for example a simple saline solution or a diluted acid, and a true hybrid material of metal and liquid is thus created. It is the unusual "marriage," as Weißmüller calls

this union of metal and water which, when triggered by an electric signal, enables the properties of the material to change at the touch of a button.
As ions are dissolved in the liquid, the surfaces of the metal can be electrically charged. In other words, the mechanical properties of the metallic partner are changed by the application of an electric potential in the liquid partner. The effect can be traced back to a strengthening or weakening of the atomic bonding in the surface of the metal when extra electrons are added to or withdrawn from the surface atoms. The strength of the material can be as much as doubled when required. Alternatively, the material can be switched to a state which is weaker, but more damage tolerant, energy-absorbing and malleable.
Specific applications are still a matter for the future. However, researchers are already thinking ahead. In principle, the material can create electric signals spontaneously and selectively, so as to strengthen the matter in regions of local stress concentration. Damage, for instance in the form of cracks, could thereby be prevented or even healed. This has brought scientists a great step closer to their objective of 'intelligent' high performance materials.
Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Helmholtz Association of German Research Centres**.

Journal Reference:

1. H.-J. Jin, J. Weissmuller. **A Material with Electrically Tunable Strength and Flow Stress**. *Science*, 2011; 332 (6034): 1179 DOI: 10.1126/science.1202190

http://www.sciencedaily.com/releases/2011/06/110606113106.htm

Carbon Release to Atmosphere 10 Times Faster Than in the Past, Geologists Find

Researchers have found that the rate of release of carbon into the atmosphere today is nearly 10 times as fast as during the Paleocene-Eocene Thermal Maximum (PETM), 55.9 million years ago. (Credit: © Cyril Hou / Fotolia)

ScienceDaily (June 6, 2011) — The rate of release of carbon into the atmosphere today is nearly 10 times as fast as during the Paleocene-Eocene Thermal Maximum (PETM), 55.9 million years ago, the best analog we have for current global warming, according to an international team of geologists. Rate matters and this current rapid change may not allow sufficient time for the biological environment to adjust.

"We looked at the PETM because it is thought to be the best ancient analog for future climate change caused by fossil fuel burning," said Lee R. Kump, professor of geosciences, Penn State.

However, the researchers note in the current issue of *Nature Geoscience*, that the source of the carbon, the rate of emission and the total amount of carbon involved in this event during the PETM are poorly characterized.

Investigations of the PETM are usually done using core samples from areas that were deep sea bottom 55.9 million years ago. These cores contain layers of calcium carbonate from marine animals that can show whether the carbon in the carbonate came from organic or inorganic sources. Unfortunately, when large amounts of greenhouse gases --carbon dioxide or methane -- are in the atmosphere, the oceans become more acidic, and acid dissolves calcium carbonate.

"We were concerned with the fidelity of the deep sea records," said Kump. "How do we determine the rate of change of atmospheric carbon if the record is incomplete? The incomplete record makes the warming appear more abrupt."

Kump and his colleagues decided to look at information coming from areas that were shallow arctic ocean bottom during the PETM. During a Worldwide Universities Network expedition to train graduate students from Penn State, the University of Southampton, University of Leeds, University of Utrecht and University of Oslo in how projects develop, the researchers visited Spitsbergen, Norway. They uncovered a supply of rock cores curated by a forward-thinking young coal-mining company geologist, Malte Jochmann.

"Deep-sea cores usually have from 10 cm to a meter (about 4 inches to 3 feet) of core corresponding to the PETM," said Kump. "The Spitsbergen cores have 150 meters (492 feet) of sediment for the PETM."

The larger sediment section, made up of mud that came into the shallow ocean contains organic matter that can also supply the carbon isotope signature and provide the greenhouse gas profile of the atmosphere. With the larger core segment, it is easier to look at what happened through time and ocean acidification would not degrade the contents.

"We think the Spitsbergen core is relatively complete and shows an interval of about 20,000 years for the injection of carbon dioxide during the PETM," said Kump.

Using the data collected from the cores, the researchers forced a computer model to in essence run backward. They set up the models to find the proper amounts of greenhouse gases and atmospheric temperature that would have resulted in the carbon isotope ratios observed in the cores.

The outcome was a warming of from 9 to 16 degrees Fahrenheit and an acidification event in the oceans.

"Rather than the 20,000 years of the PETM which is long enough for ecological systems to adapt, carbon is now being released into the atmosphere at a rate 10 times faster," said Kump. "It is possible that this is faster than ecosystems can adapt."

Other Penn State researchers on this project include Ying Cui, graduate student and Katherine H. Freeman, professor; geosciences, Christopher K. Junium and Aaron F. Diefendorf, former graduates students and Nathan M. Urban former postdoctoral fellow.

Other researchers include Ian C. Harding, senior lecturer, and Adam J. Charles graduate student, National Oceanography Centre Southampton, University of Southampton, UK and Andy J. Ridgwell, professor of Earth system modeling, School of Geographical Sciences, University of Bristol, UK.

The National Science Foundation, Worldwide Universities Network and Penn State supported this work.

Story Source:

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

Journal Reference:

1. Ying Cui, Lee R. Kump, Andy J. Ridgwell, Adam J. Charles, Christopher K. Junium, Aaron F. Diefendorf, Katherine H. Freeman, Nathan M. Urban, Ian C. Harding. **Slow release of fossil carbon during the Palaeocene–Eocene Thermal Maximum**. *Nature Geoscience*, 2011; DOI: 10.1038/ngeo1179

http://www.sciencedaily.com/releases/2011/06/110605132433.htm

New Solar System Formation Models Indicate That Jupiter's Foray Robbed Mars of Mass

True-color simulated view of Jupiter composed of four images taken by NASA's Cassini spacecraft. (Credit: NASA/JPL/University of Arizona)

ScienceDaily (June 6, 2011) — Planetary scientists have long wondered why Mars is only about half the size and one-tenth the mass of Earth. As next-door neighbors in the inner solar system, probably formed about the same time, why isn't Mars more like Earth and Venus in size and mass? A paper published in the journal *Nature* provides the first cohesive explanation and, by doing so, reveals an unexpected twist in the early lives of Jupiter and Saturn as well.

Dr. Kevin Walsh, a research scientist at Southwest Research Institute® (SwRI®), led an international team performing simulations of the early solar system, demonstrating how an infant Jupiter may have migrated to within 1.5 astronomical units (AU, the distance from the Sun to Earth) of the Sun, stripping a lot of material from the region and essentially starving Mars of formation materials.

"If Jupiter had moved inwards from its birthplace down to 1.5 AU from the Sun, and then turned around when Saturn formed as other models suggest, eventually migrating outwards towards its current location, it would have truncated the distribution of solids in the inner solar system at about 1 AU and explained the small mass of Mars," says Walsh. "The problem was whether the inward and outward migration of Jupiter through the 2 to 4 AU region could be compatible with the existence of the asteroid belt today, in this same region. So, we started to do a huge number of simulations.

"The result was fantastic," says Walsh. "Our simulations not only showed that the migration of Jupiter was consistent with the existence of the asteroid belt, but also explained properties of the belt never understood before."

The asteroid belt is populated with two very different types of rubble, very dry bodies as well as water-rich orbs similar to comets. Walsh and collaborators showed that the passage of Jupiter depleted and then re-populated the asteroid belt region with inner-belt bodies originating between 1 and 3 AU as well as outer-belt

bodies originating between and beyond the giant planets, producing the significant compositional differences existing today across the belt.

The collaborators call their simulation the "Grand Tack Scenario," from the abrupt change in the motion of Jupiter at 1.5 AU, like that of a sailboat tacking around a buoy. The migration of the gas giants is also supported by observations of many extra-solar planets found in widely varying ranges from their parent stars, implying migrations of planets elsewhere in universe.

The paper, published in the June 5 issue of the journal *Nature*, was written by Walsh; Alessandro Morbidelli of the Université de Nice, France; Sean N. Raymond of Université de Bordeaux, France; David P. O'Brien of Planetary Science Institute in Tucson, Ariz.; and Avi M. Mandell of NASA's Goddard Space Flight Center.

The research was funded by the Helmholtz Alliance, the French National Center for Scientific Research and NASA.

Story Source:

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

Journal Reference:

1. Kevin J. Walsh, Alessandro Morbidelli, Sean N. Raymond, David P. O'Brien, Avi M. Mandell. **A low mass for Mars from Jupiter's early gas-driven migration**. *Nature*, 2011; DOI: 10.1038/nature10201

http://www.sciencedaily.com/releases/2011/06/110605132437.htm

Early Light Refines Brain's Circuitry for Vision: Studies Show Importance of Visual Stimulation in Wiring Up Species' Brains to See

Light and sight: connected at the beginning Because the retinal layer of rods and cones is not connected early in mice, neuroscientists had no reason to suspect that light helps develop neural connections for vision. David Berson, right, with Jordan Renna, has shown that photosensitive cells he discovered a decade ago are connected and do help with neural development. (Credit: Mike Cohea/Brown University)

ScienceDaily (June 6, 2011) — Any parent knows that newborns still have a lot of neurological work to do to attain fully acute vision. In a wide variety of nascent animals, genes provide them with only a rough wiring plan and then leave it to the developing nervous system to do its own finish work. Two studies by Brown University researchers provide new evidence of a role for exposure to light in the environment as mouse pups and tadpoles organize and refine the circuitry of their vision systems.

"Through a combination of light-independent and light-dependent processes, the visual system is getting tuned up over time," said David Berson, professor of neuroscience.

His new work, published in advance online June 5 in *Nature Neuroscience*, offers the surprising result that light exposure can enhance how well mice can organize the nerve endings from their left eye and their right eye in an area of the brain where they start out somewhat jumbled. Neuroscientists had thought that mammals were unable to see at this stage, but a new type of light-sensitive cell that Berson discovered a decade ago turns out to let in the light.

Meanwhile, Berson's colleague Carlos Aizenman, assistant professor of neuroscience, co-authored a paper online May 31 in the Journal of Neuroscience showing that newborn tadpoles depend on light to coordinate and improve the response speed, strength and reliability of a network of neurons in a vision-processing region of their brains.

"This is how activity is allowing visual circuits to refine and sort themselves out," said Aizenman. "Activity is fine-tuning all these connections. It's making the circuit function in a much more efficient, synchronous way."

Not completely blind mice

Berson, postdoctoral scholar Jordan Renna, and former postdoctoral researcher Shijun Weng conducted several experiments in newborn mice to see whether light influences the process by which the mice rewire to distinguish between their eyes.

"For certain functions, the brain wants to keep track of which eye is which," Berson said. Among those functions are the perception of depth and distance.

At a circuit level, the brain keeps signals from the two eyes distinct by segregating their nerve endings into separate regions in the dorsal lateral geniculate nucleus (dLGN), a key waystation on the path to the visual cortex and conscious visual perception. Scientists have long known this sorting-out process depends on waves of activity that spontaneously excite cells in the inner retina. They did not know until now that the waves are influenced by a light-sensitive type of cell called intrinsically photosensitive retinal ganglion cells (ipRGCs).

About a decade ago, a team Berson led at Brown discovered the ipRGCs, which are the first light-sensitive cells to develop in the eye. They reside in the inner retina, the home of retinal cells that send visual information directly to the brain. The outer retina is where the more familiar rods and cones sense light. Early in life, when the brain is segregating nerve endings into distinct regions in the dLGN, the two retinal layers are not connected, so until ipRGCs were discovered there was no reason to believe that light would affect the sorting process.

The new research doesn't say anything definitive about the consequences of light exposure at this stage for eyesight in adults, especially given that some mammals (such as monkeys) experience this developmental stage in utero.

"Whether different animals in nature are exposed to enough light to induce a change in segregation patterns is unclear," Renna said.

But the research shows that light exposure does improve how well the sorting goes, Berson said, and the work advances neuroscientists' understanding of the eye-distinction process, which is widely studied as a model of "activity-driven" neural development.

To assess the effect of light on retinal waves, Renna used electrodes to record the activity of cells in the inner retinas of newborn mice, first recording in the dark, then in the light, and then again in the dark. In every case retinas experienced waves, but when the retinas were exposed to light, the waves lasted about 50 percent longer.

Renna then tested whether the light-sensitive cells were really creating this wave-lengthening effect by repeating the study in "knock-out" mice in which the ability of the ipRGCs to sense light had been genetically abolished. With the cells disabled, exposure to light no longer made any difference in the duration of the waves.

Finally, to assess the effect of light on the left-right sorting process in the dLGN, Renna examined the tissues from normal mice and the mice whose ipRGCs couldn't sense light. In each case he fluorescently labeled the nerve endings from one eye red and the other green. A computer comparison of the tissues showed that the normal mice developed a higher degree of segregation between red and green than the knockout mice. In other words, the ability of ipRGCs to sense light improved sorting out one eye from another in the dLGN.

Twinkling tadpoles

In his study, Aizenman collaborated with Arto Nurmikko, professor of engineering and physics, to investigate the function of in the optic tectum of tadpole brains. They flooded the tectal neurons in live tadpoles with a molecule that makes calcium ions fluoresce. As whole networks of neurons became active, they'd take in the ions and glow. The researchers recorded the tadpoles with a high-resolution, high-speed camera that could capture the millisecond-to-millisecond activity of the neurons.

Led in the lab by engineering graduate student Heng Xu, the lead author, and postdoctoral researcher Arseny Khakhalin, the team reared some young tadpoles under normal conditions of 12 hours of light and 12 hours of darkness during the crucial days of development when the tectum is developing. They reared others in the dark, and still others with a chemical that blocks the activity of NMDA receptors, a subtype of receptor to the neurotransmitter glutamate, that is known to promote neural rewiring.

Then they exposed all the tadpoles, however they were reared, to blue LED light flashes delivered via a fiber optic cable mounted next to the eye.

What they found over the course of several experiments was that the neural networks in the tectums of tadpoles reared under normal conditions developed a faster, more cohesive, and stronger response (in terms of the number of neurons) to light.

The tectal neural networks of tadpoles kept in the dark during development failed to progress at all. Those whose NMDA receptors were blocked occupied a middle ground, showing more progress than dark-reared tadpoles but less than normal tadpoles. Tadpoles, they found, train their brains with the light they see.
Aizenman said he hopes the calcium ion imaging technique will prove useful in a wide variety of other neuroscience experiments, including studying how tadpoles neurally encode behaviors such as fleeing when they see certain stimuli.
In the meantime, his team and Berson's have added to the understanding scientists have been building of how creatures turn the somewhat mushy approximations of their brains at birth into high-functioning animal minds.
"That's what everybody is after," Aizenman said. "How do you get this fine-tuned, finely wired brain in the first place?"
Berson and Renna's work was funded by the National Institutes of Health. Aizemnan and Nurmikko's research received support from the National Science Foundation, the NIH's National Eye Institute, and the Whitehall Foundation.

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Brown University**.

Journal Reference:

1. Jordan M Renna, Shijun Weng, David M Berson. **Light acts through melanopsin to alter retinal waves and segregation of retinogeniculate afferents**. *Nature Neuroscience*, 2011; DOI: 10.1038/nn.2845

http://www.sciencedaily.com/releases/2011/06/110605132423.htm

Neuroscientists Map a New Target to Wipe Pain Away

A newly discovered peptide short circuits a pathway for chronic pain. (Credit: iStockphoto/Sebastian Meckelmann)

ScienceDaily (June 5, 2011) — Researchers at the Indiana University School of Medicine have discovered a peptide that short circuits a pathway for chronic pain. Unlike current treatments this peptide does not exhibit deleterious side effects such as reduced motor coordination, memory loss, or depression, according to an article in *Nature Medicine* posted online June 5, 2011.

The peptide, CBD3, has been shown in mice to interfere with signals that navigate calcium channels to produce pain. Unlike other substances that block pain signals, CBD3 does not directly inhibit the influx of calcium. This is important as influx of calcium regulates heart rhythm and vital functions in other organs.

Rajesh Khanna, Ph.D., assistant professor of pharmacology and toxicology at the Indiana University School of Medicine, said the peptide discovered by him and his colleagues is potentially safer to use than addictive opioids or cone snail toxin Prialt® -- a recognized analgesic that is injected into the spinal column, both of which can cause respiratory distress, cardiac irregularities and other problems.

"After opioids-the gold standard for pain control -- the next target is calcium channels," said Dr. Khanna. "Along the pain pathway in the spinal cord, there are pain-sensing neurons called nociceptors that have an abundance of calcium channels."

Earlier international research has shown that the calcium channel is a key player within the pathway for pain signals. Based on work from Dr. Khanna's laboratory, it is also accepted that an axonal protein, CRMP-2, binds to the calcium channel "acting like a remote control" to modulate transmission of excitability and pain signals, Dr. Khanna explained.

He and his colleagues discovered the CBD3 peptide, a portion of the CRMP-2 protein, realizing that its smaller size would be beneficial in producing a synthetic version for drug development.

CBD3 can be given systemically and blocks pain in a variety of acute as well as chronic pain models, he said. The novel peptide binds to the calcium channel and reduces the number of excitability signals without disrupting the beneficial global calcium flow. Upon reaching the brain, these signals are interpreted as the sensation of pain.

"Since our approach does not directly inhibit calcium entry through voltage-gated channels, we expect that this molecule will be more specific and have fewer side effects than currently available analgesics," said Dr.

Khanna. "We anticipate that this peptide will serve as a novel pharmacological therapeutic for the relief of chronic pain."
Dr. Khanna is a primary investigator in the Paul and Carole Stark Neurosciences Research Institute and the Indiana Spinal Cord and Brain Injury Research Group. His Stark Neuroscience Institute colleagues involved in the research are first author Joel M. Brittain and second author Sarah M. Wilson, both PhD students in his laboratory, and co-first-author Djane B. Duarte, Ph.D., a post-doctoral fellow. Members of the Harvard University Department of Anesthesiology also assisted with the research.
Funding for the research was provided in part by a American Heart Association National Scientist Development Grant, the Ralph W. and Grace M. Showalter Research Trust Fund and the Indiana Genomics Initiative.

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

Journal Reference:

1. Joel M Brittain, Djane B Duarte, Sarah M Wilson, Weiguo Zhu, Carrie Ballard, Philip L Johnson, Naikui Liu, Wenhui Xiong, Matthew S Ripsch, Yuying Wang, Jill C Fehrenbacher, Stephanie D Fitz, May Khanna, Chul-Kyu Park, Brian S Schmutzler, Bo Myung Cheon, Michael R Due, Tatiana Brustovetsky, Nicole M Ashpole, Andy Hudmon, Samy O Meroueh, Cynthia M Hingtgen, Nickolay Brustovetsky, Ru-Rong Ji, Joyce H Hurley, Xiaoming Jin, Anantha Shekhar, Xiao-Ming Xu, Gerry S Oxford, Michael R Vasko, Fletcher A White, Rajesh Khanna. **Suppression of inflammatory and neuropathic pain by uncoupling CRMP-2 from the presynaptic Ca^{2+} channel complex**. *Nature Medicine*, 2011; DOI: 10.1038/nm.2345

http://www.sciencedaily.com/releases/2011/06/110605132425.htm

Physicists Store Antimatter Atoms for 1,000 Seconds -- And Still Counting

This is an artistic representation of the ALPHA neutral antimatter trap, suggesting the nature of the ALPHA apparatus as a container for antihydrogen. (Credit: Chukman So, copyright © 2011 Wurtele Research Group. All rights reserved.)

ScienceDaily (June 5, 2011) — The ALPHA Collaboration, an international team of scientists working at CERN in Geneva, Switzerland, has created and stored a total of 309 antihydrogen atoms, some for up to 1,000 seconds (almost 17 minutes), with an indication of much longer storage time as well.

ALPHA announced in November, 2010, that they had succeeded in storing antimatter atoms for the first time ever, having captured 38 atoms of antihydrogen and storing each for a sixth of a second. In the weeks following, ALPHA continued to collect anti-atoms and hold them for longer and longer times.

Scientists at the U.S. Department of Energy's Lawrence Berkeley National Laboratory (Berkeley Lab) and the University of California at Berkeley, including Joel Fajans and Jonathan Wurtele of Berkeley Lab's Accelerator and Fusion Research Division (AFRD), both UC Berkeley physics professors, are members of the ALPHA Collaboration.

Says Fajans, "Perhaps the most important aspect of this result is that after just one second these antihydrogen atoms had surely already decayed to ground state. These were likely the first ground state anti-atoms ever made." Since almost all precision measurements require atoms in the ground state, ALPHA's achievement opens a path to new experiments with antimatter.

A principal component of ALPHA's atom trap is a superconducting octupole magnet proposed and prototyped in Berkeley Lab's AFRD. It takes ALPHA about 15 minutes to make and capture atoms of antihydrogen in their magnetic trap.

"So far, the only way we know whether we've caught an anti-atom is to turn off the magnet," says Fajans. "When the anti-atom hits the wall of the trap it annihilates, which tells us that we got one. In the beginning we were turning off our trap as soon as possible after each attempt to make anti-atoms, so as not to miss any."

Says Wurtele, "At first we needed to demonstrate that we could trap antihydrogen. Once we proved that, we started optimizing the system and made rapid progress, a real qualitative change."

Initially ALPHA caught only about one anti-atom in every 10 tries, but Fajans notes that at its best the ALPHA apparatus trapped one anti-atom with nearly every attempt.

Although the physical set-ups are different, ALPHA's ability to hold anti-atoms in a magnetic trap for 1,000 seconds, and presumably longer, compares well to the length of time ordinary atoms can be magnetically confined.

"A thousand seconds is more than enough time to perform measurements on a confined anti-atom," says Fajans. "For instance, it's enough time for the anti-atoms to interact with laser beams or microwaves." He jokes that, at CERN, "it's even enough time to go for coffee."

The ALPHA Collaboration not only made and stored the long-lived antihydrogen atoms, it was able to measure their energy distribution.

"It may not sound exciting, but it's the first experiment done on trapped antihydrogen atoms," Wurtele says. "This summer we're planning more experiments, with microwaves. Hopefully we will measure microwave-induced changes of the atomic state of the anti-atoms." With these and other experiments the ALPHA Collaboration aims to determine the properties of antihydrogen and measure matter-antimatter asymmetry with precision.

A program of upgrades is being planned that will allow experiments not possible with the current ALPHA apparatus. At present the experimenters don't have laser access to the trap. Lasers are essential for performing spectroscopy and for "cooling" the antihydrogen atoms (reducing their energy and slowing them down) to perform other experiments.

Fajans says, "We hope to have laser access by 2012. We're clearly ready to move to the next level."

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **DOE/Lawrence Berkeley National Laboratory**.

Journal Reference:

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http://www.sciencedaily.com/releases/2011/06/110605132421.htm

Could a Birth Control Pill for Men Be on the Horizon? Retinoic Acid Receptor Antagonist Interferes With Sperm Production

What may be the first non-steroidal, oral contraceptive for men is in development. (Credit: © Sven Bähren / Fotolia)

ScienceDaily (June 5, 2011) — Researchers at Columbia University Medical Center are honing in on the development of what may be the first non-steroidal, oral contraceptive for men. Tests of low doses of a compound that interferes with retinoic acid receptors (RARs), whose ligands are metabolites of dietary vitamin A, showed that it caused sterility in male mice.

Earlier results of the experiments using this RAR antagonist were published in the June 1st issue of *Endocrinology*, and an abstract extending the studies to longer drug delivery periods is scheduled for the Late Breaking Oral Session of ENDO 2011: The 93rd Annual Meeting & Expo in Boston, Massachusetts.

(The abstract, titled "Meeting Men's Contraceptive Needs -- Long-Term Oral-Administered Retinoic Acid Receptor Antagonist Inhibits Spermatogenesis in Mice with a Reversible and Rapid Recovery," was presented June 4 at the session by first author Sanny S. W. Chung, Ph.D.)

The researchers found that low doses of the drug stopped sperm production with no apparent side effects. And crucial for a contraceptive, normal fertility was restored soon after drug administration was terminated.

Earlier research had led the investigators to the discovery that manipulating the retinoid receptor pathway could interfere with the process of spermatogenesis, which is necessary for sperm production.

Scientists have known for almost 100 years that depriving an animal of dietary vitamin A causes male sterility. While investigating targeted loss of function of the gene encoding one of the RARs, RARalpha, which results in male infertility, senior author Debra J. Wolgemuth, Ph.D., ran across a paper by Bristol-Myers Squibb on a compound that was being tested for the treatment of skin and inflammatory diseases. The compound seemed to cause changes in the testis similar to the mutation that she and Dr. Chung were studying in Dr. Wolgemuth's lab.

(Dr. Wolgemuth is professor of genetics and development and of obstetrics and gynecology; and Dr. Chung is an associate research scientist, both at Columbia University Medical Center).

Bristol-Myers dropped its interest when it found that the compound also was ¬- in the company's words -- "a testicular toxin." The paper did not elaborate on how the drug caused infertility, so Dr. Wolgemuth and her team tested the drug in mice to find out; they noted that the changes it caused were similar to what one sees with vitamin A-deficiency and loss of function of RARalpha.

"We were intrigued," said Dr. Wolgemuth. "One company's toxin may be another person's contraceptive."

To investigate whether the compound prevented conception at even lower levels than those cited in the company's study, Dr. Wolgemuth and her team placed the treated male mice with females and found that reversible male sterility occurred with doses as low as 1.0mg/kg of body weight for a 4-week dosing period.

One advantage of using a non-steroidal approach, the researchers say, is avoiding the side effects commonly associated with steroidal hormone-based methods.

Male steroid-based options have been plagued with adverse effects, including ethnic variability in efficacy, as well as an increased risk of cardiovascular disease and benign prostatic hyperplasia.

Another side effect of hormonal options for men has been diminished libido. That drawback will also likely be avoided if a method involving manipulation of the retinoid receptor pathway proves successful.
"We have seen no side effects, so far, and our mice have been mating quite happily," said Dr. Wolgemuth.
The researchers say the drug will not affect vision. Although dietary vitamin A is responsible for the production of light-sensitive receptors in the eye, it does not use the RARs in this process.
"An additional benefit of our compound is that it can be taken orally as a pill, avoiding the injection process. It also appears to have a very rapid effect on sperm production and an even more rapid recovery when fertility is desired," said Dr. Chung.
But to make the pill a reality, researchers need to show that the compound is safe, effective -- and reversible -- when used for years.
Drs. Wolgemuth and Chung are now planning longer-term studies to determine how long fertility can be disrupted and still recover after administration of the drug stops. "We hope that in the not so distant future, we may finally have more choices for people," said Dr. Chung.
Authors of the *Endocrinology* study are Sanny S. W. Chung, Xiangyuan Wang, Shelby S. Roberts, Stephen M. Griffey, Peter R. Reczek, and Debra J. Wolgemuth.
This study was supported in part by grants initially from CONRAD and subsequently from the NIH, NICHD.
story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Columbia University Medical Center**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. S. S. W. Chung, X. Wang, S. S. Roberts, S. M. Griffey, P. R. Reczek, D. J. Wolgemuth. **Oral Administration of a Retinoic Acid Receptor Antagonist Reversibly Inhibits Spermatogenesis in Mice**. *Endocrinology*, 2011; DOI: 10.1210/en.2010-0941

http://www.sciencedaily.com/releases/2011/06/110604181844.htm

DNA Can Discern Between Two Quantum States, Research Shows

New research shows that a biological molecule -- DNA -- can discern between quantum states known as spin. (Credit: © Rodolfo Clix / Fotolia)

ScienceDaily (June 4, 2011) — Do the principles of quantum mechanics apply to biological systems? Until now, says Prof. Ron Naaman of the Institute's Chemical Physics Department (Faculty of Chemistry), both biologists and physicists have considered quantum systems and biological molecules to be like apples and oranges. But research he conducted together with scientists in Germany, which appeared recently in *Science*, shows that a biological molecule -- DNA -- can discern between quantum states known as spin.

Quantum phenomena, it is generally agreed, take place in extremely tiny systems -- single atoms, for instance, or very small molecules. To investigate them, scientists must usually cool their material down to temperatures approaching absolute zero. Once such a system exceeds a certain size or temperature, its quantum properties collapse, and "every day" classical physics takes over. Naaman: "Biological molecules are quite large, and they work at temperatures that are much warmer than the temperatures at which most quantum physics experiments are conducted. One would expect that the quantum phenomenon of spin, which exists in two opposing states, would be scrambled in these molecules -- and thus irrelevant to their function."

But biological molecules have another property: they are chiral. In other words, they exist in either "left-" or "right-handed" forms that can't be superimposed on one another. Double-stranded DNA molecules are doubly chiral -- both in the arrangement of the individual strands and in the direction of the helices' twist. Naaman knew from previous studies that some chiral molecules can interact in different ways with the two different spins. Together with Prof. Zeev Vager of the Particle Physics and Astrophysics Department, research student Tal Markus, and Prof. Helmut Zacharias and his research team at the University of Münster, Germany, he set out to discover whether DNA might show some spin-selective properties.

The researchers fabricated self-assembling, single layers of DNA attached to a gold substrate. They then exposed the DNA to mixed groups of electrons with both directions of spin. Indeed, the team's results

surpassed expectations: The biological molecules reacted strongly with the electrons carrying one of those spins, and hardly at all with the others. The longer the molecule, the more efficient it was at choosing electrons with the desired spin, while single strands and damaged bits of DNA did not exhibit this property. These findings imply that the ability to pick and choose electrons with a particular spin stems from the chiral nature of the DNA molecule, which somehow "sets the preference" for the spin of electrons moving through it.

In fact, says Naaman, DNA turns out to be a superb "spin filter," and the team's findings could have relevance for both biomedical research and the field of spintronics. If further studies, for instance, bear out the finding that DNA only sustains damage from spins pointing in one direction, then exposure might be reduced and medical devices designed accordingly. On the other hand, DNA and other biological molecules could become a central feature of new types of spintronic devices, which will work on particle spin rather than electric charge, as they do today.

Story Source:

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

Journal Reference:

1. B. Gohler, V. Hamelbeck, T. Z. Markus, M. Kettner, G. F. Hanne, Z. Vager, R. Naaman, H. Zacharias. **Spin Selectivity in Electron Transmission Through Self-Assembled Monolayers of Double-Stranded DNA**. *Science*, 2011; 331 (6019): 894 DOI: 10.1126/science.1199339

http://www.sciencedaily.com/releases/2011/03/110331104014.htm

Higher Density Means World Forests Are Capturing More Carbon

Forests in many regions are becoming larger carbon sinks thanks to higher density, US and European researchers say in a new report. In Europe and North America, increased density significantly raised carbon storage despite little or no expansion of forest area, according to the study, led by Aapo Rautiainen of the University of Helsinki, Finland, and published by the online, open-access journal PLoS One. These photos from the same spot in Finland, taken in 1893 (l) and in 1997 (r) show that while the forest area is the same, the trees are larger in the later photo. (Credit: I.K. Inha (1893) and K.A. Ennola (1997))

ScienceDaily (June 6, 2011) — Forests in many regions are becoming larger carbon sinks thanks to higher density, U.S. and European researchers say in a new report.

In Europe and North America, increased density significantly raised carbon storage despite little or no expansion of forest area, according to the study, led by Aapo Rautiainen of the University of Helsinki, Finland, and published in the online, open-access journal *PLoS ONE*.

Even in the South American nations studied, more density helped maintain regional carbon levels in the face of deforestation.

The researchers analyzed information from 68 nations, which together account for 72 percent of the world's forested land and 68 percent of reported carbon mass. They conclude that managing forests for timber growth and density offers a way to increase stored carbon, even with little or no expansion of forest area.

"In 2004 emissions and removals of carbon dioxide from land use, land-use change and forestry comprised about one fifth of total emissions. Tempering the fifth by slowing or reversing the loss of carbon in forests would be a worthwhile mitigation. The great role of density means that not only conservation of forest area but also managing denser, healthier forests can mitigate carbon emission," says Rautiainen.

Co-author Paul E. Waggoner, a forestry expert with Connecticut's Agricultural Experiment Station, says remote sensing by satellites of the world's forest area brings access to remote places and a uniform method. "However, to speak of carbon, we must look beyond measurements of area and apply forestry methods traditionally used to measure timber volumes."

"Forests are like cities -- they can grow both by spreading and by becoming denser," says co-author Iddo Wernick of The Rockefeller University's Program for the Human Environment.

The authors say most regions and almost all temperate nations have stopped losing forest and the study's findings constitute a new signal of what co-author Jesse Ausubel of Rockefeller calls "The Great Reversal" under way in global forests after centuries of loss and decline. "Opportunities to absorb carbon and restore the world's forests can come through increasing density or area or both."

To examine how changing forest area and density affect timber volume and carbon, the study team first focused on the United States, where the U.S. Forest Service has conducted a continuing inventory of forest area, timberland area and growing stock since 1953.

They found that while U.S. timberland area grew only 1 percent between 1953 and 2007, the combined national volume of growing stock increased by an impressive 51 percent. National forest density increased substantially.

For an international perspective, the research team examined the 2010 Global Forest Resources Assessment compiled by the UN Food and Agriculture Organization (FAO), which provides consistent figures for the years 1990 to 2010.

The data reveal uncorrelated changes of forest area and density. Countries in Africa and South America, which lost about 10 percent of their forest area over the two decades, lost somewhat less carbon, indicating a small rise in forest density.

In Asia during the second decade of the study period, density rose in 10 of the region's 21 countries. Indonesia's major loss of density and sequestered carbon, however, offset any gain in carbon storage in other Asian nations.

Europe, like the U.S., demonstrated substantial density gains, adding carbon well in excess of the estimated carbon absorbed by the larger forested area.

Says study co-author Pekka Kauppi, of the University of Helsinki, Finland, "With so much bad news available on World Environment Day, we are pleased to report that, of 68 nations studied, forest area is expanding in 45 and density is also increasing in 45. Changing area and density combined had a positive impact on the carbon stock in 51 countries."

tory Source:

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

Journal Reference:

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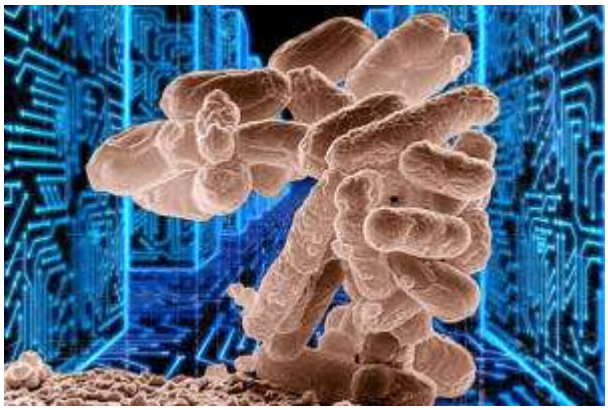
http://www.sciencedaily.com/releases/2011/06/110606113413.htm

Nanotechnologists Must Take Lessons from Nature



The simple E. coli bacterium shown can compute 1,000 times faster than the most powerful computer chip, its memory density is 100 million times higher and it needs 100 millionth the power to operate. (Credit: Jenni Ohnstad / Vanderbilt University)

ScienceDaily (June 6, 2011) — It's common knowledge that the perfect is the enemy of the good, but in the nanoscale world, perfection can act as the enemy of the best.

In the workaday world, engineers and scientists go to great lengths to make the devices we use as perfect as possible. When we flip on a light switch or turn the key on the car, we expect the lights to come on and the engine to start every time, with only rare exceptions. They have done so by using a top-down design process combined with the application of large amounts of energy to increase reliability by suppressing natural variability.

However, this brute-force approach will not work in the nanoscale world that scientists are beginning to probe in the search for new electrical and mechanical devices. That is because objects at this scale behave in a fundamentally different fashion than larger-scale objects, argue Peter Cummings, John R. Hall Professor Chemical Engineering at Vanderbilt University, and Michael Simpson, professor of materials science and engineering at University of Tennessee, Knoxville, in an article in the April issue of the *ACS Nano* journal.

'Noise' makes a difference

The defining difference between the behaviors of large-scale and nanoscale objects is the role that "noise" plays. To scientists noise isn't limited to unpleasant sounds; it is any kind of random disturbance. At the level of atoms and molecules, noise can take the form of random motion, which dominates to such an extent that it is extremely difficult to make reliable devices.

Nature, however, has managed to figure out how to put these fluctuations to work, allowing living organisms to operate reliably and far more efficiently than comparable human-made devices. It has done so by exploiting the contrarian behavior that random behavior allows.

"Contrarian investing is one strategy for winning in the stock market," Cummings said, "but it may also be a fundamental feature of all natural processes and holds the key to many diverse phenomena, including the ability of the human immunodeficiency virus to withstand modern medicines."

In their paper, Cummings and Simpson maintain that in any given population, random fluctuations -- the "noise" -- cause a small minority to act in a fashion contrary to the majority and can help the group respond to changing conditions. In this fashion, less perfection can actually be good for the whole.

Mimicking cells

At Oak Ridge National Laboratory, where the two researchers work, they are exploring this basic principle through a combination of creating virtual simulations and constructing physical cell mimics, synthetic systems constructed on the biological scale that exhibit some cell-like characteristics.

That is the lesson of nature, where a humble bacterial cell outperforms our best computer chips by a factor of 100 million, and it does this in part by being less than perfect."Instead of trying to make perfect decisions based on imperfect information, the cell plays the odds with an important twist: it hedges its bets. Sure, most of the cells will place bets on the likely winner, but an important few will put their money on the long shot,"

Simpson said. "That is the lesson of nature, where a humble bacterial cell outperforms our best computer chips by a factor of 100 million, and it does this in part by being less than perfect."
Following the lead of nature means understanding the role of chance. For example, in the AIDS virus, most infected cells are forced to produce new viruses that infect other cells. But a few of the infected cells flip the virus into a dormant state that escapes detection.
"Like ticking bombs, these dormant infections can become active sometime later, and it is these contrarian events that are the main factor preventing the eradication of AIDS," Simpson said.
"Our technology has fought against this chance using a brute force approach that consumes a lot of power," Cummings said. As a result, one of the factors limiting the building of more powerful computers is the grid-busting amount of energy they require.
Yet residing atop the cabinets of these supercomputers, basking in the heat generated in the fight to suppress the element of chance, the lowly bacteria show us another way.

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Vanderbilt University**.

Journal Reference:

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http://www.sciencedaily.com/releases/2011/04/110428132240.htm

Low-Cost Wireless Sensor Networks Open New Horizons for the Internet of Things

Connecting sensors through the Internet. (Credit: Image courtesy of Eureka)

ScienceDaily (June 6, 2011) — The ESNA project enables high effective networking based on cheap wireless sensors in a wide range of business applications -- from more comfortable and energy-efficient environmental controls to precision monitoring of agricultural resources.

The EUREKA ITEA software Cluster ESNA project has developed a flexible framework for business-oriented wireless-sensor network applications using a standard architecture to facilitate communications between all types of smart device -- from domestic appliances and environmental controls in the home to the latest process control equipment in factories. ESNA offers an impressive balance between advanced technological innovation and a business-oriented approach to defining applications. A series of implementations that were demonstrated in the EUREKA project have already led to real applications including precision agriculture, energy monitoring and management in buildings, and industrial process control.

More and more everyday appliances -- from fridges and washing machines, through heating and ventilation controls, to modern multimedia systems -- are increasingly intelligent. As home networking becomes the norm, linking all these devices will be a key driver of our future world, providing a high level of control over our everyday environment for our comfort and safety. And by using the ubiquity of the Internet, such control and interactivity can be extended across our society through the so-called 'Internet of things' from factory production to modern agriculture.

Interconnecting low cost devices

Key to this has been the development of wireless networks that enable the interconnection of all types of sensors using radio communications. The matchbox-sized devices can be incorporated into almost any device -- and at derisorily low cost. While manufacture of such devices has inevitably moved to Asia, the use of these components in wireless sensor networks has been the subject of immense interest in Europe

Battery power offers high flexibility as no power cabling is needed. And devices are multifunctional -- nodes can be equipped with many different sensor capabilities, such as temperature, humidity, movement, radiation, gases and light, opening up a broad spectrum of applications. Dynamic network establishment adds to robustness -- if one node fails, the network automatically rearranges itself to continue operation.

"We discussed wireless sensor network applications at an ITEA brokerage event in Barcelona in 2005," explains project leader Olle Olsson of the Swedish Institute of Computer Science (SICS). The subject attracted interest from partners with complementary interests in a wide mix of technologies, and from partners with more market-oriented focus, wanting to target specific markets and bridge the gap between technology and actual use.

"We saw the way EUREKA operated was good, because it enabled the matching of product and application-oriented technology development in the same project. The result was a project that combined technology 'geeks' and organisations keen to supply technologies for specific markets. We also had end users interested in using rather than selling technologies."
ESNA had two objectives: developing a strong and multifunctional basic software platform supporting very flexible application needs and demonstrating the use of this platform to meet the needs of specific market areas with relevant application frameworks.

Business-oriented applications

The EUREKA project enabled the development of business-oriented wireless sensor network applications using standard open-source architecture, technology and application-development guidelines, and proof-of-concept implementations. The ESNA architecture supports off-the-shelf sensor network nodes and guidelines cover network dimensioning and the type of nodes to use for different application domains.
"We did develop some really new things," says Olsson. "We worked on a standards-compliant generic platform based on the emerging IPV6 Internet standard, developing the world's smallest implementation of IPV6 in terms of lines of code." ESNA also made a particular effort to reduce energy use. The result was new software-controlled technology enabling devices to operate as long as possible on one set of batteries.
"On the basic software side, we consolidated the open-source Contiki software," says Olsson. "This is an open source, portable operating system for wireless sensor networks. It is designed for microcontrollers with small amounts of memory."
On the applications side, ESNA developed methods for interoperation with other IP environments to ensure wireless sensor networks were not separate, stand-alone islands but rather part of enterprise-wide IT environment. "This involved supporting industrial standards in various application areas. We now have solutions that are innovative in terms of integrating other technologies and systems."

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Eureka**.

http://www.sciencedaily.com/releases/2011/04/110412143123.htm

New Supernova Shows Signs of Atypical Composition

An exploding star, or supernova, was observed in the night sky between May 31 and June 1 in a spiral arm of our galaxy's close neighbor, M51. (Credit: Ilan Manulis, Martin Kraar Observatory)

ScienceDaily (June 6, 2011) — An exploding star, in nearby galaxy M51, shows signs of an unusual composition. The material thrown into space in the explosion contains a wide variety of elements -- a mix that is atypical of supernova events at such an early stage of the explosion, researchers say.

Exploding stars are the "factories" that produce all the heavy elements found, among other places, in our bodies. In this sense, we are all stardust. These exploding stars -- supernovae -- are highly energetic events that can occasionally light up the night sky. Such an explosion generally involves disruption in the balance between gravity -- which pulls the star's material inward -- and the thermonuclear reaction at the star's core -- which heats it and pushes it outward.

Certain types of stars that go in this way have a much bigger mass (10-100 times) and are much younger than our sun. In them, the nuclear reaction begins like that of our sun -- fusing hydrogen into helium -- but the fusion then continues, producing heavier and heavier elements. The nuclear reaction eventually stops with iron, as there is no energy benefit to the star to fuse the heavier atoms, and the balance between gravity and thermonuclear activity comes to a halt. Gravity then takes over, and the mass of the star collapses quickly, releasing so much energy in the process that the explosion ensues. The star hurls its outer layers into space, and a new "bright star" appears in the night sky where none was seen before. Just such a new star was observed in the night sky between May 31 and June 1 in a spiral arm of our galaxy's close neighbor, M51.

The first to identify the supernova were amateur astronomers in France, and soon after it was detected by the PTF Sky Survey, in which Weizmann Institute scientists participate. The phenomenon was also photographed in the new Martin Kraar Observatory at the Weizmann Institute, as well as in Tel Aviv University's Wise Observatory in Mitzpe Ramon. Israel's place on the globe enables its scientists to follow supernova events when it is daytime for many other observers, and thus to add significantly to the data collection.

The new supernova is being studied by an international team of researchers, including Dr. Avishay Gal-Yam and his research team, Drs. Ofer Yaron, David Polishook and Dong Xu, research students Iair Arcavi and Sagi Ben Ami and Director of the Kraar Observatory, Ilan Manulis, all of the Weizmann Institute's Particle Physics and Astrophysics Department, as well as scientists from the US, England, Canada and other countries. They have already noted that the material thrown into space in the explosion contains a wide variety of elements. The mix they observed is atypical of supernova events at such an early stage of the explosion, and they plan to investigate this phenomenon.
The last supernova observed in M51 (which is a mere 26 million light years away) occurred in 2005. Supernovae are thought to appear about once in 100 years in any given galaxy. The high occurrence in M51 can be explained by its interaction with another, very close galaxy, which causes the process of massive star formation to accelerate, thus increasing the rate of collapse and explosion, as well.
Gal-Yam: "We invite any amateur astronomers who may have viewed the event to send us their time-dated photos. Collaboration with amateurs is very important to us and, in this case, it might help us pinpoint the exact time of the explosion."
Dr. Avishay Gal-Yam's research is supported by the Nella and Leon Benoziyo Center for Astrophysics; the Yeda-Sela Center for Basic Research; the Legacy Heritage Fund Program of the Israel Science Foundation; the Peter and Patricia Gruber Awards; and The Lord Sieff of Brimpton Memorial Fund.

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Weizmann Institute of Science**.

http://www.sciencedaily.com/releases/2011/06/110606113112.htm

What, Me Worry? Young Adults Get Self-Esteem Boost from Debt

ScienceDaily (June 6, 2011) — Instead of feeling stressed by the money they owe, many young adults actually feel empowered by their credit card and education debts, according to a new nationwide study.
Researchers found that the more credit card and college loan debt held by young adults aged 18 to 27, the higher their self-esteem and the more they felt like they were in control of their lives. The effect was strongest among those in the lowest economic class.
Only the oldest of those studied -- those aged 28 to 34 -- began showing signs of stress about the money they owed.
"Debt can be a good thing for young people -- it can help them achieve goals that they couldn't otherwise, like a college education," said Rachel Dwyer, lead author of the study and assistant professor of sociology at Ohio State University.
But the results offer some worrying signs about how many young people view debt, she added.
"Debt can be a positive resource for young adults, but it comes with some significant dangers," Dwyer said. "Young people seem to view debt mostly in just positive terms rather than as a potential burden."
Dwyer conducted the study with Randy Hodson, professor of sociology at Ohio State, and Laura McCloud, an Ohio State graduate now at Pacific Lutheran University.
The findings appear in a recent issue of the journal *Social Science Research*.
The study involved 3,079 young adults who participated in the National Longitudinal Survey of Youth 1979 -- Young Adults sample. The NLSY interviews the same nationally representative group of Americans every two years. It is conducted by Ohio State's Center for Human Resource Research on behalf of the U.S. Bureau of Labor Statistics.
For this study, the researchers examined data on two types of debt: loans taken out to pay for college, and total credit-card debt. They looked at how both forms of debt were related to people's self-esteem and sense of mastery -- their belief that they were in control of their life, and that they had the ability to achieve their goals.
Researchers have had two competing views of how debt might affect people's self-concept, Dwyer said. Some have said debt should have positive effects because it helps people invest in their future. Others have said credit should have negative effects because it allows people to spend more money than they make, thereby risking their future.
"We thought educational debt might be seen as a positive because it is an investment in their future, while credit card debt could be viewed more negatively," Dwyer said.
"Surprisingly, though, we found that both kinds of debt had positive effects for young people. It didn't matter the type of debt, it increased their self-esteem and sense of mastery."
Some young people may be using credit card debt to help finance their college education -- for items like textbooks -- which is why they may see it as a positive, she said. But there is no way to know that from the data.
"Obviously, they are probably using credit cards for multiple purposes. Along with education spending, they could be using credit cards to pay for non-essential items. They may feel good about their debt only because it allows them to buy the things they want without having to delay gratification."
But how debt affected young people depended on what other financial resources they had available, the study found.
Results showed that those in the bottom 25 percent in total family income got the largest boost from holding debt -- the more debt they held, both education and credit card, the bigger the positive impact on their self-esteem and mastery.
Those in the middle class didn't see any impact on their self-esteem and mastery by holding educational debt, perhaps because it is so common among their peers that it is seen as normal. But they did see boosts from holding credit-card debt -- the more debt, the more positive effects.
On the other hand, the study found that young adults who came from the most affluent families received no boost at all from holding debt.
"The wealthiest young people have the most resources and options available to them, so debt is not an issue for them," Dwyer said.
"The groups that most need the debt -- the middle and lower classes -- get the most benefits to their self-concept, but may also face the greatest difficulties in paying off what they owe."

The oldest people in the study, those over age 28, were just starting to feel the stress of their debt, according to Dwyer.

For these young adults, having education debt is still associated with higher self-esteem and mastery, compared to those who don't have any such debt. That suggests they still see some benefits to investing in a college degree.

But the amount of education debt mattered -- having higher levels of debt actually reduced their sense of self-esteem and mastery.

"By age 28, they may be realizing that they overestimated how much money they were going to earn in their jobs. When they took out the loans, they may have thought they would pay off their debts easily, and it is turning out that it is not as easy as they had hoped," she said.

Overall, Dwyer said the results suggest that debt can be an important resource for young adults that allow them to make investments that improve their self-concept. But the results may also have troubling implications for the future of young people.

"Debt may make young people feel better about themselves in the short-term, but that doesn't mean it won't have negative consequences in the long term," she said.

"We found that the positive effects may wear off over time, but they still have to pay the bills. The question is whether they will be able to. There needs to be additional research to answer this question."

The study was supported by a grant from the National Science Foundation.

Story Source:

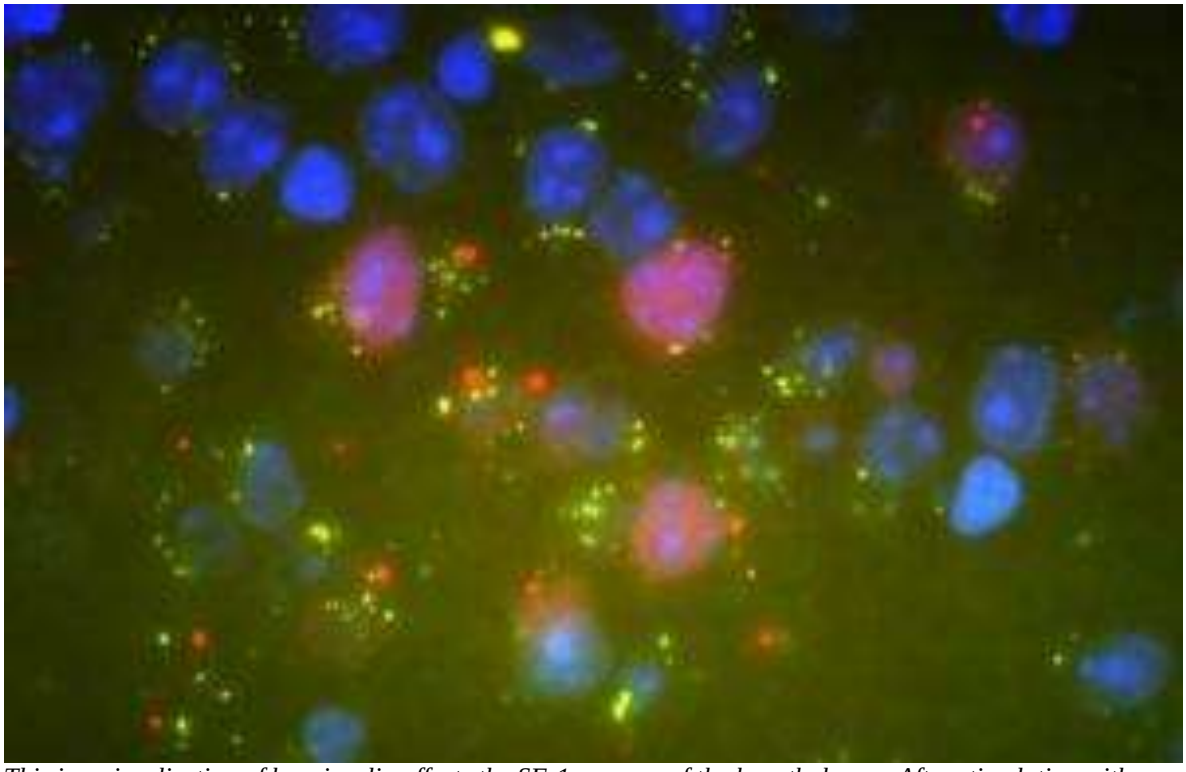
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Ohio State University**.

Journal Reference:

1. Rachel E. Dwyer, Laura McCloud, Randy Hodson. **Youth debt, mastery, and self-esteem: Class-stratified effects of indebtedness on self-concept**. *Social Science Research*, 2011; 40 (3): 727 DOI: 10.1016/j.ssresearch.2011.02.001

http://www.sciencedaily.com/releases/2011/06/110606113401.htm

Insulin Action in the Brain Can Lead to Obesity: How Insulin in Hypothalamus Controls Body's Energy Balance



This is a visualization of how insulin affects the SF-1 neurons of the hypothalamus. After stimulation with insulin, the SF-1 cells (red) form the signaling molecule PiP3 (green). (Blue: cell nucleus) (Credit: © Max Planck Institute for Neurological Research)

ScienceDaily (June 6, 2011) — Fat-rich food makes you fat. Behind this simple equation lie complex signalling pathways, through which the neurotransmitters in the brain control the body's energy balance. Scientists at the Cologne-based Max Planck Institute for Neurological Research and the Cluster of Excellence in Cellular Stress Responses in Ageing-associated Diseases (CECAD) at the University of Cologne have clarified an important step in this complex control circuit. They have succeeded in showing how the hormone insulin acts in the part of the brain known as the ventromedial hypothalamus.

The consumption of high-fat food causes more insulin to be released by the pancreas. This triggers a signalling cascade in special nerve cells in the brain, the SF-1 neurons, in which the enzyme P13-kinase plays an important role. Over the course of several intermediary steps, the insulin inhibits the transmission of nerve impulses in such a way that the feeling of satiety is suppressed and energy expenditure reduced. This promotes overweight and obesity.

The hypothalamus plays an important role in energy homeostasis: the regulation of the body's energy balance. Special neurons in this part of the brain, known as POMC cells, react to neurotransmitters and thus control eating behaviour and energy expenditure. The hormone insulin is an important messenger substance. Insulin causes the carbohydrate consumed in food to be transported to target cells (e.g. muscles) and is then available to these cells as an energy source. When high-fat food is consumed, more insulin is produced in the pancreas, and its concentration in the brain also increases. The interaction between the insulin and the target cells in the brain also plays a crucial role in the control of the body's energy balance. However, the precise molecular mechanisms that lie behind the control exercised by insulin remain largely unclear.

A research group led by Jens Brüning, Director of the Max Planck Institute for Neurological Research and scientific coordinator of the CECAD (Cellular Stress Responses in Aging-Associated Diseases) cluster of excellence at the University of Cologne has achieved an important step in the explanation of this complex regulatory process. As the scientists have shown, insulin in the SF-1 neurons -- another group of neurons in

the hypothalamus -- triggers a signalling cascade. Interestingly, however, these cells appear only to be regulated by insulin when high-fat food is consumed and in the case of overweight. The enzyme P13-kinase plays a central role in this cascade of messenger substances. In the course of the intermediary steps in the process, the enzyme activates ion channels and thereby prevents the transmission of nerve impulses. The researchers suspect that the SF-1 cells communicate in this way with the POMC cells.
Kinases are enzymes that activate other molecules through phosphorylation -- the addition of a phosphate group to a protein or other organic molecule. "If insulin binds to its receptor on the surface of the SF-1 cells, it triggers the activation of the PI3-kinase," explains Tim Klöckener, first author of the study. "The PI3-kinase, in turn, controls the formation of PIP3, another signalling molecule, through phosphorylation. PIP3 makes the corresponding channels in the cell wall permeable to potassium ions." Their influx causes the neuron to 'fire' more slowly and the transmission of electrical impulses is suppressed.
"Therefore, in overweight people, insulin probably indirectly inhibits the POMC neurons, which are responsible for the feeling of satiety, via the intermediary station of the SF-1 neurons," supposes the scientist. "At the same time, there is a further increase in food consumption." The direct proof that the two types of neurons communicate with each other in this way still remains to be found, however.
In order to find out how insulin acts in the brain, the Cologne-based scientists compared mice that lacked an insulin receptor on the SF-1 neurons with mice whose insulin receptors were intact. With normal food consumption, the researchers discovered no difference between the two groups. This would indicate that insulin does not exercise a key influence on the activity of these cells in slim individuals. However, when the rodents were fed high-fat food, those with the defective insulin receptor remained slim, while their counterparts with functional receptors rapidly gained weight. The weight gain was due to both an increase in appetite and reduced calorie expenditure. This effect of insulin could constitute an evolutionary adaptation by the body to an irregular food supply and extended periods of hunger: if an excess supply of high-fat food is temporarily available, the body can lay down energy reserves particularly effectively through the action of insulin.
It is not currently possible to say whether the findings of this research will eventually help to facilitate targeted intervention in the body's energy balance. "We are currently still very far away from a practical application," says Jens Brüning. "Our objective is to find out how hunger and the feeling of satiety arise. Only when we understand the entire system at work here, we will be able to start developing treatments."

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

Journal Reference:

1. Tim Klöckener, Simon Hess, Bengt F Belgardt, Lars Paeger, Linda A W Verhagen, Andreas Husch, Jong-Woo Sohn, Brigitte Hampel, Harveen Dhillon, Jeffrey M Zigman, Bradford B Lowell, Kevin W Williams, Joel K Elmquist, Tamas L Horvath, Peter Kloppenburg, Jens C Brüning. **High-fat feeding promotes obesity via insulin receptor/PI3K-dependent inhibition of SF-1 VMH neurons**. *Nature Neuroscience*, 2011; DOI: 10.1038/nn.2847

http://www.sciencedaily.com/releases/2011/06/110606121839.htm

More Men With Migraine Suffer from PTSD Than Women, Study Finds

ScienceDaily (June 1, 2011) — A recently published paper highlights that while the risk of post-traumatic stress disorder (PTSD) is more common in those with migraine than those without migraine irrespective of sex, the risk is greater in male migraineurs than female migraineurs.

Study details are now available in *Headache: The Journal of Head and Face Pain*, published by Wiley-Blackwell on behalf of the American Headache Society.

In this paper, lead author B. Lee Peterlin and colleagues review the epidemiology of PTSD and migraine, underscoring the established sex differences. While individually both migraine and PTSD are more common in women than men, a recent study by Peterlin and colleagues -- the only study to date to look at sex differences in the PTSD-migraine association -- suggests that men with migraines had up to a four-fold greater odds of PTSD than females who experience migraine headaches. This finding suggests that sex hormones play an important role in the PTSD-migraine association.

The age of the traumatic life event resulting in PTSD may also be an important factor for the sex differences in the PTSD-migraine association. When a traumatic life event occurs before 13 years of age, the risk of depression is greater than the risk of PTSD; however, when the traumatic life event occurs after 12 years of age, the risk of PTSD is greater.[37] Although the migraine population has a documented high prevalence of abuse, the peak age of vulnerability for childhood sexual abuse, is under 13 years of age. In contrast transportation accidents and combat, (two of the most common traumatic events reported by migraineurs with PTSD in one study), may be more commonly experienced by those older than 12 years of age. It is therefore possible that in the migraine population, sex differences in the type and age of traumatization contributes to the sex differences in the risk of PTSD.
Studies have also shown that the presence of PTSD in those with migraine is associated with greater headache-related disability than in migraine sufferers without PTSD. Dr. Peterlin explains, "The current data indicate that behavioral PTSD treatment alone can positively influence chronic pain conditions and disability. Therefore, physicians should consider screening migraine sufferers for PTSD, and men in particular. Further, in those migraineurs with PTSD, behavioral therapy should be considered, alone or in combination with pharmacological treatment." The authors suggest that further research investigating the sex differences in the association between PTSD and migraine is necessary to validate the sex differences found in their study, as well as to determine suitable treatment options in those migraineurs suffering with PTSD.

A second related article published this month in Headache also reviews sex and gender differences in those with headache. Todd Smitherman, PhD, from the University of Mississippi and Thomas Ward, MD, of the Dartmouth Medical School in New Hampshire reviewed extant medical literature to examine the psychosocial factors of gender and social role expectations, and coping strategies as they relate to sex and gender differences in headache pain.

A distinction was made in this paper between sex -- the biologically-based indicators of male or female; and gender -- "the traits and behaviors characteristic of and appropriate to members of each sexual category" (Unger, 1976) given that pain-related differences between men and women established in the medical literature cannot be reduced solely to biological determinants.

The authors suggest that women's pain experiences, multiple role responsibilities, and coping strategies likely influence the sex and gender differences in pain perception and response. "Gender-based differences are not strictly biological and important psychosocial issues are involved with headache pain as well," Dr. Smitherman concluded. "Further research of the impact of sex and gender on psychosocial variables may help clinicians tailor treatment plans that reduce pain and disability for headache patients."

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Wiley-Blackwell**, via AlphaGalileo.

Journal References:

1. B. Lee Peterlin, Satnam S. Nijjar, Gretchen E. Tietjen. **Post-Traumatic Stress Disorder and Migraine: Epidemiology, Sex Differences, and Potential Mechanisms**. *Headache: The Journal of Head and Face Pain*, 2011; DOI: 10.1111/j.1526-4610.2011.01907.x
2. Todd A. Smitherman, Thomas N. Ward. **Psychosocial Factors of Relevance to Sex and Gender Studies in Headache**. *Headache: The Journal of Head and Face Pain*, 2011; DOI: 10.1111/j.1526-4610.2011.01919.x

http://www.sciencedaily.com/releases/2011/06/110601091143.htm

Tiny Talk on a Barnacle's Back: Scientists Use New Imaging Technique to Reveal Complex Microbial Interactions

In this photo illustration, the Scripps Institution of Oceanography pier is shown with images generated using imaging mass spectrometry set between piling. One of the molecules identified in metabolic exchange by the study is illustrated along the upper course of the pier. Barnacles and other marine organisms cling to one of the pier's pilings. (Credit: Photo courtesy of Garlandcannon/Flickr)

ScienceDaily (May 10, 2011) — Even the merest of microbes must be able to talk, to be able to interact with its environment and with others to not just survive, but to thrive. This cellular chatter comes in the form of signaling molecules and exchanged metabolites (molecules involved in the process of metabolism or living) that can have effects far larger than the organism itself. Humans, for example, rely upon thousands of products derived from microbially produced molecules, everything from antibiotics and food supplements to ingredients used in toothpaste and paint.

Remarkably, most of what's known about how microbes communicate with each other is the result of indirect observation and measurements. There has been no general or informative technique for observing the manifold metabolic exchange and signaling interactions between microbes, their hosts and environments.

Until now. In a paper published in the May 5 online issue of the journal *Angewandte Chemie*, researchers at the UC San Diego School of Medicine and Scripps Institution of Oceanography report using a new form of imaging mass spectrometry to dramatically visualize multiplex microbial interactions.

"Being able to better see and understand the metabolic interplay between microbial communities and their surrounding biology means we can better detect and characterize the molecules involved and perhaps discover new and better therapeutic and commercially viable compounds," said Pieter C. Dorrestein, PhD, associate professor at the UCSD Skaggs School of Pharmacy and Pharmaceutical Sciences and the paper's senior author.

Dorrestein and colleagues used matrix-assisted laser desorption ionization (MALDI) mass spectrometry, a relatively new approach that creates two-dimensional, spatial images of microbes and biomolecules (proteins, peptides, sugars) too fragile to withstand other mass spectrometry techniques.

As their first subject, the scientists collected marine microbial assemblages scraped off the slimy surfaces of a barnacle attached to the Scripps Pier. The resulting images, produced after careful preparation, offered new revelations.

"One of the things we see that we haven't with other techniques is that the dialog between microbes is multiplexed," said Dorrestein. "There are many conversations going on at the same time, many changes happening at the same time. We see competition for resources such as iron, but also that microbes secrete molecules that alter the phenotypes (sets of observable characteristics) of neighboring organisms."

Dorrestein said the ability to better visualize the vastly complex world of microbial communication is changing the ways scientists investigate how two or more microbes are studied and eventually engineered.

"Rather than enumerating which microbes are present, as in many metagenomic efforts, our current approach is anticipated to address the why, when and how questions of microbial interactions instead of just the who," Dorrestein said.

Co-authors of the paper are Yu-Liang Yang, Yuquan Xu, Michael J. Meehan, Bradley S. Moore, Nuno Bandeira, UCSD Skaggs School of Pharmacy and Pharmaceutical Sciences; Roland Kersten, Center for Marine Biotechnology and Biomedicine, Scripps Institution of Oceanography, UCSD; Wei-Ting Liu, UCSD Department of Chemistry and Biochemistry.

Funding for this research was provided, in part, by the National Institutes of Health and the Beckman Foundation.

Story Source:

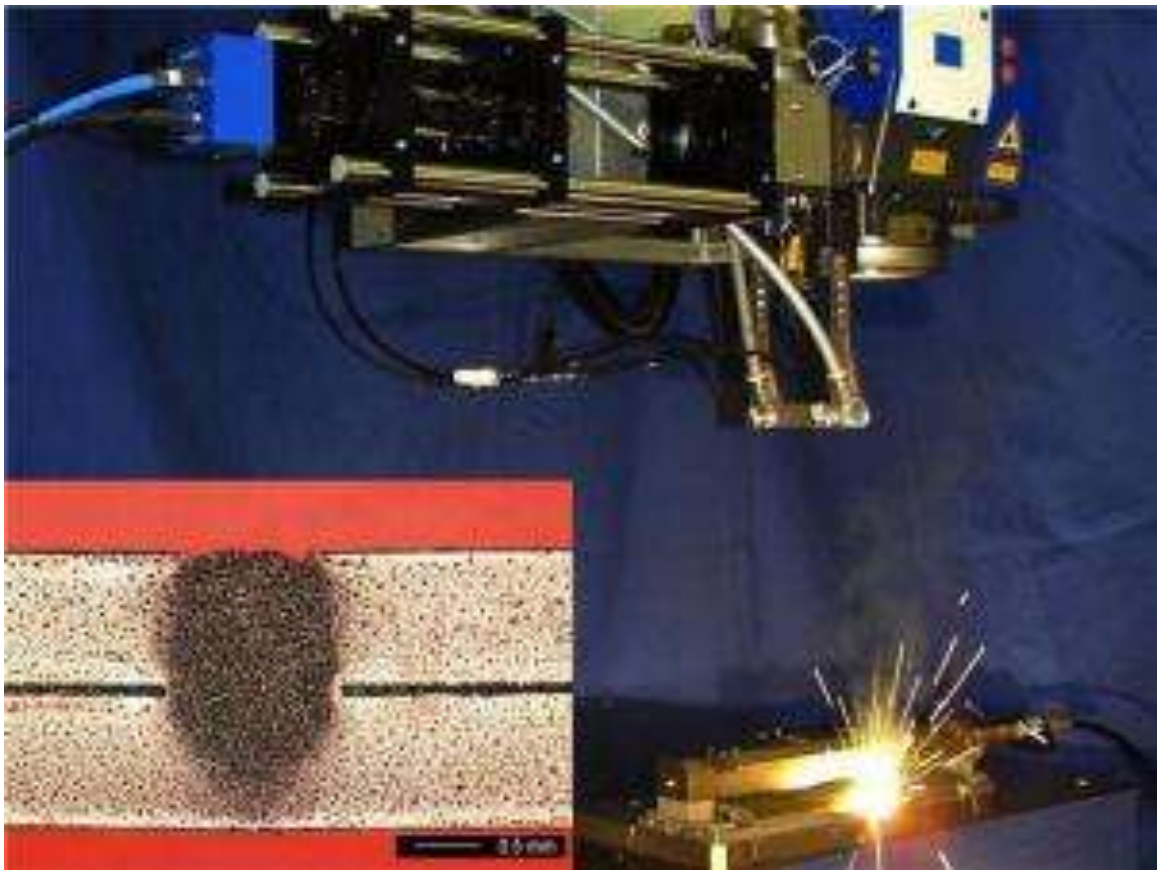
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of California - San Diego**. The original article was written by Scott LaFee.

Journal Reference:

1. Yu-Liang Yang, Yuquan Xu, Roland D. Kersten, Wei-Ting Liu, Michael J. Meehan, Bradley S. Moore, Nuno Bandeira, Pieter C. Dorrestein. **Connecting Chemotypes and Phenotypes of Cultured Marine Microbial Assemblages by Imaging Mass Spectrometry**. *Angewandte Chemie*, 2011; DOI: 10.1002/ange.201101225

http://www.sciencedaily.com/releases/2011/05/110510141433.htm

Perfect Welds for Car Bodies



In the new surface welding process the laser produces a perfect seam. Bottom left: Weld seam profi le – the penetration depth is controlled without damaging the bottom surface. (Credit: Image courtesy of Fraunhofer-Gesellschaft)

ScienceDaily (May 12, 2011) — Surface welding instead of penetration welding, allows a laser to produce a weld that is only visible on one side. But how do you control the laser power to prevent it burning a hole through the sheets of metal? A new camera system analyzes thermal images in real time -- and ensures a perfect weld.

As if controlled by an invisible hand, the welding head on the robot's arm races along the sheet metal parts. Where the laser hits, sparks fly and the metal glows red hot. The process lasts just a few seconds. The outer door panel and the door frame are now welded together perfectly. A thin weld seam extends along the join, but it can only be seen on one side. From the other side of the welded car door the join is invisible. This is a perfect weld -- the kind every car manufacturer dreams of, because it could be used anywhere on the car body. Expensive work to hide the seam, such as folding the sheet metal or covering with trim would no longer be necessary.

Research scientists at the Fraunhofer Institute for Physical Measurement Techniques IPM in Freiburg have turned this car makers' dream into reality. 'Controlled partial penetration welding' is how experts refer to the process in which the laser does not burn right through all the sheets of metal -- in contrast to full penetration welding, where a hole briefly forms in the melt pool. Instead, the weld seam is controlled to penetrate the lower sheet without damaging the bottom surface. Up to now, however, it was not possible to precisely control this type of welding and produce a seam that meets the requirements in respect of strength.

"As we do not weld through the sheet, basically we cannot see what we are doing," states Andreas Blug, project manager at Fraunhofer IPM, outlining the problem. But they found the solution using an innovative camera that generates temperature images. This enables the system to recognize how deep the laser has

penetrated into the sheets. Where it burns into the metal, causing it to melt, the images show a hot region. If the bottom of the melt pool reaches the gap between the upper and lower sheets, the conduction of heat is interrupted and a cooler point can be seen. This is referred to as the full penetration hole. From the relative frequency of this full penetration hole the system calculates the penetration depth into the lower sheet. A software program then adapts the output of the laser to the specific requirements. "The process is closed loop controlled in real time," Blug explains. An extremely rapid camera system is needed for this -- which is the key to Fraunhofer IPM's innovation. The system is based on cellular neural networks (CNN). A tiny processor is integrated in each pixel. They all work simultaneously and speed up the analysis of the individual images enormously, whereas in conventional image processing systems a few processors process the data consecutively. "In this way the system analyzes up to 14,000 images per second," says Blug. This compares with the usual rate of only 1,000 to 2,000 images per second.
Together with colleagues from the IFSW Institut für Strahlwerkzeuge at Stuttgart University and the Institut für Grundlagen der Elektrotechnik und Elektronik (IEE) at Dresden University of Technology, the Fraunhofer IPM research scientists have now developed a prototype which perfectly controls the surface welding process, offering car makers a further great benefit in comparison with full penetration welding: zinc does not vaporize on the bottom side of the weld. The corrosion problems encountered on galvanized car bodies are therefore a thing of the past.

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Fraunhofer-Gesellschaft**.

http://www.sciencedaily.com/releases/2011/05/110512103944.htm

Darkness Stifles Reproduction of Surface-Dwelling Fish

A cave-dwelling Poecilia mexicana, or Atlantic molly. (Credit: Image courtesy of North Carolina State University)

ScienceDaily (June 6, 2011) — There's a reason to be afraid of the dark. Fish accustomed to living near the light of the water's surface become proverbial "fish out of water" when they move to dark environments like those found in caves, according to a study from North Carolina State University.

In research published this week in *Biology Letters*, a Royal Society scientific journal, NC State post-doctoral researcher Rüdiger Riesch and colleagues found that Atlantic molly females from regular surface streams have a difficult time adjusting to cavelike conditions. Surface female fish had trouble reproducing in the dark conditions, study results show. In addition, many surface-dwelling females introduced to dark conditions -- surprisingly, according to the researchers -- suffered from high incidents of stress-induced bacterial columnaris disease, or "fin rot," which causes patchy lesions on the bodies of the fish.

"Permanent darkness severely hampers reproduction in surface-dwelling females," Riesch says. "But this study also shows that the successful colonization of a subterranean habitat must have been a rare event for Atlantic mollies."

The study was designed to provide an answer to why Atlantic mollies -- their scientific name is Poecilia mexicana -- living close to each other in and near a cave in southern Mexico can evolve in different ways. These population differences are normally attributed to geographic separation -- like mountain ridges or some other physical barrier -- but no physical barrier exists in or around the cave where these Atlantic mollies live. In the study, the researchers placed some Atlantic mollies in cavelike total darkness while others received a "normal day" of 12 hours of light and 12 hours of darkness.

Most of the cave-dwelling fish of either sex as well as male surface-dwelling fish performed well in both light and darkness. Surface-dwelling females, however, did not breed well or maintain good health in the darkness. One explanation for the results, Riesch says, has to do with the amount of resources fish have available for reproduction. A fish that has evolved in light has difficulties navigating and finding food in darkness, resulting in reproductive failure.

"Light and dark can completely disrupt life and reproduction for certain fish, and specific key adaptations are necessary to survive in caves," Riesch says. "This study may be one answer to why fish of the same species living side by side can be so different."

The research was funded by the National Science Foundation.

Story Source:

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

Journal Reference:

1. R. Riesch, M. Plath, I. Schlupp. **Speciation in caves: experimental evidence that permanent darkness promotes reproductive isolation**. *Biology Letters*, 2011; DOI: 10.1098/rsbl.2011.0237

http://www.sciencedaily.com/releases/2011/05/110510211609.htm

Will Global Climate Change Enhance Boreal Forest Growth?

With an increasingly warmer climate, there is a trend for springs to arrive earlier and summers to be hotter. Since spring and summer are the prime growing seasons for plants -- when flowers bloom and trees increase in girth and height -- do these climate changes mean greater seasonal growth for plants? This is a critical question for forest management, especially in the boreal region -- an area particularly sensitive to the effects of climate change. (Credit: © MarisTerauds / Fotolia)

ScienceDaily (June 6, 2011) — With an increasingly warmer climate, there is a trend for springs to arrive earlier and summers to be hotter. Since spring and summer are the prime growing seasons for plants -- when flowers bloom and trees increase in girth and height -- do these climate changes mean greater seasonal growth for plants? This is a critical question for forest management, especially in the boreal region -- an area particularly sensitive to the effects of climate change.

Dr. Jian-Guo Huang, currently a post-doc at the University of Alberta, and colleagues from the University of Quebec at Montreal were interested in assessing whether a potentially extended growing season affects stem xylem formation and growth in black spruce (*Picea mariana*) in Western Quebec, Canada. They published their findings in the May issue of the *American Journal of Botany*.

Xylem cells conduct water and nutrients from roots to the leaves, but also provide mechanical support and form the wood of trees. Growth patterns of xylem are of interest to foresters because thicker-walled xylem cells produce denser wood -- and aspects of the climate, such as temperature and rainfall, may impact not only the number of cells produced during a growing season, but also cell wall thickness.

By taking microcore samples from black spruce trees at three different latitudes ranging from 47.5o to 50oN in Western Quebec throughout the growing season (May-September) in 2005 and 2006, Huang and colleagues were able to determine when xylem cell production began and ended, as well as the pattern of xylem cell growth. They then compared these data to soil and air temperature and precipitation data gathered from local climate stations.

"Every small wood xylem cell contains meteorological information during its growing process," Huang commented. "Exploring a series of micro-wood xylem cells helps us understand the macro-climate variability."

When the authors examined the pattern of xylem cell initiation, they found an interesting correlation with patterns in air temperatures in the two years. Across all three sites, xylem cell production in black spruce trees started earlier in 2006 than in 2005, corresponding with an earlier spring (and warmer May temperatures) in 2006 -- indicating a positive relationship between temperature and onset of xylem production.

Temperature affects not only when cells begin to grow, but also the growth patterns of those cells. Xylem cells produced early in the season -- earlywood -- are large in size with thin walls, while those produced later in the season -- latewood -- are smaller and have thicker walls.

Despite early warm temperatures in 2006, temperatures for the rest of the growing season were actually lower in June through August compared with 2005. And, correspondingly, Huang and co-authors found that in 2006 black spruce trees stopped producing both early and latewood earlier than in 2005. Consequently there were higher ratios of latewood cells to total xylem cells in 2006, and narrower, less-productive growth rings.

"Our study implies that despite the expected occurrence of earlier phenological development due to early spring climate warming, boreal trees like *Picea mariana* might not be producing wider rings if cold temperatures occur later in the growing season in June to August," Huang said. "These results may challenge the view that boreal trees could be benefiting from spring warming to enhance growth."
Thus, not only is the timing of the onset of spring important, but the amplitude of summer warming temperatures also plays a role in wood production.
Huang and his colleagues intend to further explore how intra-annual xylem formation of other boreal species, particularly broadleaf species, is responding to climate warming and varies across species and sites.
"Because broadleaf species are more limited by precipitation, early spring warming (i.e., early onset of cell production) followed by cold June-August temperatures (i.e., less drought stress) might favor xylem cell production, resulting in wider rings and better growth, when compared with conifers like *Picea mariana*," commented Huang. "These different growth responses to climate warming across species might lead to potential changes in forest growth, structure and composition, as well as the whole forest ecosystem productivity, and carbon equilibrium."

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **American Journal of Botany**, via EurekAlert!, a service of AAAS.

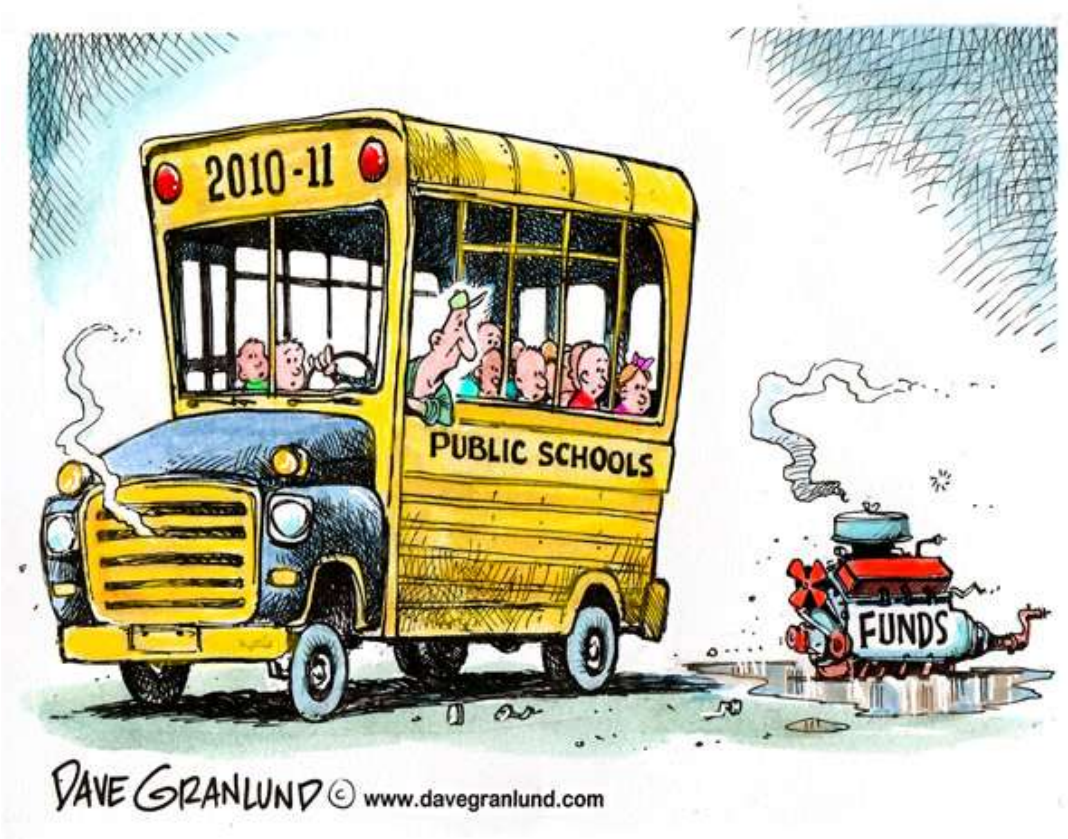
Journal Reference:

1. J.-G. Huang, Y. Bergeron, L. Zhai, B. Denneler. **Variation in intra-annual radial growth (xylem formation) of Picea mariana (Pinaceae) along a latitudinal gradient in western Quebec, Canada**. *American Journal of Botany*, 2011; 98 (5): 792 DOI: 10.3732/ajb.1000074

http://www.sciencedaily.com/releases/2011/05/110516102251.htm

Improve Schools: Treat students like prisoners

Posted: 02 Jun 2011 12:56 PM PDT



Check out this letter to the editor that the Superintendent of Ithaca Public Schools in Michigan Nathan Bootz sent to the local paper. The letter is addressed to governor Rick Snyder and in it Bootz simply asks for the same provisions for his students that state supplies for its prisoners!

Bravo, Mr. Bootz.

Dear Governor Snyder,

In these tough economic times, schools are hurting. And yes, everyone in Michigan is hurting right now financially, but why aren't we protecting schools? Schools are the one place on Earth that people look to to "fix" what is wrong with society by educating our youth and preparing them to take on the issues that society has created.

One solution I believe we must do is take a look at our corrections system in Michigan. We rank nationally at the top in the number of people we incarcerate. We also spend the most money per prisoner annually than any other state in the union. Now, I like to be at the top of lists, but this is one ranking that I don't believe Michigan wants to be on top of.

Consider the life of a Michigan prisoner. They get three square meals a day. Access to free health care. Internet. Cable television. Access to a library. A weight room. Computer lab. They can earn a degree. A roof over their heads. Clothing. Everything we just listed we DO NOT provide to our school children.

This is why I'm proposing to make my school a prison. The State of Michigan spends annually somewhere between $30,000 and $40,000 per prisoner, yet we are struggling to provide schools with $7,000 per student. I guess we need to treat our students like they are prisoners, with equal funding. Please give my students three meals a day. Please give my children access to free health care. Please provide my school district Internet access and computers. Please put books in my library. Please give my students a weight room so we can be big and strong. We provide all of these things to prisoners because they have constitutional rights. What about the rights of youth, our future?!

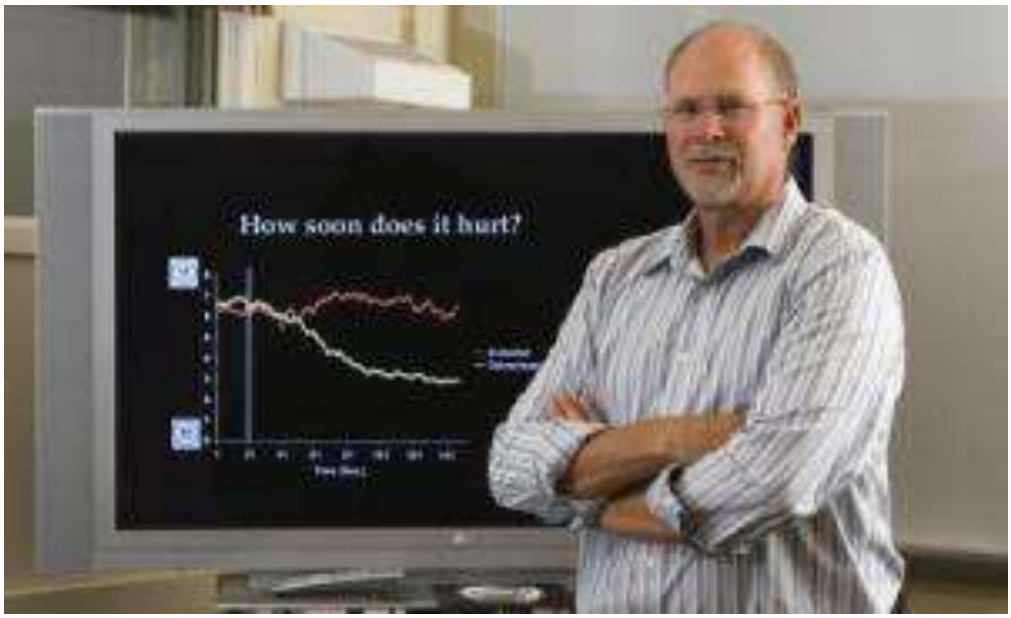
Please provide for my students in my school district the same way we provide for a prisoner. It's the least we can do to prepare our students for the future...by giving our schools the resources necessary to keep our students OUT of prison.

Respectfully submitted,

Nathan Bootz
Superintendent
Ithaca Public Schools

http://feedproxy.google.com/~r/BookPatrol/~3/ZScocVrmC4k/improve-schools-treat-students-like.html?utm_source=feedburner&utm_medium=email

Pain of Ostracism Can Be Deep, Long-Lasting



Kipling D. Williams, a Purdue professor of psychological sciences, studies how ostracism hurts individuals as much or even more than a physical injury. (Credit: Purdue University photo/Mark Simons)

ScienceDaily (June 6, 2011) — Ostracism or exclusion may not leave external scars, but it can cause pain that often is deeper and lasts longer than a physical injury, according to a Purdue University expert.

"Being excluded or ostracized is an invisible form of bullying that doesn't leave bruises, and therefore we often underestimate its impact," said Kipling D. Williams, a professor of psychological sciences. "Being excluded by high school friends, office colleagues, or even spouses or family members can be excruciating. And because ostracism is experienced in three stages, the life of those painful feelings can be extended for the long term. People and clinicians need to be aware of this so they can avoid depression or other negative experiences."

When a person is ostracized, the brain's dorsal anterior cingulate cortex, which registers physical pain, also feels this social injury, Williams said. The process of ostracism includes three stages: the initial acts of being ignored or excluded, coping and resignation.

Williams' research is reported in the current issue of *Current Directions in Psychological Sciences*. The article was co-authored by Steve A. Nida, associate provost and dean of The Citadel Graduate College and a professor of psychology.

"Being excluded is painful because it threatens fundamental human needs, such as belonging and self-esteem," Williams said. "Again and again research has found that strong, harmful reactions are possible even when ostracized by a stranger or for a short amount of time."

More than 5,000 people have participated in studies using a computer game designed by Williams to show how just two or three minutes of ostracism can produce lingering negative feelings.

"How can it be that such a brief experience, even when being ignored and excluded by strangers with whom the individual will never have any face-to-face interaction, can have such a powerful effect?" he said. "The effect is consistent even though individuals' personalities vary."

People also vary in how they cope, which is the second stage of ostracism. Coping can mean the person tries to harder be included. For example, some of those who are ostracized may be more likely to engage in behaviors that increase their future inclusion by mimicking, complying, obeying orders, cooperating or expressing attraction.

"They will go to great lengths to enhance their sense of belonging and self-esteem," Williams said.

If they feel there is little hope for re-inclusion or that they have little control over their lives, they may resort to provocative behavior and even aggression.

"At some point, they stop worrying about being liked, and they just want to be noticed," Williams said. However, if a person has been ostracized for a long time, they may not have the ability to continue coping as the pain lingers. Some people may give up, Williams said.
"The third stage is called resignation. This is when people who have been ostracized are less helpful and more aggressive to others in general," he said. "It also increases anger and sadness, and long-term ostracism can result in alienation, depression, helplessness and feelings of unworthiness."
Williams is trying to better understand how ostracized individuals may be attracted to extreme groups and what might be the reactions of ostracized groups.
"These groups provide members with a sense of belonging, self-worth and control, but they can fuel narrowness, radicalism and intolerance, and perhaps a propensity toward hostility and violence toward others," he said. "When a person feels ostracized they feel out of control, and aggressive behavior is one way to restore that control. When these individuals come together in a group there can be negative consequences."
Williams is a professor in the Department of Psychological Sciences in Purdue's College of Health and Human Sciences.

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Purdue University**.

Journal Reference:

1. K. D. Williams, S. A. Nida. **Ostracism: Consequences and Coping**. *Current Directions in Psychological Science*, 2011; 20 (2): 71 DOI: 10.1177/0963721411402480

http://www.sciencedaily.com/releases/2011/05/110510151216.htm

Severity of Facial Wrinkles May Predict Bone Density in Early Menopause, Study Suggests

ScienceDaily (June 4, 2011) — A news study finds that the worse a woman's skin wrinkles are during the first few years of menopause, the lower her bone density is.

The results are being presented at The Endocrine Society's 93rd Annual Meeting in Boston.

"In postmenopausal women the appearance of the skin may offer a glimpse of the skeletal well-being, a relationship not previously described," said Lubna Pal, MD, a reproductive endocrinologist and associate professor at Yale School of Medicine, New Haven, Conn.

The study demonstrates only an association between bone density and skin wrinkling, stressed Pal, the study's principal investigator. However, she called their findings noteworthy.

"This information," Pal said, "may allow for the possibility of identifying postmenopausal women at fracture risk at a glance, without dependence on costly tests."

The study is an ancillary study to an ongoing multicenter trial called the Kronos Early Estrogen Prevention Study, or KEEPS, which is funded by the Aurora Foundation and the Kronos Longevity Research Institute in Phoenix. This ancillary study included 114 women in their late 40s and early 50s who had had their last menstrual period within the past three years and who were not taking hormone therapy. Women were excluded from participating if they had undergone any cosmetic skin procedures.

Women received a score for face and neck wrinkles based on the number of sites with wrinkles and on the depth of the wrinkles. The skin firmness or rigidity was measured at the forehead and the cheek with a device called a durometer. Study participants also underwent measurement of bone density by dual X-ray absorptiometry (DEXA) and by a portable heel ultrasound device.

The investigators found a significant inverse correlation between the wrinkle score and the bone density, meaning the higher the score (and the worse the wrinkles), the lower the bone density. This relationship was evident at all skeletal sites -- hip, lumbar spine and heel -- and was independent of age, body composition or other factors known to influence bone density, Pal said. Additionally, firmer skin of the face and forehead was associated with greater bone density.

Although the connection between bones and skin may seem unclear, Pal explained that they share common building blocks -- a group of proteins known as collagens. As we age, changes in collagen occur that may account for age related skin changes including worsening skin wrinkles and sagging skin, and also contribute to deterioration in bone quality and quantity.

Long-term studies are needed to substantiate a relationship between wrinkles and the risk of bone fracture, Pal said.

"Ultimately, we want to know if intensity of skin wrinkles can allow identification of women who are more likely to fracture a bone, especially the femoral neck or the hip, an often fatal injury in older people," she said. "If this is the case, then including the study of skin wrinkles to other clinical risk factors may allow identification of fracture risk in populations that do not have access to more costly technology."

Story Source:

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

http://www.sciencedaily.com/releases/2011/06/110604181911.htm

Precision-Tinted Lenses Offer Real Migraine Relief, Reveals New Study

A new MSU study reveals why precision-tinted lenses reduce headaches for migraine sufferers. (Credit: Photo by G.L. Kohuth)

ScienceDaily (June 6, 2011) — Precision tinted lenses have been used widely to reduce visual perceptual distortions in poor readers, and are increasingly used for migraine sufferers, but until now the science behind these effects has been unclear. Now research published in the journal *Cephalalgia*, uses functional magnetic resonance imaging (fMRI) for the first time to suggest a neurological basis for these visual remedies.

The new research shows how coloured glasses tuned to each migraine sufferer work by normalizing activity in the brain. The researchers saw specific abnormal brain activity (known as hyperactivation) when migraine sufferers saw intense patterns. The tinted lenses considerably reduced the effect.

Jie Huang along with colleagues from Michigan State University and the University of Michigan, US, and the University of Essex, UK, homed in on specific visual stimuli known to trigger migraines. These patterns, high contrast stripes or 'gratings,' can give the illusion of shape, colour and movement. These not only trigger migraines but also may cause seizures in those with photosensitive epilepsy.

Before the brain imaging took place, participants were tested and prescribed precision ophthalmic tints (POTs) with an Intuitive Colorimeter. Previous studies have suggested that some 42% of migraine with aura sufferers saw their migraine frequency halved on days when they wore POTs. The researchers used the colorimeter to illuminate text with coloured light, manipulating hue and saturation at constant luminance. For each test participant this gave an optimal hue and saturation (chromaticity) of light that led to the greatest comfort, reducing perceptual distortion. The test subjects then viewed stressful striped patterns illuminated with their optimal coloured light settings to screen for efficacy. The researchers used these readings to generate both effective POTs for each migraine sufferer and also two other pairs of grey and coloured lenses with slightly different properties as controls. 11 patients who frequently suffered from migraine enrolled in the fMRI study. Each patient was paired with a migraine-free control, who was also tested with that patient's three sets of lenses.

Once in the fMRI machine, the researchers exposed subjects to a range of striped patterns -- these had varying likelihood of triggering distortion and discomfort. This study aimed to investigate the effect of the POTs on the cortical activation induced by the stressful pattern in each of the visual areas of the brain. Although patients reported some relief using all of the lenses (by around 40%), the POT lenses had a significant effect when viewing the stressful stripes (70% discomfort reduction). Both control and migraine patients responded similarly to the non-stressful stripe patterns, and in these cases all three lenses made no difference to the

result. The POTs specifically suppressed cortical activation for migraine sufferers in visual area V2 of the occipital cortex of the brain, and this POT-suppressed cortical activation was also extended to the other extra-striate visual areas V3, V3A, and V4

"The reduced cortical activation in V2 by the POTs may have been responsible for the POT-induced suppression of the illusions and distortions, considering that V2 neurons but not V1 neurons in macaque monkeys respond to illusory contour stimuli," Huang suggests.

The cause of these responses to specific visual stimuli is likely to differ from the photophobia (light sensitivity) migraine sufferers often report during an attack. Going forward, the authors suggest that the specific characteristic of the cortical activation in the extra-striate visual areas they recorded could provide a potential biomarker for identifying those migraine patients suffering cortical hyperactivation. This biomarker could prove useful not only for further evaluation of POTs but also for studying the effectiveness of drugs to prevent migraine.

Story Source:

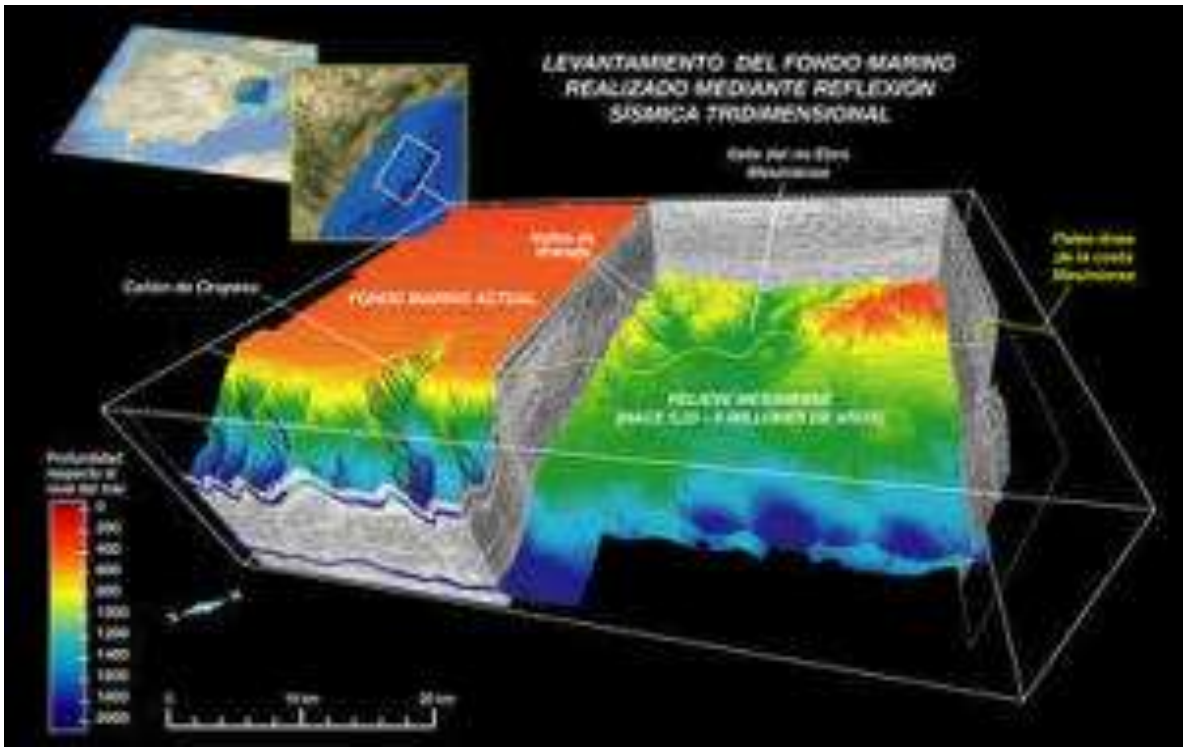
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **SAGE Publications**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Jie Huang, Xiaopeng Zong, Arnold Wilkins, Brian Jenkins, Andrea Bozoki, and Yue Cao. **fMRI evidence that precision ophthalmic tints reduce cortical hyperactivation in migraine**. *Cephalalgia*, 0333102411409076, May 26, 2011 DOI: 10.1177/0333102411409076

http://www.sciencedaily.com/releases/2011/05/110526064629.htm

What the Margins of Spain's Ebro River Basin Looked Like 6 Million Years Ago



The fall in sea level in the Messinian in this part of the Mediterranean basin was about 1,300 meters. (Credit: SINC/ICM)

ScienceDaily (June 6, 2011) — A Spanish research team, using 3-D reflection seismology, has for the first time mapped the geomorphological features of the Ebro river basin 5 to 6 million years ago. The images obtained show that the surface analysed is today 2.5 or 3 kilometres below the sea bed.

"The results shed light on the way in which the sea level fell during the Messinian (between 5.33 and 6 million years ago), and imply that the subsequent inundation of the river margins happened extremely quickly," says Roger Urgeles, lead author of the study and a researcher at the Department of Marine Geology of the Institute of Sea Sciences (CSIC).

The study, which has been published in Basin Research, was based on 3-D reflection seismology carried out on a 2,700 km² block of the continental margin of the Ebro. This technique enabled the researchers to see the morphology of the continental margin as it was six million years ago in great detail, and to map its drainage network, coastline and river valleys, channels, meanders and terraces.

According to Urgeles, the images obtained show that the Ebro river of six million years ago eroded and penetrated up to 1,300 metres into the continental margin. "The numerical simulations of fluvial transport and drainage evolution show that the Ebro in the Messinian period was similar in size and drainage basin to the Ebro of today," the expert points out.

The researchers say the period studied was "highly unique" in the Mediterranean, because when the Straits of Gibraltar closed, the sea level in the basin fell "dramatically," exposing the continental margins to atmospheric agents.

Quantitative analysis enabled the team of scientists to determine the real depth of this part of the continental margin during the Messinian. To do this, they restored the position of the Messinian coastline identified in the 3-D seismic data, using techniques that make it possible to remove the effects of thermal subsidence, flexure of Earth's crust and the compacting of sediments.

"The sea level during this period and in this part of the Mediterranean basin fell by around 1,300 metres," says Urgeles. The results also make it possible to determine the extent of the clastic structures associated with this

drop in the sea level. "These structures are of interest to the oil industry, since they can act as a reservoir for hydrocarbons."

Exclusive 3-D technology

The acquisition of data using this geophysical technique -- 3-D reflection seismology -- "is accessible to very few research groups in the world," due to the high costs it entails. It is used almost exclusively in oil exploration. The data it provides provide a relief map of the ancient land surface, with the data of a similar quality to data taken from the planet's surface.

Using this technique, the research team managed to characterise the morphology of the strata and discontinuities. The scientists describe this tool as "much more rigorous and detailed" in its analysis of ancient sedimentary processes than the 2D reflection seismology traditionally used in academia.

This study was based on a 3-D reflection seismology block made available by the oil company British Gas, along with the diagraphs (physical properties of the sediments extracted in a survey drill) of a three kilometre-deep well also made available by the company.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Plataforma SINC**, via AlphaGalileo.

Journal Reference:

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http://www.sciencedaily.com/releases/2011/06/110602121708.htm

Yo-Yo Dieting Vs. Obesity? Dieters May Be Healthier, Live Longer, Mouse Study Suggests

A new study suggests that yo-yo dieters may be healthier and live longer than those who stay obese. (Credit: © Karen Roach / Fotolia)

ScienceDaily (June 6, 2011) — Yo-yo dieters may be healthier and live longer than those who stay obese, a new Ohio University study in mice suggests.

Mice that switched between a high-fat and low-fat diet every four weeks during their approximate two-year lifespan lived about 25 percent longer and had better blood glucose levels than obese animals that ate a high-fat diet. The yo-yo dieters also lived about as long as a control group of mice steadily fed a low-fat diet.

Some experts argue that constantly shedding and regaining pounds can be harmful to health. The new research, presented at the annual meeting of the Endocrine Society in Boston, suggests, however, that yo-yo dieting is preferable to remaining obese and not dieting at all.

"If the conventional wisdom is true, it would discourage a lot of overweight people from losing weight," said study lead author Edward List, a scientist at Ohio University's Edison Biotechnology Institute. "The new research shows that the simple act of gaining and losing weight does not seem detrimental to lifespan."

About 34 percent of American adults are considered to be obese; an additional 34 percent are classified as overweight, according to the Centers for Disease Control and Prevention. Although millions of Americans diet each year, research has shown that few people maintain long-term weight loss.

In the first study on yo-yo dieting of its kind, List and colleagues followed 30 mice on one of three dietary regimens over the course of a little over two years, the typical lifespan of this particular strain of laboratory mouse. The animals on the high-fat diet ate more, weighed more and had higher levels of body fat and fasting blood glucose. They also become glucose intolerant, or pre-diabetic, said List, whose research is supported by the National Institutes of Health, AMVETS and Ohio University.

The health profile of the mice on the yo-yo diet declined during their high-fat food phases, but their weight and blood glucose levels returned to normal levels during their low-fat diet stages. Lifespan -- the "gold standard" for lifelong health status -- was 2.04 years for the yo-yo dieting mice, compared to 1.5 years for the obese mice. The control group lived, on average, for 2.09 years.

Although replicating the research in humans is ideal, List said, it would be challenging to pursue a long-term controlled diet study. Various factors, including illness, can impact weight cycling. Mice can serve as a good model for obesity research, he noted, as they allow researchers to follow the effects of diet choices on lifespan over a relatively short time period.

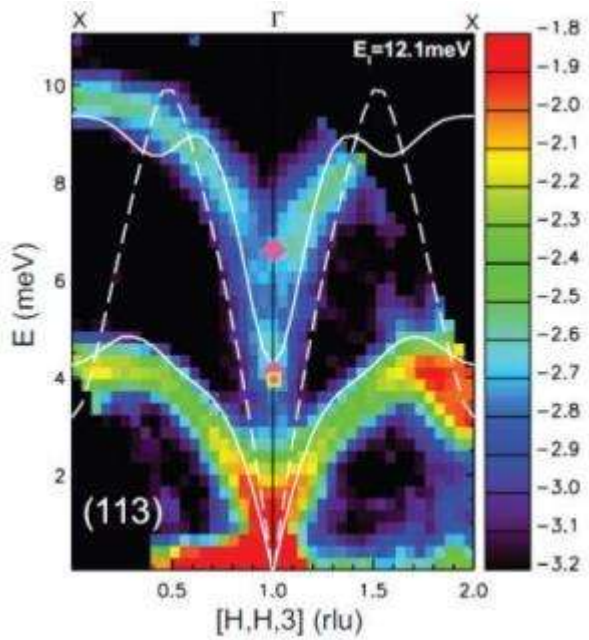
"The study adds to our understanding of the benefit of losing weight," he said. "I would hope that this encourages people to not give up."

List plans to expand the study to a larger population of mice. He'll also further examine preliminary findings that suggest that the yo-yo dieting animals experienced a reduction in cytokine levels. High levels of cytokine are linked to increased inflammation, which is associated with diseases such as diabetes, heart disease and cancer.
Co-authors of the study are former Ohio University student Jacob Wright-Piekarski, now a medical student with St. Louis University, and Edison Biotechnology Institute scientists Darlene Berryman, an associate professor in the College of Health Sciences and Professions, and John Kopchick, Goll-Ohio Eminent Scholar of molecular biology in the College of Osteopathic Medicine.

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Ohio University**.

http://www.sciencedaily.com/releases/2011/06/110606142342.htm

Neutron Analysis Explains Dynamics Behind Best Thermoelectric Materials



Neutron scattering experiments performed at ORNL show that lead telluride exhibits a strong anharmonic coupling between its optical and acoustic lattice vibrations, with a drop in thermal conductivity resembling a waterfall in this data image. This newly discovered coupling helps explain the low thermal conductivity that makes lead telluride a promising material for thermoelectric devices. (Credit: ORNL)

ScienceDaily (June 6, 2011) — Neutron analysis of the atomic dynamics behind thermal conductivity is helping scientists at the Department of Energy's Oak Ridge National Laboratory gain a deeper understanding of how thermoelectric materials work. The analysis could spur the development of a broader range of products with the capability to transform heat to electricity.

Researchers performed experiments at both of ORNL's neutron facilities -- the Spallation Neutron Source and the High Flux Isotope Reactor -- to learn why the material lead telluride, which has a similar molecular structure to common table salt, has very low thermal conductivity, or heat loss -- a property that makes lead telluride a compelling thermoelectric material.

"The microscopic origin of the low thermal conductivity is not well understood. Once we do understand it better we can design materials that perform better at converting heat to electricity," said Olivier Delaire, a researcher and Clifford Shull Fellow in ORNL's Neutron Sciences Directorate.

Delaire's research, reported in *Nature Materials*, shows that an unusual coupling of microscopic vibrational modes, called phonons, is responsible for the disruption of the dynamics that transport the thermal energy in lead telluride.

In typical crystalline materials, which have a lattice-like atomic structure, the conduction of heat is enhanced by the propagation of phonons along the lattice. The atoms conduct heat by vibrating in a chain, similar to vibrations propagating along a spring.

Delaire's team determined through analysis at the SNS that lead telluride, although having the same crystal lattice as rock salt, exhibits a strong coupling of phonons, which results in a disruption of the lattice effect and cancels the ability to conduct heat.

"The resolution of the SNS's Cold Neutron Chopper Spectrometer, along with the high flux, have been quite important to making these time of flight measurements," Delaire said.

By controlling thermal conductivity in thermoelectrics, less energy is dispersed and more heat can be directed to power generation. Today, thermoelectric materials are used to power the deep-space probes that explore the outer planets and solar system. Cruising beyond the range of solar collectors, the crafts' reactor thermoelectric generators use heat from decaying radioisotopes to generate power.

New, advanced thermoelectric materials could be used to develop more earthly applications, such as vehicle exhaust systems that convert exhaust heat into electricity, reducing the need for alternators. New thermoelectric materials could also help concentrate solar energy for power generation and recover waste heat for industrial processes.

Delaire's team performed additional neutron measurements with HFIR's triple-axis spectrometer. Data analysis has been facilitated through collaboration with ORNL's Materials Theory group. Samples were synthesized and characterized in ORNL's Correlated Electrons Materials group.

The work was funded by DOE's Office of Science as part of the Solid-State Solar-Thermal Energy Conversion Center (S3TEC) Energy Research Frontier Center.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **DOE/Oak Ridge National Laboratory**.

Journal Reference:

1. O. Delaire, J. Ma, K. Marty, A. F. May, M. A. McGuire, M-H. Du, D. J. Singh, A. Podlesnyak, G. Ehlers, M. D. Lumsden, B. C. Sales. **Giant anharmonic phonon scattering in PbTe**. *Nature Materials*, 2011; DOI: 10.1038/nmat3035

http://www.sciencedaily.com/releases/2011/06/110606152212.htm

Deciding to Stay or Go Is a Deep-Seated Brain Function, Monkey-Watching Researchers Find

Rhesus macaque monkey. (Credit: © Colette / Fotolia)

ScienceDaily (June 6, 2011) — Birds do it. Bees do it. Even little kids picking strawberries do it.

Every creature that forages for food decides at some point that the food source they're working on is no richer than the rest of the patch and that it's time to move on and find something better.

This kind of foraging decision is a fundamental problem that goes far back in evolutionary history and is dealt with by creatures that don't even have proper brains, said Michael Platt, a professor of neurobiology and director of the Center for Cognitive Neuroscience at Duke University.

Platt and his colleagues now say they've identified a function in the primate brain that appears to be handling this stay-or-go problem. They have found that the dorsal anterior cingulate cortex (ACC), an area of the brain known to operate while weighing conflicts, steadily increases its activity during foraging decisions until a threshold level of activity is reached, whereupon the individual decides it's time to move on.

In lab experiments with rhesus macaque monkeys, Platt and postdoctoral fellows Benjamin Hayden and John Pearson put the animals through a series of trials in which they repeatedly had to decide whether to stay with a source that was giving ever-smaller squirts of fruit juice, or move to another, possibly better, source. The animals were merely gazing at a preferred target on a display screen, not moving from one tree to the next, but the decision-making process should be the same, Platt said.

For the other variable in this basic equation, travel time, the researchers added delays when monkeys chose to leave one resource and move to another, simulating short and long travel times.

As the monkeys repeatedly chose to stay with their current source or move to another, the researchers watched a small set of neurons within the anterior cingulate cortex fire with increasing activity for each decision. The rate of firing in this group of neurons grew until a threshold was reached, at which time the

monkey immediately decided to move on, Platt said. "It is as if there is a threshold for deciding it's time to leave set in the brain," he said.
When the researchers raised the "travel time" to the next foraging spot in the experiment, it raised the decision-making threshold, Platt said.
This all fits with a 1976 theory by evolutionary ecologist Eric Charnov, called the Marginal Value Theorem, Platt said. It says that all foragers make calculations of reward and cost that tell them to leave a patch when their intake diminishes to the average intake rate for the overall environment. That is, one doesn't pick a blueberry bush until it's bare, only until it looks about as abundant as the bushes on either side of it. Shorter travel time to the next patch means it costs less to move, and foragers should move more easily. This theorem has been found to hold in organisms as diverse as worms, bees, wasps, spiders, fish, birds, seals and even plants, Platt said.
"This is a really fundamental solution to a fundamental problem," Platt said.
Platt said the work also relates to recent papers on the Web-browsing habits of humans. In the case of Internet users, the cost of travel time translates to download speed. The faster the downloads, the quicker browsers are willing to forage elsewhere, Platt said.
They aren't sure yet where the brain's signaling goes after the stay-or-go threshold in the ACC is reached. Platt believes this kind of "integrate-to-threshold" mechanism would be a good way to handle a lot of functions in the brain and may be found in other kinds of systems. This particular threshold in the ACC might also be a way to explain maladaptive behaviors like attention deficit, in which a person decides to move on constantly, or compulsive behavior, in which a person can't seem to move on at all, he said.
The research appears online in *Nature Neuroscience*, June 5, 2011. It was supported by the National Institutes of Health and a fellowship from the Tourette Syndrome Association.

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Duke University**.

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http://www.sciencedaily.com/releases/2011/06/110606152210.htm

Scanning the Skies for Debris Hazards

The SSA programme is enabling Europe to detect hazards to critical space infrastructure. This artist's impression shows a possible design for the future radar system, which will scan low Earth orbits to detect hazardous debris objects and deliver data to a catalogue database. (Credit: ESA - P. Carrill)

ScienceDaily (June 6, 2011) — Today, orbiting satellites are threatened by over 700 000 pieces of debris. Avoiding them requires knowing where they are, and that means surveillance with radar and telescopes. The European Space Agency is designing a system to catalog debris and warn satellite operators when to take evasive action.

This week, over 150 global experts will meet at an ESA-organised conference to share the latest research findings on space debris, surveillance technology, orbital hazard detection and satellite safety. The first European Space Surveillance Conference (ESS2011) will be held 7-9 June in Madrid, Spain.

The conference spotlights ESA's Space Situational Awareness (SSA) programme, now in the preliminary phase, which aims to put in place a 'three-legged' system to warn of hazards posed by orbital debris, space weather and natural objects like asteroids that may strike Earth.

Extensive reuse of existing resources

Since 2009, the Agency's SSA team have been working to define the system's overall technical structure, while actively evaluating existing European assets, such as scientific research radars and telescopes, which could contribute to SSA.

The development strategy is based on an extensive use of national and European assets, as well as the procurement of the missing components of the future SSA System.

2011 is a busy year for SSA surveillance development activities, perhaps the most urgent leg of the programme.

Complex engineering and scientific challenge

A new generation of software was recently implemented to warn when satellites could be hit by orbiting debris.

"At the moment, it is undergoing extensive testing using known debris orbits, but it's a first step toward the software we'll use when Europe has its own surveillance capability," says ESA's Emmet Fletcher, Head of the Space Surveillance and Tracking Segment at the SSA programme office.

Hosting an international conference like ESS2011 is crucial for staying up to date with global best practises and meeting scientific experts who work with current-generation radars and telescopes.

Debris surveillance is a complex engineering and scientific challenge in part due to the fact that even a tiny piece of debris -- just 1 centimetre across -- can seriously damage or even destroy a functioning satellite if it impacts at orbital velocities.

"We are now finalising a pan-European survey and test of existing tracking facilities, such as radars and telescopes located in France, Germany, Italy, Norway, UK, Switzerland and Spain," says Emmet.
"Knowing how precise these are is fundamental to designing ESA's new SSA system, which may make use of their data in combination with debris readings obtained by new, highly accurate radars and telescopes in the future.
"We know there is a huge amount of knowledge across Europe and globally. Having a single forum where experts from around the world can meet and present new information is vital and helps move our collective know-how forward.
"New techniques, new approaches and sharing past experience helps all space-faring nations work more safely in orbit."

Conference brings together global experts

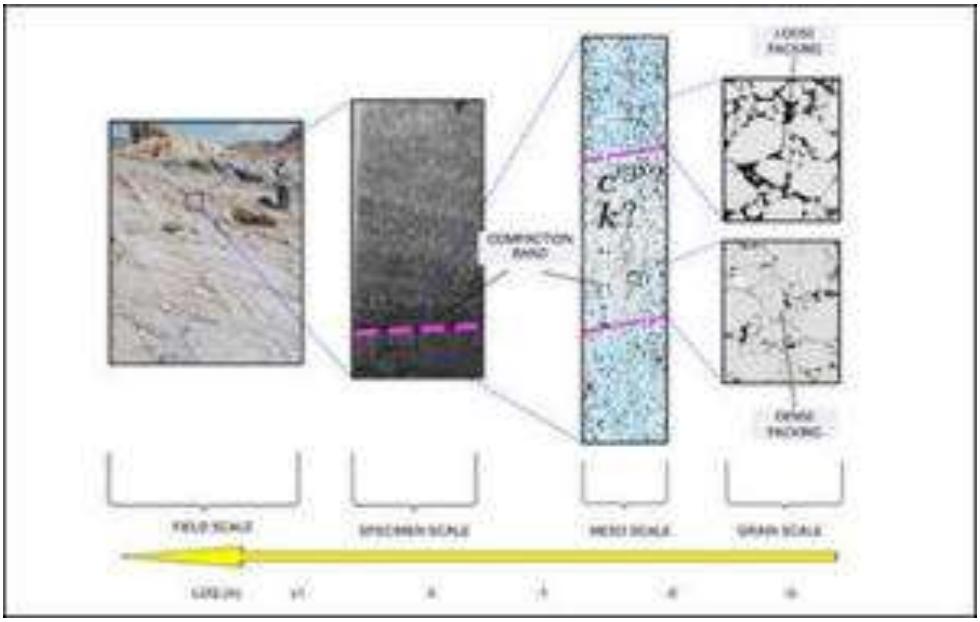
At the conference, over 150 experts from more than 20 nations will take in over 50 presentations. There are also dedicated information sessions on policy, optical and radar observations, and engineering design as well as presentations from the future customers of the SSA system.
Today, Europe cannot scan as much of space as necessary to provide comprehensive debris warning services to private and public spacecraft operators, like those flying telecommunication, climate and weather satellites.
"But we have to ensure that the design for the next-generation debris surveillance and tracking systems that SSA will propose at the end of the current preliminary phase in 2012 will perform as needed at a cost that is realistic," says Emmet.
"This is a challenging task, and achieving it means that conferences like ESS2011, involving a large number of experts, are crucial for knowing the best way forward."

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **European Space Agency**.

http://www.sciencedaily.com/releases/2011/06/110606141726.htm

Compaction Bands in Sandstone Are Permeable: Findings Could Aid Hydraulic Fracturing, Other Fluid Extraction Techniques



Compaction bands at multiple scales ranging from the field scale to the specimen scale to the meso and grain scale. At the field scale, picture shows the presence of narrow tabular structures within the host rock in the Valley of Fire. At the grain scale, images show clear differences in porosity (dark spots) density. This research aims at quantifying the impact of grain scale features in macroscopic physical properties that control behavior all the way to the field scale. (Credit: José Andrade/Caltech)

ScienceDaily (June 6, 2011) — When geologists survey an area of land for the potential that gas or petroleum deposits could exist there, they must take into account the composition of rocks that lie below the surface. Take, for instance, sandstone -- a sedimentary rock composed mostly of weakly cemented quartz grains. Previous research had suggested that compaction bands -- highly compressed, narrow, flat layers within the sandstone -- are much less permeable than the host rock and might act as barriers to the flow of oil or gas. Now, researchers led by José Andrade, associate professor of civil and mechanical engineering at the California Institute of Technology (Caltech), have analyzed X-ray images of Aztec sandstone and revealed that compaction bands are actually more permeable than earlier models indicated. While they do appear to be less permeable than the surrounding host rock, they do not appear to block the flow of fluids. Their findings were reported in the May 17 issue of *Geophysical Research Letters*.

The study includes the first observations and calculations that show fluids have the ability to flow in sandstone that has compaction bands. Prior to this study, there had been inferences of how permeable these formations were, but those inferences were made from 2D images. This paper provides the first permeability calculations based on actual rock samples taken directly from the field in the Valley of Fire, Nevada. From the data they collected, the researchers concluded that these formations are not as impermeable as previously believed, and that therefore their ability to trap fluids -- like oil, gas, and CO2 -- should be measured based on 3D images taken from the field.

"These results are very important for the development of new technologies such as CO2 sequestration -- removing CO2 from the atmosphere and depositing it in an underground reservoir -- and hydraulic fracturing of rocks for natural gas extraction," says Andrade. "The quantitative connection between the microstructure of the rock and the rock's macroscopic properties, such as hydraulic conductivity, is crucial, as physical processes are controlled by pore-scale features in porous materials. This work is at the forefront of making this quantitative connection."

The research team connected the rocks' 3D micromechanical features -- such as grain size distribution, which was obtained using microcomputed tomography images of the rocks to build a 3D model -- with quantitative

macroscopic flow properties in rocks from the field, which they measured on many different scales. Those measurements were the first ever to look at the three-dimensional ability of compaction bands to transmit fluid. The researchers say the combination of these advanced imaging technologies and multiscale computational models will lead to unprecedentedly accurate measurements of crucial physical properties, such as permeability, in rocks and similar materials.

Andrade says the team wants to expand these findings and techniques. "An immediate idea involves the coupling of solid deformation and chemistry," he says. "Accounting for the effect of pressures and their potential to exacerbate chemical reactions between fluids and the solid matrix in porous materials, such as compaction bands, remains a fundamental problem with multiple applications ranging from hydraulic fracturing for geothermal energy and natural gas extraction, to applications in biological tissue for modeling important processes such as osteoporosis. For instance, chemical reactions take place as part of the process utilized in fracturing rocks to enhance the extraction of natural gas."

Other coauthors of the paper, "Connecting microstructural attributes and permeability from 3D tomographic images of in situ shear-enhanced compaction bands using multiscale computations," are WaiChing Sun, visiting scholar at Caltech; John Rudnicki, professor of civil and environmental engineering at Northwestern University; and Peter Eichhubl, research scientist in the Bureau of Economic Geology at the University of Texas at Austin.

The work was partially funded by the Geoscience Research Program of the U.S. Department of Energy.

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 Katie Neith.

Journal Reference:

1. WaiChing Sun, José E. Andrade, John W. Rudnicki, Peter Eichhubl. **Connecting microstructural attributes and permeability from 3D tomographic images of in situ shear-enhanced compaction bands using multiscale computations**. *Geophysical Research Letters*, 2011; 38 (10) DOI: 10.1029/2011GL047683

http://www.sciencedaily.com/releases/2011/06/110606131800.htm

Experts Recommend Screening for Vitamin D Deficiency in at-Risk Populations

ScienceDaily (June 6, 2011) — The Endocrine Society has released "Evaluation, Treatment, and Prevention of Vitamin D Deficiency: An Endocrine Society Clinical Practice Guideline." The clinical practice guideline (CPG) is published in the July 2011 issue of the *Journal of Clinical Endocrinology & Metabolism* (JCEM), a publication of The Endocrine Society.

The major source of vitamin D for children and adults is exposure to natural sunlight as very few foods naturally contain or are fortified with vitamin D. Vitamin D deficiency is common throughout the world and results in abnormalities of calcium, phosphorus and bone metabolism which can lead to muscle weakness, osteomalacia, osteopenia and osteoporosis. In children, vitamin D deficiency can result in skeletal deformities known as rickets.

"Vitamin D deficiency is very common in all age groups and it is important that physicians and health care providers have the best evidence-based recommendations for evaluating, treating and preventing vitamin D deficiency in patients at highest risk," said Michael F. Holick, PhD, MD, of the Boston University School of Medicine and chair of the task force that authored the CPG. "The Society's new Clinical Practice Guideline was developed by experts in the field who carefully reviewed the current literature and features the latest and most comprehensive recommendations available on the prevention and treatment of vitamin D deficiency."

Recommendations from the CPG include:

- Screening for vitamin D deficiency in individuals at risk for deficiency;
- Measurement of vitamin D level by a reliable assay as the initial diagnostic test in patients at risk for deficiency; and
- Treatment with either vitaminD2 or vitamin D3 for deficient patients.

The CPG also features recommendations for dietary intake of vitamin D in patients at risk for vitamin D deficiency. These recommendations include:

- Infants and children ages 0-1 year require at least 400 IU/day (IU=25 ng) of vitamin D and children 1 year and older require at least 600 IU/day to maximize bone health. To raise the blood level of vitamin D consistently above 30 ng/ml may require at least 1,000 IU/day of vitamin D;
- Adults aged 19-50 years require at least 600 IU/day of vitamin D to maximize bone health and muscle function and at least 1,500-2,000 IU/day of vitamin D may be needed to maintain blood level of vitamin D above 30 ng/ml;
- Adults aged 50-70 years and adults older than 70 years require at least 600 IU/day and 800 IU/day respectively of vitamin D. At least 1,500-2,000 IU/day of vitamin D may be needed to maintain blood level of vitamin D above 30 ng/ml; and
- Pregnant and lactating women require at least 600 IU/day of vitamin D and at least 1,500 IU/day of vitamin D may be needed to maintain blood level of vitamin D above 30 ng/ml.

"At the present time, there is not sufficient evidence to recommend screening individuals who are not at risk for deficiency or to prescribe vitamin D to attain the non-calcemic benefit for cardiovascular protection," said Holick.

Other members of The Endocrine Society task force that developed this CPG include: Neil Binkley of the University of Wisconsin; Heike Bischoff-Ferrari of University Hospital Zurich in Switzerland; Catherine Gordon of Children's Hospital Boston; David Hanley of the University of Calgary Facility of Medicine in Canada; Robert Heaney of Creighton University in Omaha, Neb.; M. Hassan Murad of Mayo Clinic in Rochester, Minn.; and Connie Weaver of Purdue University in West Lafayette, Ind.

The Society established the Clinical Practice Guideline (CPG) Program to provide endocrinologists and other clinicians with evidence-based recommendations in the diagnosis and treatment of endocrine-related conditions. Each CPG is created by a task force of topic-related experts in the field. Task forces rely on scientific reviews of the literature in the development of CPG recommendations. The Endocrine Society does not solicit or accept corporate support for its CPGs. All CPGs are supported entirely by Society funds.

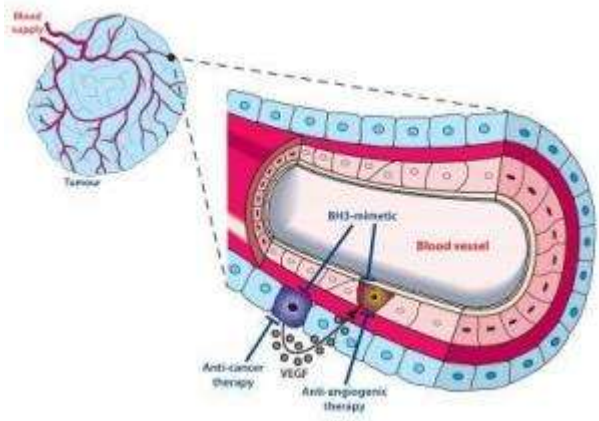
story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **The Endocrine Society**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. M. E. Molitch, D. R. Clemmons, S. Malozowski, G. R. Merriam, M. L. Vance. **Evaluation and Treatment of Adult Growth Hormone Deficiency: An Endocrine Society Clinical Practice Guideline**. *Journal of Clinical Endocrinology & Metabolism*, 2011; 96 (6): 1587 DOI: 10.1210/jc.2011-0179

http://www.sciencedaily.com/releases/2011/06/110606121935.htm

New Strategy to Attack Tumor-Feeding Blood Vessels



Cancers such as breast cancer, lung cancer and melanoma release the blood vessel growth factor, VEGF, to encourage blood vessels to grow within the tumor, supplying it with nutrients. Tumors can be treated with anti-cancer medications that kill the cancer cells, and anti-angiogenic medications that starve the tumour by attacking its blood supply. The study suggests that a third type of medication, BH3-mimetics, may enhance the tumor-killing effect of anti-cancer and anti-angiogenic medications. (Credit: Walter and Eliza Hall Institute)

ScienceDaily (June 6, 2011) — Scientists at the Walter and Eliza Hall Institute have discovered a key molecule needed to kill the blood vessels that supply tumours.

The research team from the institute's Molecular Genetics of Cancer and Cancer and Haematology divisions found that for anti-cancer therapies that target tumour blood vessels to work the death- inducing molecule Bim is required. The finding could lead to improved anti-cancer treatments that are based on a two- or three-pronged attack on both the tumour and its blood supply. The research will be published online in the *Journal of Experimental Medicine*.

The growth of solid tumours, such as lung cancer, breast cancer and melanoma, depends on nutrients and oxygen being provided by the tumour blood supply. Cancer cells encourage the growth of blood vessels to feed a tumour by producing the hormone-like protein, vascular endothelial growth factor (VEGF). The research by Drs Edwina Naik, Leigh Coultas and Lorraine O'Reilly, and Professors Jerry Adams and Andreas Strasser showed that VEGF produced by tumours blocks production of Bim in the cells that line the tumour blood vessels.

New 'anti-angiogenic' medications that attack the blood vessels within tumours are showing promise in starving many types of cancers by reducing their blood supply.

In this study, in experimental melanoma, lung cancer and breast cancer models, Bim levels increased in the cells lining the blood vessels when VEGF was depleted by anti-angiogenic drugs, ultimately killing the blood vessel cells. VEGF depletion reduced the number of blood vessels in tumours, making the tumours shrink. However, in mice in which the blood vessels do not express Bim, VEGF depletion did not affect the number of tumour-associated blood vessels, and tumours grown in Bim-deficient mice did not respond to anti-angiogenic treatments.

Dr Strasser said this finding suggests that strategies for treating tumours by attacking the tumour blood supply could be optimised by incorporating drugs called BH3-mimetics that cause cell death by acting like Bim at a molecular level. "Similarly, therapies that increase the amount of Bim in tumour blood vessels could enhance the effects of anti-angiogenic agents," Dr Strasser said.

"BH3 mimetics may have two beneficial effects in cancer therapy. Our previous research had showed they can directly trigger death in tumour cells, particularly when the tumour is also attacked by chemotherapeutic drugs. We now think BH3-mimetics could also impact tumour cells indirectly by killing endothelial cells within tumours.

"This suggests that a promising new approach to the therapy of solid tumours may be to use a three-medication combination of a drug that specifically targets the tumour cell, an anti- angiogenic agent to impair

the tumour blood vessels, plus a BH3 mimetic that will help the anti- tumour drug to directly kill the tumour cells and also will help the anti-angiogenic agent to kill the intra-tumoral endothelial cells, which in turn will starve the tumour, causing even more tumour cell death."

The research was supported by the Cancer Council Victoria, the National Health and Medical Research Council, the Australian Research Council, the US National Institutes of Health, the Leukemia and Lymphoma Society and Genentech.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Walter and Eliza Hall Institute**.

Journal Reference:

1. Edwina Naik, Lorraine A. O'Reilly, Marie-Liesse Asselin-Labat, Delphine Merino, Ann Lin, Michele Cook, Leigh Coultas, Philippe Bouillet, Jerry M. Adams, Andreas Strasser. **Destruction of tumor vasculature and abated tumor growth upon VEGF blockade is driven by proapoptotic protein Bim in endothelial cells**. *Journal of Experimental Medicine*, 2011; DOI: 10.1084/jem.20100951

http://www.sciencedaily.com/releases/2011/06/110606112814.htm

Zooplankton Main Fare for Arctic Cod, Marine Birds and Bowhead Whales

Calanus glacialis is perhaps the Arctic's most important species. Researchers have now been able to document how this zooplankton has adapted perfectly to an extreme natural environment. Notice the lipid sac that comprises nearly the entire organism. (Credit: Photo by Janne Søreide / UNIS)

ScienceDaily (June 6, 2011) — In parts of the northern Arctic region, the delicate balance of the food chain depends heavily on the diminutive copepod *Calanus glacialis*. This herbivorous Arctic zooplankton species is specially adapted to melting sea ice and the blooming of a few small algal species.

With funding from the Research Council of Norway researchers at the University Centre in Svalbard (UNIS) have made new discoveries about the relationship between sunlight, phytoplankton and zooplankton, and about the critical role that sea ice plays for plankton. Their research project, "Climate effects on planktonic food quality and trophic transfer in Arctic Marginal Ice Zones," is nicknamed Cleopatra.

Changes in the ice conditions of the polar continental shelf could have an impact on the algae that cling to the ice or float free in the water masses. This could have major ramifications for *Calanus glacialis* and all of its predators.

Eat and be eaten

The zooplankton Calanus is a genus of marine copepods -- tiny crustaceans related to krill, *Calanus glacialis* is perhaps the Arctic's most important species. Researchers have now been able to document how this zooplankton has adapted perfectly to an extreme natural environment.

Terrestrial areas of the Arctic comprise a polar desert. In the ocean, however, a fertile combination of melting ice, nutrients and sunlight gives rise to a virtual explosion of life in the summer half of the year. In the Arctic food chain, the most sought-after nutritional compounds are the omega-3 fatty acids -- produced exclusively by marine algae (sea ice algae and phytoplankton). *Calanus glacialis* graze on these algae and are a key source of nutrients in the Arctic food chain. To survive the long Arctic winters, *Calanus glacialis* stores a large amount of fat (lipids), which can amount to as much as 70 percent of its body mass. This lipid-rich zooplankton is the primary food source for Arctic cod, marine birds and bowhead whales. Arctic cod, in turn, are the main course for seals, which are the favourite meal of polar bears.

The ocean's "grass and grazers"

"In the Arctic Marginal Ice Zones, the ocean is covered with ice in the winter. When the ice finally releases its grip with the advent of Arctic springtime, an explosive production of biomass occurs," explains Jørgen Berge, a professor of biology at UNIS and Cleopatra project manager.

The Cleopatra project was launched to enhance knowledge about the most important food chain links: ice algae and phytoplankton, which can be thought of as the grass of the ocean, while zooplanktons are the ocean's cows.

Cold, nutrient-rich waters

April is when the algae living on the underside of the ice initially bloom. These ice algae are specially adapted to utilising the minute amounts of sunlight that penetrate the ice and snow cover on the earliest spring days. The resulting algal bloom -- and the critical value of these algae as a food source -- were the focus of post-doctoral research fellow Eva Leu's studies. She has now documented these algae's seasonal cycle and their dependence on various environmental factors.

The project's researchers were also able to follow the development of *Calanus glacialis* as it rose from the ocean depths in April to graze on ice algae growing on the underside of sea ice. The mature females utilise this initial bloom peak of biomass production for sex development and egg production. Post-doctoral research fellow Janne Søreide has carried out important work in this area.

Not until July does the sea ice in Rijpfjorden melt away. This triggers another, larger bloom peak of biomass, this time in the form of phytoplankton that swim in the ice-free waters. By this time, the offspring of *Calanus glacialis* have grown large enough to feed greedily on this bounty of nutrients.

Perfectly timed

The second part of the Cleopatra project was carried out in Svalbard's Kongsfjorden and in the UNIS laboratory. Kongsfjorden is the fjord where Dr Leu conducted trials exposing algae to various amounts of light, while Dr Søreide and her colleagues were tracking *Calanus glacialis* through its first six developmental stages, recording what happened when the zooplankton consumed various amounts and qualities of food. Dr Leu and Dr Søreide have documented through this research how the stages of *Calanus glacialis* development are perfectly synchronised with the two distinct algal blooms of the northern Arctic.

The main conclusion drawn from the research project is that *Calanus glacialis*, an all-important species of the polar continental shelf, is perfectly adapted to its environment -- and that changes in the melting of Arctic sea ice could well disrupt its cycle.

Too rapid sea ice melting in April could expose the ice algae to excessive sunlight, which the researchers found from their trials can kill the algae; at the very least the shock causes the algae to produce less omega-3. The ice melting too quickly may also induce phytoplankton to bloom prematurely in summer, which means the *Calanus glacialis* offspring could arrive too late for their first banquet.

In their next studies, the researchers intend to map the impact of faster melting sea ice on the Arctic's overall food web.

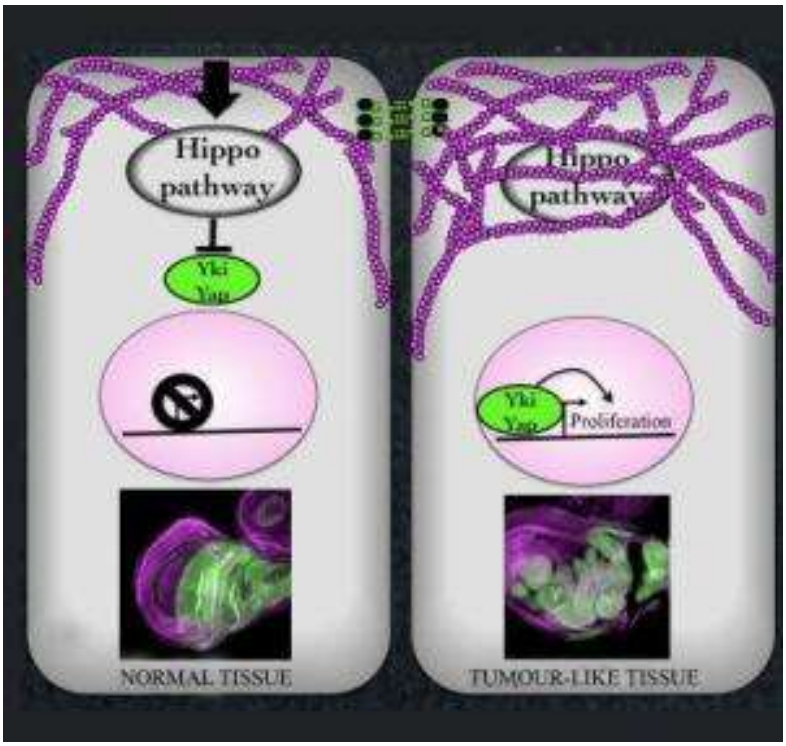
The Cleopatra project involved researchers from UNIS, the Norwegian Polar Institute, the University of Oslo and the University of Tromsø. Researchers from Germany, Poland, Russia, Sweden and the UK also participated, and there was collaboration with Canadian and EU projects as well.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Research Council of Norway, The**.

http://www.sciencedaily.com/releases/2011/06/110606112526.htm

Scientists Uncover Role for Cell Scaffold in Tumor Formation: Fruit Fly Reveals Surprising Link



In normal tissue, with an intact cytoskeleton (in purple), the Hippo complex blocks the Yorkie protein (Yki, in green) from activating proliferation genes in the nucleus (image on the left). When the cytoskeleton is deregulated, Yorkie is free to enter the nucleus and activate proliferation of the cell (image on the right). (Credit: Drawing by Florence Janody, IGC)

ScienceDaily (June 6, 2011) — A group of scientists at the Instituto Gulbenkian de Ciência, in Portugal, has uncovered a surprising link between the cell's skeleton and organ size. The team, led by Florence Janody, shows in the journal *Development*, that one of the proteins that regulates the skeleton of the cell also acts to blocks activation of genes that promote cell survival and proliferation. Their findings have implications for cancer research, as they add to the puzzle of understanding how proliferation genes are abnormally activated, often leading to tumours.

During development of an embryo, cells proliferate and organs grow. This process is tightly regulated, at several levels, to ensure that organs do not outgrow the body they are in. One of the key regulators in this process is the Hippo complex of proteins -- first identified in the fruit fly *Drosophila melanogaster*. Mutant flies, in which this complex is defective are larger than their counterparts -- they are hippopotamus-like. A search for analogous genes uncovered a similar role for the Hippo complex in mammals -- organs grow larger than they should. In adults, this abnormal and untimely growth often leads to tumour formation.

A flurry of papers has shown that the Hippo complex itself is regulated by a range of signaling inputs within the cell. Florence Janody's group identified a new, and unexpected input: the cell skeleton (called cytoskeleton), in particular one of its proteins, the actin-capping protein.

Using *Drosophila* larvae, the IGC team showed that when the actin-capping proteins are inactive, there is overgrowth of tissue in the area that will become the adult wing. This growth is reminiscent of tumour formation. The researchers dissected the different steps in the process that lead to abnormal growth. Inactivating actin-capping proteins leads to accumulation of actin, a major component of the cytoskeleton; this reduces the activity of the Hippo complex, leaving another protein, Yorkie, free to act on the DNA in the nucleus, turning on proliferation genes.

The cytoskeleton serves several functions in a cell: it provides structure, motility (allows cells to move, change shape and divide) and membrane traffic (transport of proteins and other large molecules within the

cell). The actin protein forms cables that crisscross the cell. The cables are constantly being elongated and shortened at their ends. The actin-capping proteins are involved in this process.
In Florence's words, ' What we've revealed is that the cytoskeleton needs to be very tightly regulated within the cell, to prevent abnormal growth in the larvae. Since Hippo is also turned on in the adult and in mammals, we believe these findings provide insights into how this process may be manipulated in human cells, with a view to preventing tumour formation, or blocking its progression'.

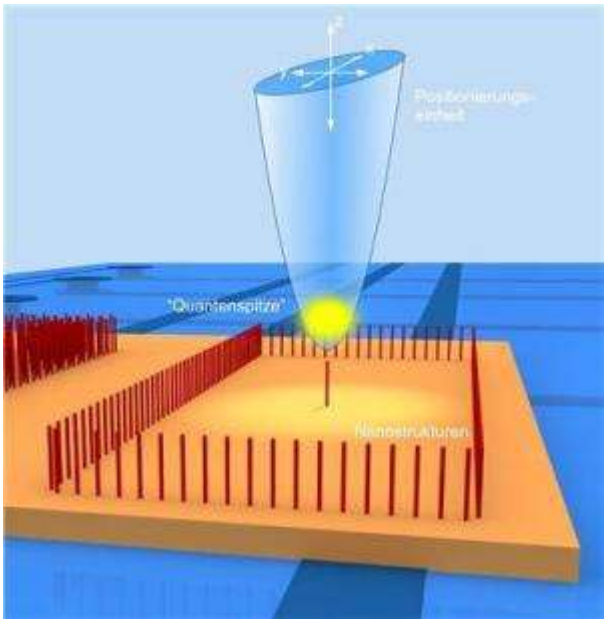
Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Instituto Gulbenkian de Ciência (IGC)**, via AlphaGalileo.

Journal Reference:

1. B. G. Fernandez, P. Gaspar, C. Bras-Pereira, B. Jezowska, S. R. Rebelo, F. Janody. **Actin-Capping Protein and the Hippo pathway regulate F-actin and tissue growth in Drosophila**. *Development*, 2011; 138 (11): 2337 DOI: 10.1242/dev.063545

http://www.sciencedaily.com/releases/2011/06/110606075639.htm

Microscopy With a Quantum Tip: Physicists Use Ultra-Cold Rubidium Atoms to Probe and Image Nanostructured Surfaces



An ultra-cold cloud of atoms (yellow) is trapped in a magnetic trap and scanned across a nanostruc-tured surface. In "contact mode" a loss of atoms from the cloud can be measured, which depends on the surface topography. In the "dynamical mode" the frequency and amplitude of the cloud's cen-tre-of-mass oscillation changes depending on the surface structure. Both methods allow the surface topography to be imaged. (Credit: Image courtesy of Universitaet Tübingen)

ScienceDaily (June 6, 2011) — Microscopes make tiny objects visible, as their name suggests. However, modern microscopes often do this in a round-about way, not by optically imaging the object with light, but by probing the surface with a fine, needle-like tip. Here, where optical imaging methods reach their limits, scanning probe microscopes can show, by different methods, structures as small as one millionth of a millimetre. With their help, phenomena in the nanoworld become visible and targeted manipulation becomes possible. The heart of a scanning probe microscope is a moveable, suspended tip, which, like the needle on a record player, reacts to small height variations on the surface, and turns these into signals that can be displayed on a computer.

Tübingen researchers have now been able to create this tip, not out of solid material, as in the case of the record player, but out of an ultra-cold, dilute gas of atoms. To do this, they cooled an especially pure gas of rubidium atoms to a temperature less than a millionth of a degree above absolute zero temperature, and stored the atoms in a magnetic trap. This "quantum tip" can be precisely positioned and enables the probing of nanostructured surfaces. With this method, more accurate measurements of the interactions between atoms and surfaces are possible and further cooling of the probe tip gives rise to a so-called Bose-Einstein condensate, which allows a significant increase in the resolution of the microscope. The work was led by Prof. Dr. József Fortágh, head of the Nano-Atom-Optics group, and his co-worker Dr. Andreas Günther. PhD student Michael Gierling is first author of the study, which appeared on May 29 as an advance online publication in the journal *Nature Nanotechnology*.

The scientists demonstrated the use of their cold-atom scanning probe tip by testing a surface with vertically grown carbon nanotubes. The tip was scanned over the sample using a type of magnetic conveyor belt. The first measurements in the so-called "contact mode" revealed how the tall tubes stripped some atoms out of the atom cloud. These atom losses told the researchers about the location and height of the nanotubes and enabled the imaging of the surface topography.

When the temperature of an atomic gas approaches absolute zero, a quantum mechanical phenomenon occurs, turning the cloud into what's known as a Bose-Einstein condensate. In this state it is no longer possible to

distinguish between the atoms. They become, so to speak, a single, giant "super-atom." With such a Bose-Einstein condensate it was possible for the Tübingen scientists to microscopically resolve individual freestanding nanotubes. According to the researchers, future improvements to the cold-atom scanning probe microscope could, in theory, increase the current resolution of about eight micrometres by a factor of a thousand.
The microscope also functions in the so-called "dynamical mode." The researchers again created a Bose-Einstein condensate close to the nanotubes. They then allowed the condensate to oscillate perpendicular to the surface, and observed how the frequency and size of these oscillations changed, depending on the topography of the nanostructured sample. In this way they were able to obtain a well resolved image of the surface. The researchers write that this method has an advantage because no atoms are loss from the cloud. This could be helpful in cases where atoms that are adsorbed on the sample might influence subsequent measurements.
The researchers conclude: "the extreme purity of the probe tip and quantum control over the atomic states in a Bose-Einstein condensate open up new possibilities of scanning probe microscopy with non-classical probe tips." Beyond this, the researchers hope to develop new applications from the demonstrated coupling between ultra-cold quantum gases and nanostructures.
The study was done within the framework of the BMBF programme "NanoFutur" and in collaboration with several groups from the Center for Collective Quantum Phenomena (CQ) Tübingen, to which various research groups from the Faculty of Mathematics and Natural Science belong.

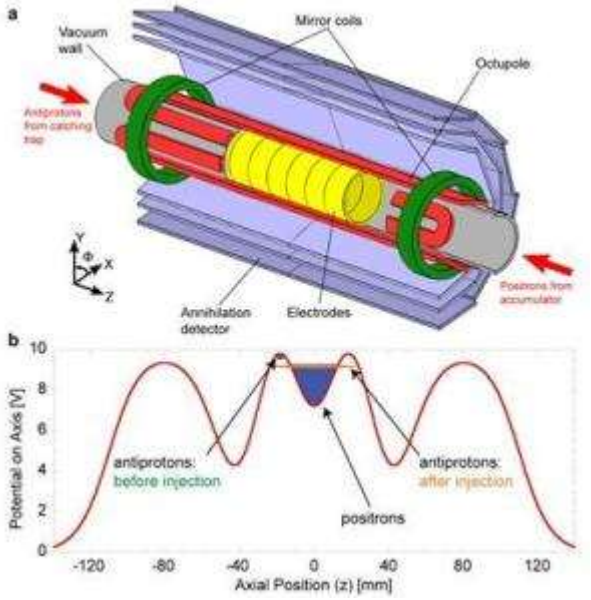
Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Universitaet Tübingen**, via AlphaGalileo.

Journal Reference:

1. M. Gierling, P. Schneeweiss, G. Visanescu, P. Federsel, M. Häffner, D. P. Kern, T. E. Judd, A. Günther, J. Fortágh. **Cold-atom scanning probe microscopy**. *Nature Nanotechnology*, 2011; DOI: 10.1038/NNANO.2011.80

http://www.sciencedaily.com/releases/2011/06/110606075628.htm

CERN Experiment Traps Antimatter Atoms for 1000 Seconds



Antimatter trap. (Credit: Image courtesy of CERN)

ScienceDaily (June 5, 2011) — In a paper published online by the journal Nature Physics today, the ALPHA experiment at CERN[1] reports that it has succeeded in trapping antimatter atoms for over 16 minutes: long enough to begin to study their properties in detail. ALPHA is part of a broad programme at CERN's antiproton decelerator (AD)[2] investigating the mysteries of one of nature's most elusive substances.

Today, we live in a universe apparently made entirely of matter, yet at the big bang matter and antimatter would have existed in equal quantities. Nature seems to have a slight preference for matter, which allows our universe and everything in it to exist. One way of investigating nature's preference for matter is to compare hydrogen atoms with their antimatter counterparts, and that's what makes today's result important.

"We can keep the antihydrogen atoms trapped for 1000 seconds," explained ALPHA spokesperson Jeffrey Hangst of Aarhus University. "This is long enough to begin to study them -- even with the small number that we can catch so far."

In the paper published today, some 300 trapped antiatoms are reported to have been studied. The trapping of antiatoms will allow antihydrogen to be mapped precisely using laser or microwave spectroscopy so that it can be compared to the hydrogen atom, which is among the best-known systems in physics. Any difference should become apparent under careful scrutiny. Trapping antiatoms could also provide a complementary approach to measuring the influence of gravity on antimatter, which will soon be investigated with antihydrogen by the AEgIS experiment.

Another important consequence of trapping antihydrogen for long periods is that the antiatoms have time to relax into their ground state, which will allow ALPHA to conduct the precision measurements necessary to investigate a symmetry known as CPT. Symmetries in physics describe how processes look under certain transformations. C, for example, involves swapping the electric charges of the particles involved in the process. P is like looking in the mirror, while T involves reversing the arrow of time.

Individually, each of these symmetries is broken -- processes do not always look the same. CPT, however, says that a particle moving forward through time in our universe should be indistinguishable from an antiparticle moving backwards through time in a mirror universe, and it is thought to be perfectly respected by nature. CPT symmetry requires that hydrogen and antihydrogen have identical spectra.

"Any hint of CPT symmetry breaking would require a serious rethink of our understanding of nature," said Hangst. "But half of the universe has gone missing, so some kind of rethink is apparently on the agenda. "

The next step for ALPHA is to start performing measurements on trapped antihydrogen, and this is due to get underway later this year. The first step is to illuminate the trapped anti-atoms with microwaves, to determine if they absorb exactly the same frequencies (or energies) as their matter cousins.
"If you hit the trapped antihydrogen atoms with just the right microwave frequency, they will escape from the trap, and we can detect the annihilation -- even for just a single atom," explained Hangst. "This would provide the first ever look inside the structure of antihydrogen -- element number 1 on the anti-periodic table."
Notes:
1. CERN, the European Organization for Nuclear Research, is the world's leading laboratory for particle physics. It has its headquarters in Geneva. At present, its Member States are Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, the Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom. One candidate for accession: Romania. India, Israel, Japan, the Russian Federation, the United States of America, Turkey, the European Commission and UNESCO have Observer status.
2. ALPHA is one of several AD experiments investigating antimatter at CERN. ATRAP has pioneered trapping techniques, and is also investigating antihydrogen. ASACUSA has made measurements of unprecedented precision of the antiproton's mass, so far not revealing any divergence from that of the proton. ASACUSA is also developing complementary techniques for studying antihydrogen. AEgIS studies how antiprotons fall under gravity, and ACE investigates the potential use of antiprotons for cancer therapy.

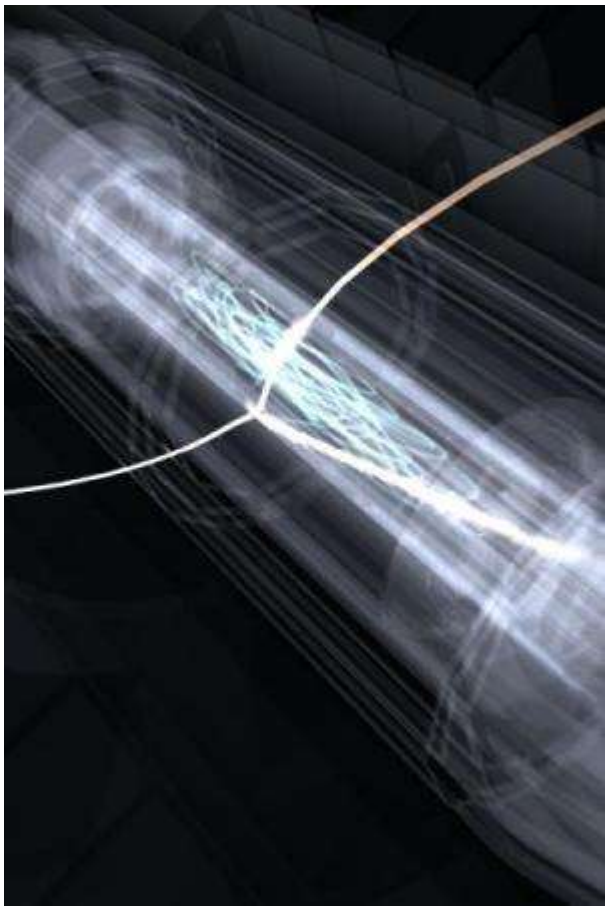
Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **CERN**, via AlphaGalileo.

Journal Reference:

1. ALPHA Collaboration: G. B. Andresen, M. D. Ashkezari, M. Baquero-Ruiz, W. Bertsche, P. D. Bowe, E. Butler, C. L. Cesar, M. Charlton, A. Deller, S. Eriksson, J. Fajans, T. Friesen, M. C. Fujiwara, D. R. Gill, A. Gutierrez, J. S. Hangst, W. N. Hardy, R. S. Hayano, M. E. Hayden, A. J. Humphries, R. Hydomako, S. Jonsell, S. L. Kemp, L. Kurchaninov, N. Madsen, S. Menary, P. Nolan, K. Olchanski, A. Olin, P. Pusa, C. Ø. Rasmussen, F. Robicheaux, E. Sarid, D. M. Silveira, C. So, J. W. Storey, R. I. Thompson, D. P. van der Werf, J. S. Wurtele, Y. Yamazaki. **Confinement of antihydrogen for 1,000 seconds**. *Nature Physics*, 2011; DOI: 10.1038/nphys2025

http://www.sciencedaily.com/releases/2011/06/110605191458.htm

Upping the Anti: Canadian Researchers Instrumental in Game-Changing Antimatter Study



This is an artist's image of the ALPHA trap which captured and stored antihydrogen atoms. (Credit: Chukman So)

ScienceDaily (June 5, 2011) — Science fiction is fast approaching science fact as researchers are progressing rapidly toward "bottling" antimatter.

In a paper published online in the journal *Nature Physics*, the ALPHA experiment at CERN, including key Canadian contributors, reports that it has succeeded in storing antimatter atoms for over 16 minutes. While carrying around bottled antimatter like in the movie "Angels and Demons" remains fundamentally far-fetched, storing antimatter for long periods of time opens up new vistas for scientists struggling to understand this elusive substance. ALPHA managed to store twice the antihydrogen (the antimatter partner to normal hydrogen) 5,000 times longer than the previous best, setting the stage, for example, to test whether antihydrogen and normal hydrogen fall the same way due to gravity.

Lead author Makoto Fujiwara, TRIUMF research scientist, University of Calgary adjunct professor, and spokesperson of the Canadian part of the ALPHA team said, "We know we have confined antihydrogen atoms for at least for 1,000 seconds. That's almost as long as one period in hockey! This is potentially a game changer in antimatter research."

Antimatter remains one of the biggest mysteries of science. At the Big Bang, matter and antimatter should have been produced equally, but since they destroy each other upon contact, eventually nothing should have remained but pure energy (light). However, all observations suggest that only the antimatter has vanished. To figure out what happened to "the lost half of the universe," scientists are eager to determine if, as predicted, the laws of physics are the same for both matter and antimatter. ALPHA uses an analogue of a very well-known system in physics, the hydrogen atom (one electron orbiting one proton), and testing whether its

antimatter twin, antihydrogen (an antielectron orbiting an antiproton), behaves the same. But to study something one must hold onto it long enough.
Fujiwara asks, "Does antimatter shine in the same colour as matter? Does it experience the gravity in the same way as matter?" These are still very difficult experiments, and they will take long and hard work, but this new result is a very important step. Now experiments will be about 10,000 times less difficult than before!"
Explained ALPHA spokesperson Jeffrey Hangst of Aarhus University, "This would provide the first-ever look inside the structure of antihydrogen -- element 1 on the anti-periodic table."
Antihydrogen atoms were first made in large quantities at CERN eight years ago, but can't be stored conventionally since antiatoms touching the ordinary-matter walls of a bottle would instantly annihilate. The ALPHA collaboration succeeded by developing a sophisticated "magnetic bottle" using a state-of-the-art superconducting magnet to suspend the antiatoms away from the walls, last year demonstrating definitive proof of antihydrogen atom capture for about a tenth of a second, likely the first contained antiatoms in the history of the universe.
Canadian scientists have been playing leading roles in the antihydrogen detection and data analysis aspects of the project. The next step for ALPHA is to start performing measurements on bottled antihydrogen, and this is due to get underway later this year. The first step is to illuminate the trapped anti-atoms with microwaves to determine if they absorb exactly the same frequencies (or energies) as their matter twins.
"I've always liked hydrogen atoms," said Walter Hardy of the University of British Columbia a leading expert in atomic hydrogen studies. "It's ironic that we are now trying to measure the same properties of antihydrogen that I measured many years ago on regular hydrogen. It is a crucial comparison, though, and will tell us if we truly understand the relationship between matter and antimatter. "
Support for ALPHA-Canada and its research came from NSERC (National Science and Engineering Research Council, TRIUMF, AIF (Alberta Ingenuity Fund), the Killam Trust, and FQRNT (Le Fonds québécois de la recherche sur la nature et les technologies).

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These bones were made for walking

Human-like foot arches strengthen argument that Australopithecus 'Lucy' was not a climber.
Matt Kaplan

Bone that resolved contention: a fourth metatarsal from Australopithecus afarensis.Image courtesy of Carol Ward and Elizabeth Harman (deceased)

One of the earliest human ancestors, Australopithecus afarensis, the most famous skeleton of which is commonly known as 'Lucy', seems to have had human-like foot arches that would have allowed it to walk around effectively on two legs.

The finding, published today in Science[1], centres on the discovery in Hadar, Ethiopia, of a 3.2 million-year-old fourth metatarsal bone from an A. afarensis. The analysis was done by a team led by Carol Ward, a palaeontologist at the University of Missouri in Columbia.

The fourth metatarsal, a small bone that makes up the inner part of the fourth toe, is useful to palaeontologists because of the way that it differs in shape between tree climbers and land walkers. Ward's team found that Lucy's metatarsal was more like that of a modern human than a chimpanzee.

"This paper presents the most convincing skeletal evidence yet that A. afarensis had well-developed, modern human-like, arches," says Jeremy DeSilva, a functional morphologist at Boston University in Massachusetts.

For the tree-dwelling chimpanzee, the fourth metatarsal lies flatter against the ground, and the middle of the foot is mobile. This flat-footed structure grants chimpanzees tremendous flexibility and allows them to grasp branches in trees. Human feet are very different. The fourth metatarsal is twisted along its long axis and sits at an angle to the ground, because the bones of the foot form an arch from front to back and side to side. The presence of these arches robs humans of the ability to grasp with their feet but makes the foot rigid enough to function as a solid lever as it pushes off the ground, and to absorb shocks during walking and running.

An arch look

It has long been questioned whether A. afarensis had a flexible foot like a chimpanzee or a more human-like arched one. Because fossilized foot bones are rare and fourth metatarsals of A. afarensis have never before been found, many had speculated that the species had feet that were something of a compromise between those of chimpanzees and humans. Now Ward and her colleagues are putting this matter to rest.

As in the human foot, the ends of the A. afarensis fourth metatarsal are angled and twisted relative to one another, reflecting the presence of stiff arches. This strongly suggests that the early hominin had the ability to walk and run in much the same way as humans.

The discovery shows that A. afarensis was not dividing its time between trees and open land. "I'm sure they went into trees sometimes, but they would not have been able to do this much better than you or I could," says Ward.

"Based upon this discovery I think if you saw Lucy in clothing walking across a soccer field you would think she was a child, not an australopithecine," says Bruce Latimer, a palaeoanthropologist at Case Western Reserve University in Cleveland, Ohio.
The finding could also resolve a long debate surrounding some of the most famous hominin footprints ever discovered. At Laetoli, Tanzania, some hominins walked across a bed of wet volcanic ash 3.6 million years ago. "When I saw those footprints being excavated, I thought, gosh, you'd lose these on a modern day beach, they have an arch and a totally human gait," recalls Latimer. However, the movements were so close to human that many palaeontologists doubted they could have possibly belonged to the ancient A. afarensis. "This work certainly puts a nail in the coffin of that argument," says Latimer.

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'The End of Internationalization?'

June 3, 2011
VANCOUVER, B.C. – Is the internationalization of higher education suffering from a midlife crisis? Jane Knight, a professor at the Ontario Institute for Studies in Education at the University of Toronto, posed that question during a standing-room only session provocatively titled "The End of Internationalization?" Thursday at the NAFSA: Association of International Educators conference.
"Or are we having an identity crisis? Or are we losing its true north? Are we losing some of the key values about what is behind and supporting and guiding internationalization?"

Panelists at the session argued that as internationalization has moved from a fringe to core university activity, it remains imperative for professionals to scrutinize what they're working toward and why. Every university now says it wants to be "international," but what does that mean -- as Knight said, "internationalization has become a catch-all phrase for everything" -- and to what end?
"Internationalization is not a goal in itself," said Uwe Brandenburg, a consultant with the Centre for Higher Education, in Germany. "It's a means to an end. It's an instrument to achieve something. It's not good just because it's international." Instead of looking at internationalization as its own end, Brandenburg said, universities should focus on the way it contributes to improving teaching, learning, research, innovation and civic engagement.
Brandenburg was particularly critical of a sole focus on numbers – on increasing study abroad or international student enrollments to X or Y percentages, say. By way of example he cited an analysis by his center finding that 66 percent of international engineering students in Germany do not graduate, raising the question, as he put it: "Why did we get them in the first place? Is it good to have them and to brag that you have 60 percent international students or 40 or 20, but not [focus on] what is your graduation rate?"
He continued: "My favorite useless B.S. indicator is the number of partnerships. Every university can tell you how many partnerships they have. 241. 358. The number means nothing. [The same for] percentage of international students. What does it mean? Why do you want to have 50? Why do you want to have 20?"
"For what purpose? The 'why' behind these sheer numbers is something I miss sometimes."
Knight proposed a deeper discussion about the values underlying internationalization of higher education, which she suggested have shifted over the years. These shifts, she said, have been from cooperation to competition, mutual benefit to self-interest, exchange and partnership to commercial trade and activity, and, as illustrated by the rise in influence of global rankings, from capacity-building to status- or prestige-building.
The speakers on Thursday's panel could be described as friendly critics, deeply engaged in the field of international education themselves. But, said Hans de Wit, a professor of internationalization at the Hogeschool van Amsterdam, University of Applied Sciences, and co-editor of *The Journal of Studies in International Education*, "We have ignored the debate about what are we doing, why are we doing it, and how are we doing it."
Reiterating Brandenburg's point, he said, "Internationalization is not a goal itself," but a way to improve quality of education, research, etc. "If we take that as a foundation and debate from there, we'll get somewhere."
Nearly 9,000 international educators have gathered for the NAFSA conference, which continues through today.
— Elizabeth Redden

http://www.insidehighered.com/news/2011/06/03/international_educators_debate_the_why_behind_their_profession

Could Pirates Be Your Friends?

June 6, 2011
BALTIMORE — In the digital age, "copy" has become something of a four-letter word for academic publishers. The copyright wars between publishers, libraries, and interlopers such as Google have resulted in courtroom skirmishes over what is free, what is fair — and what, ultimately, is best for creativity and intellectual life.
But parallel to this heady debate, university presses face another copying problem that has been complicated by the growing importance of digital content: Piracy.
"Illicit activities with scholarly books used to be limited to worries about someone taking the last copy of a book from the MLA stand … or these quaint events like photocopying and Kinko's," said Garrett Kiely, director of the University of Chicago Press. "But now," Kiely continued, "with the Internet, it's incredibly easy to scan books, break the [digital rights management safeguards] on the digital files and make them available all over the world."

Contra the debates about e-reserve copying and "orphan works," there are few who would argue that copying and uploading entire e-books to free-content websites constitutes "fair use" of the authors' intellectual property.
However, here at the annual conference of the Association of American University Presses on Friday, Kiely suggested that piracy might not pose such a threat to authors or the people who publish them.
In a session titled "Is Piracy Good for Sales," the Chicago press director did not suggest that piracy be encouraged or legalized. But he made a case for ignoring pirates — and even appreciating piracy that might, in some cases, boost the visibility of certain titles that otherwise would have languished behind a pay wall.
The University of Chicago Press has published hundreds of titles in e-book form, including a number of "trade" books, which are aimed at a general audience and are considered more likely to become profitable. But when the press recently analyzed which of its books were being pirated, it found that most came from the more obscure, less lucrative parts of its list.
"The majority of the titles that were infringed upon were scholarly monographs," Kiely explained. "It's very hard to find a correlation between the appearance of these books on these sites, and lost sales. In some cases you can't help but think that … obscurity might be our biggest problem, rather than piracy."
The cost of combating piracy — a tedious and sometimes fruitless exercise — may, in such cases, far exceed the cost in lost sales from having those titles available for free, he added. Allowing more obscure titles to change hands freely on the Web might even result in buzz, which could eventually translate to more sales, Kiely added.
But fellow panelist Christoph Brem, vice president of sales for the Attributor Corporation, a company that foils pirates on behalf of publishers (including a handful of university presses), was quick to draw a distinction between "guerilla marketing" strategies aimed at creating new markets by seeding old ones with free copies of a product, and failing to pursue pirates whose thievery could theoretically produce similar results.
The difference is control, Brem said. When you identify tastemakers and give them free versions of your product, it is like a controlled burn: intentional, limited, and measurable.
"I haven't seen a single instance that proves that piracy is good for sales," Brem said. "I have seen statistics that show that protection is good for sales." He cited studies that show that every day, there are 1.5 to 3 million search-engine queries for free, illegal versions of the 90 top-selling titles in Amazon's online bookstore. "I think it's hard to argue that all this leads to more sales," Brem said.
But during a Q&A session, several of the university press reps in the audience suggested that the same rules that apply to piracy and sales in the context of a Dan Brown thriller might not translate to, say, a book on 19th century weather anomalies as recorded by Meriwether Lewis and William Clark.
Scholars working from electronic texts are more likely to want to make annotations that they can return to later — which can be harder to do with a pirated e-book, said Bob Stein, director of the Institute for the Future of the Book. Apps designed to help save, organize, and share annotations might not work with pirated

versions of certain e-books, Stein said, noting that he had recently experienced such difficulties while attempting to annotate a pirated copy of John Updike's *Rabbit, Run.*

And while a casual reader, for example, might not have to worry about accurately notating the precise location of certain passages of an e-book, scholars do, said Michael Jensen, director of strategic Web communications at the National Academies Press. A scholar, on the other hand, fearing incorrect metadata, might be wary of citing a pirated version, Jensen suggested. So even if that scholar had originally downloaded a pirated copy of the book (for purposes of low-cost browsing), he might ask his library to buy a legitimate copy if he ends up wanting to cite it.

"To some extent, our realm seems more appropriate for piracy, as far as driving sales, than almost any other sector in publishing," Jensen said.

It may be that university presses need little convincing. According to a recent survey by the AAUP, piracy ranks among the least alarming issues facing the association's membership. Only 28 percent of respondents said piracy was cause for major concern, while the remaining 72 percent said it was either mildly or not at all concerning.

For the latest technology news and opinion from Inside Higher Ed, follow @IHEtech on Twitter.

— Steve Kolowich

http://www.insidehighered.com/news/2011/06/06/university_press_meeting_debates_role_of_piracy

Butchering dinner 3.4 million years ago

Slashed animal bones suggest early hominins were chopping up predator kills earlier than we thought.
Richard Lovett

Stone tools probably made the parallel marks on the upper animal bone from the Ethiopian dig.Dikika Research Project

Early hominins were using stone tools to butcher meat as long ago as 3.4 million years, about 800,000 years earlier than previous evidence dates to, scientists report in this week's issue of Nature.[1]

The finding comes from an examination of animal bones found last year in the Lower Awash Valley of Ethiopia. This site is not far from the spot where the same research team, led by palaeoanthropologist Zeresenay Alemseged of the California Academy of Science, San Francisco, had previously discovered a 3.3-million-year-old juvenile Australopithecus afarensis fossil dubbed 'Lucy's Baby'. That find is one of the most complete skeletons of an ancient human ancestor to be discovered so far[2].

The animal bones — one from an impala-sized creature, the other from one closer in size to a buffalo — bear cut marks that indicate butchering, says their finder, Shannon McPherron, an archaeologist at the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, and a member of Alemseged's team.

This, he says, means that early hominins — presumably Australopithecus afarensis — were not only using tools, but also venturing out of the safety of the forests and onto the plains in search of meat.

However, they probably weren't hunting, McPherron says; it is more likely that they were scavenging predator kills. Still, the search for large-animal meat is an important step in human development. "We've put

this important, fundamental behaviour back into Lucy's time," says McPherron, who is lead author of the new study.

The same is true for tool usage. Previously, the earliest known date for tool usage was about 2.5 million years ago — right about the time that humanity's own genus, Homo, was first emerging. Now, it seems that tool usage pre-dates our genus. "We're pushing much deeper into our evolutionary past," McPherron says.

Different for chimps

It's an important find, says David Braun, a Palaeolithic archaeologist at the University of Cape Town in South Africa, because our closest living relatives don't engage in such behaviours. "Chimpanzees do not recognize large animals or carcasses killed by other animals as food," he says. "At some point, hominins did."

Proving the discovery was a two-step process, involving both dating the bones and verifying that the marks on them were inflicted by stone tools rather than by trampling, teeth or post-fossilization damage.

To do that, the team examined the bones both chemically and under a microscope. The chemical tests confirmed that the damage had occurred before the bones were fossilized; the microscopic examination confirmed that it was the result of cutting.

"The results are very clear," McPherron says.

Some of the cuts are V-shaped in cross section, for instance — a shape characteristic of those made by sharp tools — with scratches inside the cuts left by the tool's rough edge. Other marks showed signs of scraping, and still others indicated that the bones had been bashed with blunt rocks — perhaps in an effort to reach the marrow.

Paul Renne directs the Berkeley Geochronology Center in California, and has worked on studies of some of the oldest known cut-marked bones found previously. "It sure looks convincing to me," he says of the new find.

As for dating, McPherron says the scientists were lucky, because the fossils came from a gully cutting through strata that had been well studied in conjunction with other finds, such as Lucy's Baby, which was discovered only a few hundred metres away. In particular, radioisotope studies had dated two important strata, one at the highest levels in the gully and the other near the bottom. On the basis of these, the scientists knew that the bones could be no more than 3.42 million and no less than 3.24 million years old.

Project leader Zeresenay Alemseged with the fossil of a rhino living at the same time as the early tool-wielding hominins.Dikika Research Project
The pattern of magnetic field reversals — which occur at intervals in Earth's history — in the intervening sediments, and estimates of sedimentation rates, further refined the estimate. "The best estimate is 3.39 million years," McPherron says.
Renne concurs. "I think they have a really good case for 3.2 to 3.4 million years ago," he says. Within that range, he adds, the precise date isn't critical. "The fact that they're older than 3 million is pretty exciting."

Convenient rocks

However, the discovery doesn't mean that early hominins made tools. They may simply have used convenient rocks for tasks such as butchering. But their efforts still required planning because the nearest source of suitable rocks was about 6 kilometres away from where the bones were found.
Renne and Braun are pleased but not startled. "We were hoping there would be older stuff [than my own findings]," Renne says.
Braun adds that the earliest known tools, dating to about 2.5 million years ago, are very well made, which has prompted scientists to wonder whether our ancestors had somehow instantaneously discovered how to make them, or whether older, cruder tools remain to be found.

"I think many palaeoanthropologists will start looking in this window between 3.2 and 2.5 million years ago for what may be the origins of stone tool production," he says.
McPherron suggests that the best way to do this might be to go to outcrops that could once have been quarry sites. "If we're going to find evidence of tool manufacture in this time period, we're probably going to have to go to where the stones are and look there," he says.

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Tobacco-Free Is No Panacea

June 6, 2011
PHOENIX -- A straightforward presentation on how colleges are (or aren't) complying with the American College Health Association's guidelines for tobacco-free campuses sparked a much longer discussion here at ACHA's annual conference Friday, illustrating the challenges health educators face in trying to boot nicotine from the grounds.
Those in the audience identified many of the same problems on their campuses that the presenter cited: inability or unwillingness to enforce the policy; fear of alienating or getting pushback from students and staff who smoke; and shaky transition periods that can result in ineffective procedures.
Beginning in September 2009, Sara Plaspohl, an assistant professor of health sciences at Armstrong Atlantic State University, in Georgia, analyzed the policies and practices of 162 tobacco-free colleges and universities (as identified by the American Lung Association) that responded to her survey. (Fourteen did not participate; as of today, ALA has identified 242 tobacco-free institutions. This is not to be confused with smoke-free institutions, which are twice as common; according to the American Nonsmokers' Rights Foundation, there are at least 500 smoke-free colleges and universities.)
The vast majority of these colleges were on the small end of the spectrum, with fewer than 10,000 students; were located in the Midwest or South; and were either two-year or private institutions. Although most said they followed the ACHA guidelines, which aim to assist colleges with "evaluating progress toward becoming or maintaining tobacco-free living and learning environments," many did not.
Plaspohl found that while nearly all of these colleges had (self-reportedly) developed clear policies that reflect ACHA's best practices, and had comprehensive marketing and signage promoting their policy, fewer offered actual programs or products recommended by ACHA, such as patches in their health centers to aid those quitting smoking, and only one in three had a task force to maintain the policy or adjust it as needed. "About 2/3 of schools established this policy, and it's on autopilot now," she said.
But the most troublesome area was enforcement, both with campus regulars such as students and faculty, and with people who wandered onto the grounds for meetings, events and the like. Three-fourths of colleges reported having consistent consequences or penalties for noncompliance, but only 54.5 percent said they "always" enforce their policy, while 37.5 percent "occasionally" enforce it.
The methods of enforcement and types of penalties issued varied by institution, but for the most part the consequences were soft. Smokers would often get a friendly reminder of the policy, or a warning that they could be cited or lose some sort of privilege after repeated violations. As one audience member from a tobacco-free campus put it, "When they intervene, it's motivational, not confrontational."
This can be problematic, however. Some said students and staff (in many cases, they said, the latter were more resistant) did not take the policies seriously, either because they weren't enforced or because they saw other people smoking. "They smoke right underneath the sign that says 'no smoking,' " one person from a newly smoke-free campus said. "The students see one person smoking and they think, 'Why can't I smoke?' "
Jane Croeker, health and wellness promotion director at the University of North Dakota, said that both enforcement and messaging have been key in reducing tobacco use rates on her campus. "You shouldn't have to have a whole array of separate compliance strategies if it's being held up in the same way as other policies," she said. Supervisors should be charged with ensuring faculty and staff comply, and students should be educated on where they're allowed to use tobacco products.
When attendees raised less-common issues they'd faced at their colleges, such as complaints that tobacco-free policies discriminate against people who are addicted to nicotine or don't have time to leave campus to smoke, Croeker said it's important to stay focused. "Be careful not to be diverted from the main issue, and keep coming back to your key points about health," she said, adding that "focusing too much on secondhand smoke can be a problem because [policies often address] outdoor environments."
Colleges in the survey suggested other strategies for success, as well. Starting planning early and communicating the policy to everyone who will be affected can increase compliance when the tobacco ban does take effect. They also said it helps to enlist key administrators like the president, and student leaders from different campus groups. "If it comes from the students, and the students play an active role, it's most likely going to be much better accepted," Plaspohl said. "You don't have to reinvent the wheel, you just have to know your campus and know what works for you."

On average, colleges complied with 72 percent of the ACHA guidelines, Plaspohl found. In terms of demographics, public institutions and those in the Northeast (there were only four), as well as ones enrolling between 5,000 and 9,999 students, fared the best. There was no difference in compliance between urban, suburban and rural institutions.
Considering their implementation processes, colleges often said they had trouble deciding how quickly to start and how severely to enforce, for fear of resistance. But they offered a bit of advice, which Plaspohl shared at the session: "Just do it," she said. "Don't be afraid. Be diligent, be firm, be patient and be persistent.... It's not about denying [smokers'] rights, it's about promoting and creating a healthy environment for all."
— Allie Grasgreen

http://www.insidehighered.com/news/2011/06/06/health_educators_discuss_tobacco_free_college_and_university_policy_compliance_at_acha_conference

'Turn Your Zzz's Into A's'

June 3, 2011

PHOENIX -- Did you get a complete and restful night's sleep last night? If not, and if right now you're reading this article rather than focusing on work, your time might be better spent on a short nap to boost your focus and productivity.

That's what the National Sleep Foundation says, and it's a message that health education professionals at the University of California at Davis have been spreading to their students over the course of a four-year campaign, encouraging napping to boost academic performance. They shared their strategies here Thursday at the annual meeting of the American College Health Association.

"We're familiar with the benefits of sleep," said Amelia Goodfellow, a student assistant in sleep and stress at the UC Davis health center. "We're not as familiar with the impacts or positive effects of napping, which are very similar." For students, the benefits of increased productivity and concentration will translate to better academic performance, the presenters argued -- even though they acknowledge having no data to back that up.

However, research has repeatedly shown that when supplementing 7-9 hours of sleep, 20-30 minute naps do offer these benefits, particularly when taken between the hours of 10 to 11 a.m. or 2 to 4 p.m., when human sleep rhythms trigger a natural slump with grogginess and lack of focus.

So for Goodfellow and her co-presenter Jason B. Spitzer, a health educator at Davis, encouraging students to take naps and improve their state of mind -- not to mention stay awake and alert during classes -- was more important than proving through research that they correlate with better grades. (They also haven't tracked whether more students have started napping over the years, saying the focus up to this point has been more on perfecting the message. But now they're starting to "think creatively" about how to track campaign outcomes, Spitzer said.)

Gathering data from the National College Health Assessment and a 9-question assessment called the Pittsburgh Sleep Quality Index, they discovered that while 33 percent of Davis students didn't nap at all, three-quarters of those who did nap did so for too long -- more than 30 minutes, to the point where they'd wake up groggy and negate the whole point of the nap. (Although males napped more than females -- about 80 percent versus 70 percent -- the gender proportion of students who napped for the appropriate 30 minutes was about even.) That told the educators that a napping campaign would have to address two distinct populations: non-nappers and long nappers.

While each subset would need its own targeted themes -- for non-nappers, focusing on the reasons why they should and the lack of time and effort required to do so; for long nappers, strategies to limit sleep and suggestions for nap locations other than bed -- the key message was the same: take naps, get better grades.

The campaign has evolved over the years, and today involves multiple platforms and strategies. Health educators hand out "nap kits" at the cost of $2.75 apiece; they include earplugs, an eye mask and a tip card with directions to additional resources online. They advertise with fliers and advertisements in the student newspaper featuring napping tips and benefits, and they team with the student government to spread the word

on napping during National Sleep Awareness Week. And tapping into social media sites such as Facebook and Twitter gets the educators "a bigger bang for our buck," Goodfellow said.

Napping campaigns are far from common; the only other two the Davis educators know of are at Oregon State and San Diego State Universities, the latter of which pioneered the idea and inspired the Davis "nap map," which records the best places to nap on campus, "rated and evaluated by students, for students" Goodfellow said.

The nap map is a key component to the campaign (it's received more than 16,000 hits online) because students can be resistant to napping on campus, and this resource includes photographs and descriptions of dozens of prime napping spots, both indoors and outdoors.

The best locations have comfortable furniture and low light, and aren't too loud. However, one should not sacrifice safety for the sake of privacy. "You have to kind of weigh both of those criteria," Goodfellow said. "You want someplace that's private where you won't be near too many people, but isn't so private that it's unsafe."

Goodfellow and Spitzer said departments across the campus have bought into the campaign, and some -- particularly offices like the Student Academic Success Center, which is designed to support struggling students -- even distribute materials themselves. The only resistance was anecdotal, Goodfellow said. "We've had a couple interesting encounters with librarians not wanting people to nap." (She jokingly noted that she herself at first resisted the nap map: "I was kind of reluctant to share my own napping spots because I didn't want them publicized too much," she said.)

The Davis campaign is still being revised every year, as student barriers to napping either emerge or don't break down. "Again, we're seeing that students are napping for too long, and we want to improve their napping and their sleep quality," Spitzer said. Hence the next step for Davis: a campaign on good sleeping habits, because napping is only beneficial as a supplement to -- not a substitute for -- a good night's sleep.

— Allie Grasgreen

http://www.insidehighered.com/news/2011/06/03/california_davis_health_educators_urge_students_to_nap

Promoting 'Consumer Friendly' Transfer

June 3, 2011
WASHINGTON — To make it easier for students to earn and transfer college credits across institutions, policy makers and educators should work together by supporting broader articulation agreements and adopting more prior learning assessments, several experts argued at a Center for American Progress event Thursday.
"Articulation and transfer is an old problem, but it's begging for new solutions," said Frank Chong, the Education Department's deputy assistant secretary for community colleges. "I really believe this is a consumer protection issue."

The average community college student earns 140 credits while pursuing a bachelor's degree even though only 120 credits are typically necessary, according to a new CAP policy brief discussed at the event. For many students, these additional 20 credits repeat credits earned elsewhere or knowledge they may have gained outside the classroom.
"Just think about those 20 credits multiplied by thousands of students," Chong said. "At a time when we're rationing education … this is not an acceptable situation…. Pathways should be transparent, clear and seamless."
Still, Chong added that there is not a "one-size-fits-all" solution to the problem of transfer. He pointed to divergent statewide responses, from Florida's common course numbering system throughout its public institutions to a recently passed bill in California that mandates the state's community colleges create transfer-specific associate degrees for full acceptance in the California State University System.
Amy Sherman, co-author of the CAP brief and associate vice president for policy and strategy alliances at the Council for Adult and Experiential Learning, offered some broad-based recommendations for how to make "a more consumer-friendly education system."
Sherman suggested that states need to "create incentives for higher education to support mobile students," or those who attend more than one institution, as many of today's students do. She encouraged policy makers to expand existing institution-to-institution articulation agreements into statewide agreements and to eventually consider working to establish "cross-state" agreements.
"We should also learn more about the mobility and outcomes of students who cross institutional borders," Sherman said. "We should define success more broadly. The student's individual outcome should matter as much as the institution's."
Finally, in the spirit of pushing more transparency, she called on educators and policy makers to "demystify the path to degree process." She favors a national database on articulation and transfer, building on what information is currently available, which would help students see clearly how their credits transfer before they enroll.
"I really think navigational assistance and advising is the missing link out there," Sherman said. "Even if there's great advising at institutions, it tends to be focused on 'my institution.' "
Articulation and transfer practices vary across the country. The CAP brief notes that 14 states have a "general education common core curriculum" that is easily transferable from one institution to another. Only seven states have a "common course numbering system." Twenty-two states have "statewide program major articulations" that allow seamless transfer between institutions if students maintain the same major. Twenty states have "block credit transfer" that allows students to transfer credit "en masse." Finally, 30 states have "transfer associate degrees," with which a student is guaranteed acceptance as a junior at a four-year institution.
Paula Compton, associate vice chancellor of the Ohio Board of Regents, offered a few successful examples of improved transfer policies adopted within her system. For example, Ohio has created Transfer Assurance Guides, or "groups of foundational courses that represent a commonly accepted pathway to the bachelor's degree," for 40 different degrees offered at institutions around the state.

Compton said faculty support is important for these types of initiatives to succeed. She added that faculty members need to see that, for example, they are not being told what learning outcomes are wanted but rather that they need to work to help create them on their own by becoming leaders in the process.

"We have over 50 faculty panels to write and review learning outcomes," Compton said. "If articulation and transfer is to work, it has to be based on trust. In a culture, it might take time to get that. But if you get people … to understand the overarching goal of what you're really trying to achieve, it's amazing."

Regarding prior learning assessments, Sherman and other panelists admitted that these credits are not universally available, are often accepted in limited ways and are often not accepted if a student transfers. Unlike with articulation agreements, there are fewer examples of statewide adoption of prior learning assessments.

The prior learning assessment most commonly accepted by institutions is credit earned by passing an Advanced Placement test with a certain score. Still, there is room for improvement in the assessment and acceptance of AP credit, Compton said. In 2007, the Ohio Board of Regents standardized that a score of 3 or higher on any AP test would earn credit at any college within the system.

Ohio's public institutions are all members of the Servicemembers Opportunity Colleges and offer the acceptance of some military training for college credit through the College-Level Examination Program. Still, Compton said the state has to do more work so that other prior learning assessments will gain wide acceptance.

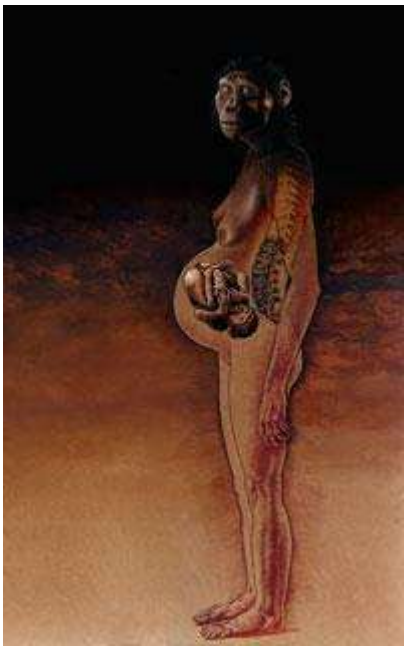
"I think there's this big fear that when you step outside of this box that quality and rigor will go down," Compton said. "We have to assure people that that's not the case."

— David Moltz

http://www.insidehighered.com/news/2011/06/03/educators_encourage_articulation_agreements_and_prior_learning_assessments

How women bend over backwards for baby

Extra spinal support helps women maintain balance during pregnancy without injury.
Heidi Ledford



A female australopithecine, like today's moms, used her spine to support baby's weight.John Gurche

The next time you see a pregnant woman teetering under the awkward weight of her growing belly, remember this: if she were a man, it would be even worse.

Researchers have found that the vertebrae that make up a woman's spine have evolved to give her more support, probably to help her cope during pregnancy. The results hold true for modern mothers as well as those of their ancient ancestors, Australopithecus, who lived more than two million years ago. Vertebrae in men lack these features.

Without this added support, women would have to draw more on their back muscles to stay upright. Over the course of nine months, that could lead to muscle fatigue and back injury.

When human ancestors made the switch from walking on four legs to walking on two, they had to make several skeletal adjustments. Vertebrae increased in number and thickness to provide added support to the upper body. The spine took on a curved shape in the lower back, to shift the shoulders backwards and move the centre of mass above the hips.

"I would advise all of my male colleagues not to become pregnant."
Karen Steudel

But the added bulk of pregnancy shifts that centre of mass forwards again, making a woman more likely to tip over towards the front. Pregnant women bring their centre of mass back over their hips by leaning back, deepening the curve at the base of their spine.

Back bend

Katherine Whitcome and Daniel Lieberman from Harvard University in Cambridge, together with their colleague Liza Shapiro of the University of Texas at Austin, measured the centre of mass of 19 pregnant women and found that they leaned back by as much as 28º beyond the normal curve of the spine, they report in Nature[1]. The researchers found this lowers the torque around the hip created by the baby's weight by roughly eight times.

Exaggerating the curve in the lower back can place more stress on the spine: vertebrae are more likely to slip against each other, leading to back pain or fractures. Whitcome and her colleagues found that a woman's spine has several features that help to prevent that damage. In women, the curve in the lower back spans three vertebrae; in men, it encompasses just two. The added vertebra helps distribute the strain over a wider area.

In addition, specialized joints located behind the spinal cord, called zygapophyseal joints, are 14% larger relative to vertebrae size in women than in men, suggesting that the joints are well adapted to resist the higher force. The joints are also oriented at a slightly different angle in women, allowing them to better brace the vertebrae against slipping.

Aside from the more obvious biological factors, this makes women more suited to carrying a baby. "I would advise all of my male colleagues not to become pregnant," jokes Karen Steudel, a biological anthropologist at the University of Wisconsin, Madison.

Running with baby

The researchers looked for, and found, the same trends between males and females in two Australopithecus fossils.

The adaptations would have been important back then, says Lieberman, "Imagine strapping seven kilos to your belly and then leading a really active life hunting, gathering, running away from predators," he says.

The results highlight the importance of a healthy lower back for survival, says Carol Ward, a palaeoanthropologist at the University of Missouri in Columbia. "A bad back really impairs your ability to move around and find food," says Ward. "So there would be strong selection for individuals to have less back pain." Given that until recently, women spent much of their adult lives pregnant, adaptations to protect the back during pregnancy would be particularly important, she says.

Whitcome is now looking at the effect of child rearing on vertebrae, and Ward notes that it would be interesting to see how these changes integrate with adaptations made for long-distance running. Some think that the need for long-distance running has provided a key selective force in human evolution (see Distance running shaped human evolution).

"But as anybody who's been 9-months' pregnant knows, running is not the thing you want to be doing," says Ward.

- **References**

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The E-Reader Effect

June 1, 2011

For technology reputed to be the future of reading, e-books have had a hard go of it in higher education. Students have for years declined to purchase electronic versions of their textbooks, and instructors have largely refrained from assigning them except when they are given no choice.

University presses, in many cases, have been even less successful than textbook publishers in selling electronic versions of their books. A new survey by the Association of American University Presses suggests that as of last December, e-book sales or licenses accounted for less than 3 percent of total revenue for the overwhelming majority of university presses.

Meanwhile, 60 percent of respondents expressed "serious concern" about the viability of their current business models. In an era of flat or declining print sales, university presses might be discouraged by the fact that e-books, to which most sectors of publishing have pinned their hope for a rebound in an era of flat or declining print sales and scarce resources, have failed to gain traction.

But there is anecdotal evidence from some presses that e-book sales have jumped in the months since the association collected its data. Several presses contacted by *Inside Higher Ed* reported that their e-book sales have risen significantly in the first part of 2011. While e-books still account for a small proportion of total sales even in these cases, the presses see the uptick as an encouraging sign that there is a market for electronic versions of "serious nonfiction" works after all — and that market might finally be stirring.

Last year, as winter approached, the University of Kentucky Press found itself in a position similar to that of most of its peers at the time: Its e-books accounted for a negligible sliver of the press's sales: 1.6 percent, according to John Hussey, the director of sales. But in February, e-book sales skyrocketed to 11.3 percent. (Hussey calls this "the Christmas boom," speculating that a lot of people got Kindles and iPads as gifts.)

The boom tempered a bit between March and April, with e-book sales dipping to between 6 and 8 percent, month-to-month. But last month they jumped again, Hussey says; although May figures have not yet been finalized, e-book sales at Kentucky have crept back toward 11 percent.

The University of North Carolina Press has also seen its e-book sales tick up in recent months, albeit at a more modest rate — from 1.5 percent between July 2009 and July 2010, to a projected 4 percent between July 2010 and next month. That includes a steep rise between January and March. The Johns Hopkins University Press says it has seen similar growth.

These are not huge gains in dollar terms, but they are significant for a couple of reasons, says Kate Torrey, director of the North Carolina press. First, they are the only part of the press that is growing. Second, the trend suggests that despite the medium's reputation for being good for casual reading but not so much studying or research, there are people out there who are interested in using e-books for more than just newspapers and beach novels.

"These are people who are buying serious scholarly books and books of really enduring value, and seem to be buying them in pretty significant numbers," Torrey says.

Also significant is which books they are buying. At Johns Hopkins, more than 70 percent of the e-books sold since last July have been "backlist" titles — books that had been out for more than a year. At the University of Kentucky, 87 percent were backlist. At the University of North Carolina, 90 percent. That means that the presses' recent success in moving e-books has not come as a result of any kind of concerted marketing effort to get customers to spring for the electronic versions. Rather, it has happened despite a lack of such efforts.

"The front list is where the majority of the publicity and promotion activities are focused," says Torrey. "And so these books are enjoying success that is not driven by the marketing and publicity activity around new books."

The relative success of backlist e-book titles in the absence of hype campaigns gives us a glimpse into the future of university press marketing if and when e-books rise to preeminence, says Hussey, the Kentucky sales director. Selling print books is all about hooking browsers, he says. That means sexy covers, grabby titles, and shelling out for prime placement on bookstore racks.

Pushing e-books, on the other hand, will turn on how well presses are able to optimize the electronic versions for search-and-discovery, Hussey says: less cover design and layout, more metadata and keyword-friendly titles and abstracts.

He points to Kentucky's top-selling e-book this year, a Holocaust memoir called *The Dentist of Auschwitz*. The book, written by concentration camp survivor Benjamin Jacobs, was originally published in 1995. Hussey believes its newfound success as an e-book can be attributed, at least in part, to its amenability to bookstore database queries. "Great book, terrible cover design," observes Hussey. "But it has fantastic keywords and metadata in its title."

About three-quarters of university presses are actively digitizing their backlists, and most of those had digitized between 25 and 50 percent of their backlist titles as of the end of last year, according to the Association of American University Presses study. Most are digitizing them in PDF or XML formats; fewer (14 percent) are using the more versatile EPUB format, which adjusts to fit the presentation styles of various types of e-readers. (More presses — 63 percent — are providing new titles in EPUB format.)

Only five out of 89 university press officials who filled out the survey said backlist digitization is not a priority. Of all respondents, most listed lack of staff, IT resources, and investment capital as the greatest barriers to backlist digitization.

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— Steve Kolowich

http://www.insidehighered.com/news/2011/06/01/e_books_becoming_a_greater_priority_of_university_presses_in_the_age_of_ipad_and_kindle

Marshes and Sea Level Rise

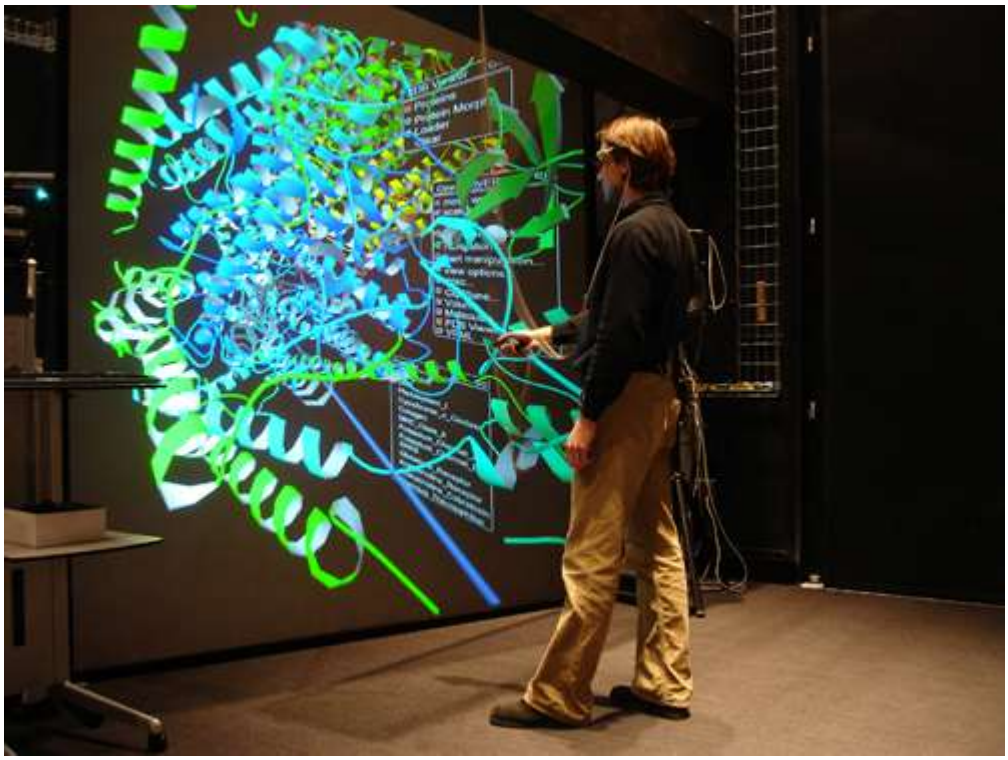
Archeologists Jennifer Pournelle and Carrie Hritz, with geologist Jennifer Smith, undertook the first non-Iraqi archaeological investigation of the Tigris-Euphrates delta in nearly 20 years. They carried out the study late last year to look for links between wetland resources and the emergence of Mesopotamian cities. The researchers proposed the project to probe how the area's gulf shoreline and marshes contributed to the economic foundation of Mesopotamian cities. Specifically, they wanted to investigate archaeological sites from 5,000 B.C. to Islamic times to learn more about how wetland resources contributed to the locale's towns and cities during the early- to mid-Holocene period.

How climate change is impacting marshes
It is a very muddy trek from the small boat to the field site along Raccoon Creek near Bridgeport, N.J. Villanova University marine scientist Nathaniel Weston and his team are all carrying ladders and equipment as they slosh through ankle deep mud toward their experiments.
"The whole reason I got into this line of research is because I like being outside, I like coastal estuaries and marsh systems, I like getting muddy, so I have fun with it," says Weston enthusiastically.
With support from the National Science Foundation (NSF), Weston, also a biogeochemist, is investigating how climate change and sea level rise may impact fresh and saltwater ecosystems, such as this marsh.
"What we wanted to do was have sites that are a gradient from fresh water to salt water so that we could investigate these processes of how salt water intrusion impacts freshwater marshes, and how sea level rise impacts both tidal freshwater and salt marshes," says Weston.
While a lot of people might just see mud, marshes like these are crucial for plants, animals and humans.
"A lot of people refer to marshes as the kidneys of Earth's ecosystems. They do a good job of filtering," explains Weston. "They also produce a lot of organic matter that acts as food for a whole set of organisms in these coastal environments. So the marsh ecosystems are basically nurseries for fish and shellfish. They provide refuge for a lot of different fish when they are in the juvenile stage."
Marshes are fairly resilient to change; they deal with a changing environment day to day because of tides, and additional changes with each season. "But the concern is that we are pushing the envelope on what they can deal with," says Weston.

In a freshwater system, adding even a little bit of salt can be a big change for the organisms living there, from plants to animals, to even bacteria.
Weston says sea levels have risen about two millimeters (0.08 inches) per year over the past century and it's averaged about three millimeters a year during the past decade. Global climate change may increase those amounts drastically.
As the Earth's climate gets hotter, ocean water warms up and expands, causing higher sea levels. Runoff from melting ice sheets and glaciers will dump even more water into the oceans. The Intergovernmental Panel on Climate Change (IPCC), chartered by the United Nations, estimates sea levels may rise up to 23 inches (58.42 centimeters) by the year 2100. Some climate scientists predict an even higher rise.
"There's pretty good evidence that sea level rise is accelerating, and it is certainly faster now than it has been in any point in the last 4,000 years," says Weston. "And so these coastal marshes that have only been able to develop in the last 4,000 years, how are they going to respond to these faster rates of sea level rise going forward? That's really what we are trying to understand," he adds.
The experiments at Raccoon Creek and several other field sites are designed to help provide insight into how a marsh is growing vertically to keep up with sea level rise. "One of the tricks with working in the marsh is you care a lot about elevation. Everything is relative to sea level," says Weston.
He uses a surface elevation table to very accurately measure the level of the marsh surface. Those measurements are taken every three months to monitor changes.
The equipment at these sites can detect changes smaller than any other means of monitoring. "Even the most accurate GPS units we have, you can see changes maybe about a centimeter, but that's just not good enough for what we are trying to do here," explains Weston.
"The funding I've received through the American Recovery and Reinvestment Act (ARRA) has allowed me to hire the personnel and purchase the equipment that this type of intensive monitoring and experimentation requires," he adds.
Some experiments at the site involve examining the composition of the soil. "So part of what we're interested in here is understanding deposition of watershed derived sediment. We take soil cores from these marsh sites, bring them back to the lab and date the recent and less recent deposition of sediment with our gamma counter," continues Weston.
The gamma counter detects both man-made and naturally occurring radioactive elements, to determine sedimentation rates, to learn more about how the marsh landscape is changing.
Whether it is the summer houses of the wealthy on the East Coast of the United States, or the vast majority of people in a developing country like Bangladesh, Weston says rising sea levels could mean that millions of people living in coastal areas are going to be much more vulnerable to extreme events such as hurricanes.
"Fifty years in the future you can expect to see much greater numbers of storm-related deaths and property damage in coastal areas," he says.
Healthy marshes act as buffers during a storm surge, nurseries for young fish and shellfish, and a water filtering system. Protecting marshes over time will be the key to keeping humans healthy, too.
Weston says monitoring these marshes is both important and enjoyable.
"When you've got a very productive marsh, very green, and you've got great blue herons or egrets flying around, fish jumping: It's a beautiful ecosystem and I really enjoy it," he says.
The research in this episode was funded by NSF through the American Recovery and Reinvestment Act of 2009.
Miles O'Brien, Science Nation Correspondent
Marsha Walton, Science Nation Producer

http://www.nsf.gov/news/special_reports/science_nation/marshescoasts.jsp?WT.mc_id=USNSF_51

3D Proteins--Getting the Big Picture



This is an example of the interactive visualization of proteins from the Protein Data Bank (PDB), using PDB browser software on the C-Wall (virtual reality wall) at the California Institute for Telecommunications and Information Technology (Calit2) at the University of California, San Diego. The work was performed by Jürgen P. Schulze, project scientist, in collaboration with Jeff Milton, Philip Weber and Professor Philip Bourne of the University of California, San Diego. The software supports collaborative viewing of proteins at multiple sites on the Internet.

Virtual reality immerses students in proteins and peptides
How do you get to know a protein? How about from the inside out?
If you ask chemistry professor James Hinton, "It's really important that students be able to touch, feel, see ... embrace--if you like, these proteins."
For decades, with funding from the National Science Foundation (NSF), Hinton has used nuclear magnetic resonance (NMR) to look at protein structure and function. But he wanted to find a way to educate and engage students about his discoveries.
"I have all of this equipment, I get a lot of information about the structure of proteins and peptides, but the one thing I didn't have was a very sophisticated way of looking at them," says Hinton, from his lab at the University of Arkansas in Fayetteville.
About five years ago, he realized there's a big difference between students looking at a drawing of a protein in a textbook and letting them "jump into" a three-dimensional display of these complex biochemical structures.
"Kids are visual people nowadays; they like to see things," says Hinton. "So I began to look around for ways of actually visualizing three-dimensional structures, and I came upon this idea of, 'Wouldn't it be nice if we had immersive techniques that would allow us to experience 3-D virtual reality?'."

With support from the Arkansas Bioscience Institute (ABI), Hinton worked with Virtalis, a company in Britain, to create an immersive 3-D virtual reality experience for studying proteins. The results have been dramatic.

"It's beginning to have a major impact on how we teach, and it is a great tool for students entering the fields of chemistry and biochemistry," notes Hinton.

"Proteins are chemical entities; they pretty much do all the work in your body," says graduate student Vitaly Vostrikov. "The problem with proteins is that they are three-dimensional entities. Visualizing them in two dimensions, on a sheet of paper, is pretty complex."

"Pretty complex" could sometimes mean tedious and frustrating for Vostrikov and many researchers studying proteins.

"Generally, when you have a protein that is of biological interest, and you want to understand the function, or to alter its activity, the first thing to do is to have the structure of the protein. Once you have the structure, you can understand what the protein looks like. For example, if it has to bind with other molecules, where do the molecules bind? Can we make binding stronger? Can we make binding weaker? Can we disrupt the binding site at all?" explains Vostrikov.

Donning a pair of 3-D glasses, he demonstrates how the immersive virtual reality display could show these structures. He could dive in and out of DNA, strains of the flu, and hemoglobin. The technology makes it possible to zoom in, zoom out, or rotate the structure; or look at components one by one.

"Understanding protein function is essential if you want to do something in pharmaceutical chemistry," adds Vostrikov.

Drug companies, universities and medical schools in the United States, Britain and Canada are using the technology. "We've had radiology groups come in, interested in imaging, of course, and the ability to do virtual reality on the human body," says Hinton.

Even people in non-scientific fields are using these imaging techniques.

"Other people have been in, including a group from Walmart. They're interested in building new stores, but it's far better to build a store in virtual reality, make your mistakes there, than break ground and start building," says Hinton.

His colleague, Paul Adams, assistant professor of chemistry and biochemistry at the University of Arkansas, says virtual reality has become an important tool for his work as well.

Adams studies abnormally functioning proteins, with the aim of learning more about the spread of cancer cells.

"I believe visualization is the epitome of trying to examine what differences among biomolecules could be the cause or the reason for them functioning in different ways and different environments," says Adams.

He says both his research and his teaching have been enhanced using the immersive 3-D virtual reality. In addition, these dramatic displays invite academic cooperation.

"If you think of interdisciplinary approaches, such as the work of a biologist, or a chemist, or a physicist: All three scientists could look at this technology, and see three different things, to come up with different ideas based on what they are seeing. And so I think that immersive technology could be a potentially novel way to interject interdisciplinary collaboration," explains Adams.

Hinton is 72 years old, and says he's "just an old man having fun." He and others at the university use a demo tape of the 3-D virtual reality as a recruiting tool. It's just the spark some young people need.

"Seeing them have fun is a great joy 'cause you feel maybe one out of these 100 or so kids will say, 'Well, biochemistry or, hmm ... chemistry, maybe I'd like that'," says Hinton.

Hinton has high praise for his students, many of whom have been supported by NSF. Immersive 3-D virtual reality allows the students, in their quest to solve real world problems, the opportunity to view their world in a different way.

Miles O'Brien, Science Nation Correspondent
Marsha Walton, Science Nation Producer

http://www.nsf.gov/news/special_reports/science_nation/3dproteins.jsp

Air Quality Worsened by Paved Surfaces

Widespread urban development alters weather patterns

A shroud of smog hangs over Houston; its air pollution is more common in hot summer months.

June 7, 2011

New research focusing on the Houston area suggests that widespread urban development alters weather patterns in a way that can make it easier for pollutants to accumulate during warm summer weather instead of being blown out to sea.

The international study, led by the National Center for Atmospheric Research (NCAR), could have implications for the air quality of fast-growing coastal cities in the United States and other mid-latitude regions overseas.

The reason: the proliferation of strip malls, subdivisions and other paved areas may interfere with breezes needed to clear away smog and other pollution.

The researchers combined extensive atmospheric measurements with computer simulations to examine the impact of pavement on breezes in Houston.

They found that, because pavement soaks up heat and keeps land areas relatively warm overnight, the contrast between land and sea temperatures is reduced during the summer.

This in turn causes a reduction in nighttime winds that would otherwise blow pollutants out to sea.

In addition, built structures interfere with local winds and contribute to relatively stagnant afternoon conditions.

"The developed area of Houston has a major impact on local air pollution," says NCAR scientist Fei Chen, lead author of the new study. "If the city continues to expand, it's going to make the winds even weaker in the summertime, and that will make air pollution much worse."

While cautioning that more work is needed to better understand the impact of urban development on wind patterns, Chen says the research can eventually help forecasters improve projections of major pollution events.
Policy-makers might also consider new approaches to development as cities work to clean up unhealthy air.
The article will be published this month in the *Journal of Geophysical Research*, published by the American Geophyiscal Union.
The research was funded by the U.S. Air Force Weather Agency, the U.S. Defense Threat Reduction Agency, and the National Science Foundation (NSF), NCAR's sponsor.
"Growing urbanization and coastal zone populations in Houston and other port cities around the globe make our ability to understand and predict complex interactions between the urban canopy and local sea-breeze circulation ever more critical," says Brad Smull of NSF's Division of Atmospheric and Geospace Sciences." This study represents a significant step toward that objective."
In addition to NCAR, the authors are affiliated with the China Meteorological Administration, the U.S. National Oceanic and Atmospheric Administration and the University of Tsukuba in Japan. The research is built on a number of previous studies on the influence of urban areas on air pollution.
Houston, known for its mix of petrochemical facilities, sprawling suburbs and traffic jams that stretch for miles, has some of the highest levels of ground-level ozone and other air pollutants in the United States. State and federal officials have long worked to regulate emissions from factories and motor vehicles in efforts to improve air quality.
The new study suggests that focusing on the city's development patterns and adding to its already extensive park system could provide air quality benefits as well.
"If you made the city greener and created lakes and ponds, then you probably would have less air pollution even if emissions stayed the same," Chen explains. "The night-time temperature over the city would be lower and winds would become stronger, blowing the pollution out to the Gulf."
Chen adds that more research is needed to determine whether paved areas are having a similar effect in other cities in the midlatitudes where sea breezes are strongest.
Coastal cities from Los Angeles to Shanghai are striving to reduce air pollution levels. However, because each city's topography and climatology is different, it remains uncertain whether expanses of pavement are significantly affecting their wind patterns.
For the Houston study, Chen and colleagues focused on the onset of a nine-day period of unusually hot weather, stagnant winds, and high pollution in the Houston-Galveston area that began on Aug. 30, 2000. They chose that date partly because they could draw on extensive atmospheric measurements taken during the summer of 2000 by researchers participating in a field project known as the Texas Air Quality Study 2000. That campaign was conducted by the National Oceanic and Atmospheric Administration, the U.S. Department of Energy, universities and the Texas Natural Resource Conservation Commission.
In addition to the real-world measurements, the study team created a series of computer simulations with a cutting-edge software tool, NCAR's Advanced Weather Research and Forecasting model.
Fei and his colleagues focused on wind patterns, which are driven by temperature contrasts between land and sea.
If Houston was covered with cropland instead of pavement, as in one of the computer simulations, inland air would heat up more than marine air during summer days and cause a sea breeze to blow onshore in the afternoon.
Conversely, the computer simulations showed that as the inland air became cooler than marine air overnight, a land breeze would blow offshore, potentially blowing away pollution.
In contrast, the actual paved surfaces of Houston absorb more heat during the day and are warmer overnight. This results in stagnation for three reasons:

- At night, the city's temperatures are similar to those offshore. The lack of a sharp temperature gradient has the effect of reducing winds.
- During the day, the hot paved urban areas tend to draw in air from offshore. However, this air is offset by prevailing wind patterns that blow toward the water, resulting in relatively little net movement in the atmosphere over the city.

- Buildings and other structures break up local winds far more than does the relatively smooth surface of croplands or a natural surface like grasslands. This tends to further reduce breezes.

"The very existence of the Houston area favors stagnation," the article states.
The study also found that drought conditions can worsen air pollution.
This is because dry soil tends to heat up more quickly than wet soil during the day. It releases more of that heat overnight, reducing water-land temperature contrast and therefore reducing nighttime breezes.
By comparing observations taken in 2000 with computer simulations of Houston-area winds and temperatures, the researchers were able to confirm that the Advanced Weather Research and Forecasting model was accurately capturing local meteorological conditions.
-NSF-

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http://www.nsf.gov/news/news_summ.jsp?cntn_id=119606&org=NSF&from=news

Fish treasure trove opened with funding from the National Science Foundation

Scientist Phil Hastings with the fishes--in the SIO Marine Vertebrate Collection.

June 7, 2011

The stories they could tell, these fishes that once swam the ocean deep and are now in jars and bottles.

In the 1960s and '70s, Richard Rosenblatt, a marine biologist at California's Scripps Institution of Oceanography (SIO), set out on field expeditions to remote places to study the fishes of the Pacific Ocean.

During trips south to Mexican waters, Rosenblatt and other scientists retrieved hundreds of specimens of various species.

Most were incorporated into the Scripps Marine Vertebrate Collection (MVC), a fish archive used by scientists around the world.

The collections formed the basis of studies on the systematics of marine fishes by Rosenblatt and others. But due primarily to a lack of space at SIO, much of the treasure trove remained unsorted.

These and more recent collections of fishes now number more than 400 inside containers big and small.

A decade ago, the MVC moved to a new location on the SIO campus, providing the needed space to process the samples.

"Each of these containers could include a couple of different species, or dozens in some cases, but from a collection or a scientific perspective, we don't know what's in those jars," said marine biologist Phil Hastings, who took over as curator of the fish collection from Rosenblatt in 1999.

"They potentially provide new data on the diversity, distribution and abundance of fishes throughout the region, but until they are fully processed they are of limited scientific value."

He'll soon find out what's in those jars.

Thanks to an award from the National Science Foundation (NSF), Hastings and colleagues have begun opening the mysterious containers.

"This unique collection from historical and remote locations may hold insights into understanding biodiversity and ecosystem changes in the ocean's pelagic zone," said Anne Maglia, program director in NSF's Division of Biological Infrastructure, which awarded the grant.

A pelagic zone is any water in a sea or lake that is not close to the bottom or near to the shore.
"By rescuing and digitizing these irreplaceable specimens," Maglia said, "the data they hold will become available to researchers around the world studying systematics, biogeography, and environmental change."
Scripps graduate student Grant Galland, for example, will use the specimens to further his research on historical changes in fish communities in the Gulf of California.
Galland has conducted field work in many of the same areas as Rosenblatt's historical expeditions, and will compare how today's marine environment has changed over the past 40 years or more.
Also through the NSF award, SIO staff members will scan and post in the collection's online database catalog records and handwritten field notes made at the time specimens were gathered in the wild.
These often provide information about the habitat, environmental conditions at the time of capture, other species observed in the area, and descriptions of freshly caught fishes.
The NSF award also will allow Hastings to archive more than 27,000 fish specimens from remote areas of the ocean.
The specimens, collected by scientists working across 2,000 locations in the eastern tropical Pacific Ocean, were recently acquired as "orphans" from the Southwest Fisheries Science Center, part of NOAA's National Marine Fisheries Service.
The NSF award also will boost the technological capabilities of the Marine Vertebrate Collection.
A high-tech X-ray machine will generate digital files of specimens to allow fish scientists from near and far to study detailed anatomical features, such as the number of fin rays and vertebrae and details of bone structure of the specimens.
"When [pioneer Scripps ichthyologist] Carl Hubbs made film-based radiographs here at Scripps in the 1950s, he had to wait for the film to be developed to see if the image turned out," said Hastings. "This new machine gives us that same information in about 30 seconds and at a much higher resolution."
Students will work on sorting, identifying and cataloguing fishes.
"They'll be studying not only the taxonomy of fishes," said Hastings, "but experiencing how a natural history collection works."
And, on a larger scale, how the ocean itself functions.
-NSF-

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http://www.nsf.gov/news/news_summ.jsp?cntn_id=119734&org=NSF&from=news

Jellyfish Blooms Transfer Food Energy From Fish to Bacteria

Impact on ocean food webs likely to increase in the future

Chrysaora quinquecirrhe, one of two jellyfish species in the study.

June 7, 2011

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Jellyfish can be a nuisance to bathers and boaters in the Chesapeake Bay on the United States' East Coast and many other places along the world's coasts.

A new study by researchers at the Virginia Institute of Marine Science (VIMS) shows that jellyfish also have a more significant impact, drastically altering marine food webs by shunting food energy toward bacteria.

An apparent increase in the size and frequency of jellyfish blooms in coastal and estuarine waters around the world during the last few decades means that jellies' impact on marine food webs is likely to increase in the future.

The results of the study, led by recent VIMS graduate Rob Condon--now a scientist at the Dauphin Island Sea Lab (DISL) in Alabama--appear in this week's issue of the journal *Proceedings of the National Academy of Sciences*.

His co-authors are VIMS scientists Deborah Steinberg and Deborah Bronk, Paul del Giorgio of the Université du Québec à Montréal, Thierry Bouvier of Université Montpellier in France, Monty Graham of DISL and Hugh Ducklow of the Marine Biological Laboratory in Woods Hole, Massachusetts.

The research was funded by the National Science Foundation (NSF).

"This intriguing finding demonstrates that changes at the top of the food web can affect even the most fundamental ecosystem processes," says David Garrison, director of NSF's Biological Oceanography Program.

Condon conducted his field studies by sampling jellyfish blooms in the York River, a tributary of lower Chesapeake Bay.

The team's experimental work took place in laboratories at VIMS, and in Canada and France.

The researchers tracked the flow of food energy in the lab by measuring the amount of carbon taken up and released by jellyfish and bacteria within closed containers during "incubation" experiments of varying length. Carbon is the "currency" of energy exchange in living systems.
"Jellyfish are voracious predators," says Condon. "They affect food webs by capturing plankton that would otherwise be eaten by fish, and converting that food energy into gelatinous biomass. This restricts the transfer of energy up the food chain, because jellyfish are not readily consumed by other predators."
Jellyfish also shunt food energy away from fish and shellfish that humans like to eat through their effects on the bacterial community.
"Marine bacteria typically play a key role in recycling carbon, nitrogen, phosphorus and other by-products of organic decay back into the food web," says Condon.
"But in our study, we found that when bacteria consumed dissolved organic matter from jellyfish they shunted it toward respiration rather than growth."
The upshot of this "jelly carbon shunt" is that bacteria in jelly-laden waters end up converting carbon back to carbon dioxide, rather than using it to grow larger or reproduce.
This means the carbon is lost as a direct source of organic energy for transfer up the food web.
The researchers think the shift toward bacterial respiration happens because jellyfish produce organic matter that is extra-rich in carbon.
They do so through excretion and the sloughing of mucus. "The mucus is the slime you feel when you pick up a jelly," says Steinberg.
The jellyfish in Condon's experiments released large quantities of carbon-rich organic matter--with 25- to 30-times more carbon than nitrogen.
That compares to a ratio of 6 parts carbon to 1 part nitrogen for the organic matter found dissolved in typical marine waters.
"The bacteria metabolized this carbon-rich material two to six times faster than they did with dissolved organic matter from water without jellyfish," says Condon.
"This rapid metabolism shunted carbon toward respiration rather than production, reducing their potential to assimilate this material by 10 to 15 percent."
Steinberg says that bacterial metabolism of dissolved organic matter from jellyfish is like "drinking Gatorade," while metabolism of dissolved organic matter from phytoplankton and other sources is like "eating a hamburger. It just doesn't provide an efficient food source for marine bacteria."
A final significant finding from the team's research is that an influx of dissolved organic matter from jellyfish blooms changes the make-up of the local microbial community.
"Dissolved organic matter [DOM] from jellyfish favored the rapid growth and dominance of specific bacterial groups that were otherwise rare in the York River," says Condon.
"This implies that jelly-DOM was channeled through a small component of the local microbial assemblage and thus induced large changes in community composition."
Overall, says Condon, the team's findings "suggest major shifts in microbial structure and function associated with jellyfish blooms, and a large detour of energy toward bacteria and away from higher trophic levels."
He adds that a host of factors, including climate change, over-harvesting of fish, fertilizer runoff and habitat modifications could help to fuel jellyfish blooms into the future.
"Indeed," he says, "we've seen this already in Chesapeake Bay. If these swarms continue to emerge, we could see a substantial biogeochemical impact on our ecosystems."
"Simply knowing how carbon is processed by phytoplankton, zooplankton, microbes or other trophic levels in space and time can lead to estimates of how much carbon energy is available for fish to consume," he says. "The more we know, the better we can manage ecosystem resources."
-NSF-

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http://www.nsf.gov/news/news_summ.jsp?cntn_id=119772&org=NSF&from=news

Carbon release to atmosphere 10 times faster than in the past

Monday, June 6, 2011

University Park, Pa. -- The rate of release of carbon into the atmosphere today is nearly 10 times as fast as during the Paleocene-Eocene Thermal Maximum (PETM), 55.9 million years ago, the best analog we have for current global warming, according to an international team of geologists. Rate matters and this current rapid change may not allow sufficient time for the biological environment to adjust.

"We looked at the PETM because it is thought to be the best ancient analog for future climate change caused by fossil fuel burning," said Lee R. Kump, professor of geosciences, Penn State.

However, the researchers note in the current issue of Nature Geoscience, that the source of the carbon, the rate of emission and the total amount of carbon involved in this event during the PETM are poorly characterized.

Investigations of the PETM are usually done using core samples from areas that were deep sea bottom 55.9 million years ago. These cores contain layers of calcium carbonate from marine animals that can show whether the carbon in the carbonate came from organic or inorganic sources. Unfortunately, when large amounts of greenhouse gases --carbon dioxide or methane -- are in the atmosphere, the oceans become more acidic, and acid dissolves calcium carbonate.

"We were concerned with the fidelity of the deep sea records," said Kump. "How do we determine the rate of change of atmospheric carbon if the record is incomplete? The incomplete record makes the warming appear more abrupt."

Kump and his colleagues decided to look at information coming from areas that were shallow arctic ocean bottom during the PETM. During a Worldwide Universities Network expedition to train graduate students from Penn State, the University of Southampton, University of Leeds, University of Utrecht and University of Oslo in how projects develop, the researchers visited Spitsbergen, Norway. They uncovered a supply of rock cores curated by a forward-thinking young coal-mining company geologist, Malte Jochmann.

"Deep-sea cores usually have from 10 cm to a meter (about 4 inches to 3 feet) of core corresponding to the PETM," said Kump. "The Spitsbergen cores have 150 meters (492 feet) of sediment for the PETM."

The larger sediment section, made up of mud that came into the shallow ocean contains organic matter that can also supply the carbon isotope signature and provide the greenhouse gas profile of the atmosphere. With the larger core segment, it is easier to look at what happened through time and ocean acidification would not degrade the contents.

"We think the Spitsbergen core is relatively complete and shows an interval of about 20,000 years for the injection of carbon dioxide during the PETM," said Kump.

Using the data collected from the cores, the researchers forced a computer model to in essence run backward. They set up the models to find the proper amounts of greenhouse gases and atmospheric temperature that would have resulted in the carbon isotope ratios observed in the cores.

The outcome was a warming of from 9 to 16 degrees Fahrenheit and an acidification event in the oceans.

"Rather than the 20,000 years of the PETM which is long enough for ecological systems to adapt, carbon is now being released into the atmosphere at a rate 10 times faster," said Kump. "It is possible that this is faster than ecosystems can adapt."

Other Penn State researchers on this project include Ying Cui, graduate student and Katherine H. Freeman, professor; geosciences, Christopher K. Junium and Aaron F. Diefendorf, former graduates students and Nathan M. Urban former postdoctoral fellow.

Other researchers include Ian C. Harding, senior lecturer, and Adam J. Charles graduate student, National Oceanography Centre Southampton, University of Southampton, UK and Andy J. Ridgwell, professor of Earth system modeling, School of Geographical Sciences, University of Bristol, UK.

The National Science Foundation, Worldwide Universities Network and Penn State supported this work.

http://live.psu.edu/story/53683

Active Galactic Nuclei: Georgia Tech Astrophysicists Use X-ray Fingerprints to Study the Eating Habits of Giant Black Holes

By studying the X-rays emitted when superheated gases plunge into distant and massive black holes, astrophysicists at the Georgia Institute of Technology have provided an important test of a long-standing theory that describes the extreme physics occurring when matter spirals into these massive objects.

Georgia Tech astrophysicists have provided an important test of a long-standing theory that describes the extreme physics occurring when matter spirals into massive objects known as black holes. Here, David Ballantyne poses with a NASA illustration of a black hole. (Click image for high-resolution version. Credit: Gary Meek)

Matter falling into black holes emits tremendous amounts of energy which can escape as visible light, ultraviolet light and X-rays. This energy can also drive outflows of gas and dust far from the black hole, affecting the growth and evolution of galaxies containing the black holes. Understanding the complex processes that occur in these active galactic nuclei is vital to theories describing the formation of galaxies such as the Milky Way, and is therefore the subject of intense research.

Though light cannot escape from black holes themselves, black holes with accretion disks – which are swirling clouds of matter about to enter the black hole – are among the most luminous objects in galaxies. By studying how the radiation and accretion disk interact, astrophysicists can learn much about the extreme gravitational fields, magnetic forces and radiation processes close to these black holes.

"We reviewed data collected from space telescopes over the past few years and found that the more rapidly a black hole was gobbling up material, the more highly ionized the accretion disk was," said David Ballantyne, an assistant professor in Georgia Tech's School of Physics. "The simple theory of accretion disks predicts this, but the relationship we saw between the ionization and rate of accretion was different from what the theory predicted."

The large difference between the observed and theoretical relationships – a linear dependence on the rate of accretion as opposed to a cubic dependence – is not surprising for a phenomenon that can't exactly be tested

under controlled laboratory conditions. In a paper published online June 3 in *The Astrophysical Journal*, Ballantyne describes the research and speculates about possible reasons for the difference between observations and theory. The research, which will appear in the Journal's June 20 issue, was supported in part by the National Science Foundation (NSF).

This artist's impression illustrates how a black hole system may look. Energy may escape from a black hole when it is in a strong magnetic field which exerts a braking effect. (Click image for high-resolution version. Credit: Dana Berry, NASA)

"As in many areas of science, especially astronomy, we end up needing more data – many more high-quality observations to better define this relationship," he added.

Astrophysicists don't have a detailed understanding of how the accretion process works, why black holes grow at different rates – or what makes them stop growing. These questions are important because the growth of active galactic nuclei – the black holes and their surrounding accretion disks – has broader effects on the galaxies of which they are part.

"The rapid accretion phase releases a lot of energy, not only in radiation, but also in outflows that drive gas out of a galaxy, which can shut off star formation and hold back the growth of the galaxy," said Ballantyne, a scientist in Georgia Tech's Center for Relativistic Astrophysics. "We could potentially learn something fundamental about the flow of energy through the accretion disk very close to the black hole. We could learn about the viscosity of this matter and how efficiently radiation transport takes place. These are very important questions in astrophysics."

X-rays are believed to originate from innermost portion of active galactic nuclei. As they pass through matter on its way into the black hole, the X-rays are altered by the materials in ways that astrophysicists can measure. In their study, Ballantyne and his collaborators were interested in studying the ionization state of

the matter – which is related to the illumination – and were able to do so by analyzing the "fingerprint" the ionization left on the X-rays.

Georgia Tech astrophysicists have provided an important test of a long-standing theory that describes the extreme physics occurring when matter spirals into massive objects known as black holes. Here, David Ballantyne, Jon McDuffie and John Rusin pose with a NASA illustration of a black hole. (Click image for high-resolution version. Credit: Gary Meek)

"From laboratory work, we understand the physics of how gas interacts with X-ray radiation because that's basically an atomic physics problem," he explained. "We can model what these fingerprints might look like on the X-rays, and compare that to the actual data to help us understand what's going on."

Because of their high energy and short wavelength, X-rays pass through many materials, such as human bodies, with little attenuation. This makes them ideal for examining processes in active galactic nuclei. Longer wavelengths, such as ultraviolet and visible light, are absorbed by intergalactic dust, or are difficult to distinguish from light originating in stars. However, X-rays do get absorbed by dense objects, such as bones – and crucially for this study – accretion disks.

Ballantyne and his collaborators Jon McDuffie and John Rusin studied ten X-ray observations reported by other scientists from eight different active galactic nuclei. The observations were made using such space telescopes as Chandra and XMM.

To be useful, they used only measurements of X-ray emissions from the innermost and hottest portion of the accretion disk, and only where the mass of the black holes – which range from a million to a billion times the size of our sun – had high quality estimates.

In pursuing the study, Ballantyne hopes to maintain the involvement of Rusin, a student from South Cobb High School in Marietta, near Atlanta. Rusin became involved when he contacted Georgia Tech to inquire about astrophysics projects.

Georgia Tech astrophysicists have provided an important test of a long-standing theory that describes the extreme physics occurring when matter spirals into massive objects known as black holes. Here, David Ballantyne poses with a NASA illustration of a black hole. (Click image for high-resolution version. Credit: Gary Meek)

"He helped us with data acquisition and was a really big help," said Ballantyne. "I treated him just like an undergraduate student. I'm pleased to know that he has decided to attend Georgia Tech."

The next step in the research will be to gather additional information from other studies of active galactic nuclei to see if the linear relationship Ballantyne's group measured holds up. The work may also lead to other techniques for learning about black holes and the accretion process.

"Black holes themselves are very simple, but what goes on around them can be very complex," Ballantyne said. "There is still a lot to be learned about how black holes get fueled, and how some accrete slowly while others grow rapidly. The astrophysics of black holes is actually very important in determining what our universe looks like."

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Old Buildings Combine Sustainability, Preservation

Studies suggest the greenest building is the one already built — a pleasing message for historic preservationists.
By John McKinney

Studies show that old buildings may be just as sustainable, if not more so, than their new and green counterparts. (Martyn E. Jones / Stockxchange.com)

Much to the consternation of developers and redevelopment agencies intent on demolishing historic buildings and constructing new ones, these days, in the name of going green, preservationists are making the case that "the greenest building is the one already built."
"When we first started working on sustainability issues and tried to get people thinking about the environmental value of reusing buildings, rather than tearing them down and building new ones, we were greeted with arched eyebrows and polite nodding heads," explains Patrice Frey, director of sustainability research for the National Trust for Historic Preservation. "That's changing now."
"This whole idea that reusing existing resources — especially historic buildings — is the ultimate in recycling is beginning to get some traction," agrees Donovan Rypkema, one of America's most prominent and outspoken preservationists, and author of the classic book in the field, *The Economics of Historic Preservation: A Community Leader's Guide*.
Helping historic preservationists present their case are new studies that calculate what is lost — in measurable environmental terms — when we tear buildings down and replace them with new ones. Plenty of studies have demonstrated the merits of constructing new green buildings, but until recently, there's been relatively little data available on the economic and environmental benefits of building reuse.
Some of the latest reports calculate both the enormous amount of energy and materials already locked into buildings (embodied energy), and the significant carbon emissions they represent.
Embodied energy is the energy consumed by all of the processes associated with the construction of a building, from the acquisition of natural resources to product delivery. This includes the mining and manufacturing of materials and equipment, plus their transport.

A discussion of embodied energy first arose during America's energy crisis in the late 1970s and early 1980s. Embodied-energy researchers developed a handy calculation: By entering a building's size and type (residential, commercial, hospital, etc.), it was easy to do the math and come up with a quick estimate of the amount of energy saved by preserving a building.

Embodied-energy calculations had little influence on the old-versus-new building debate, though because it was believed that the embodied energy content of a building was rather small compared to the energy used in operating the building over its life. Most conservation efforts were, therefore, put into reducing operating energy by improving the energy efficiency of the structure.

Nowadays, it's accepted that embodied energy can be the equivalent of many years of operational energy, and that new construction requires enormous expenditures of energy and materials. A recent study by the Environmental Protection Agency estimated that 30 to 40 percent of natural-resource extraction every year goes to the building industry.

Meanwhile, to the delight of preservationists, old buildings have been adjudged to be surprisingly energy efficient. U.S. Department of Energy research on the energy performance of existing buildings ascertained that commercial buildings constructed before 1920 use less energy per square foot than buildings from any other period of time except after 2000. Older buildings, it seems, were constructed with high thermal mass, passive heating and cooling. And, obviously, were built to last.

Some builders acknowledge that historic commercial buildings use less energy than buildings of more recent vintage but insist the exact opposite is true of homes — the older the home, the worse the energy consumption is likely to be.

Yes, but historic preservationists counter that recent studies show older homes can be remodeled and upgraded to meet energy standards at less cost — and at less cost to the environment — than tearing down and building new ones. That was the conclusion from a study in England by the Building and Social Housing Foundation and another in Scotland commissioned by Historic Scotland.

Both studies also looked at the carbon impacts of building new homes compared to retrofitting old ones. The BSHF study commissioned by the Empty Homes Agency found it could take as long as 35 to 50 years for a new green home to recover the carbon expended during the construction process, while the Historic Scotland estimate was 15 to 20 years.

"The idea that even the most energy-efficient new house could require a minimum of 15 years to recover carbon ought to be reason enough to give us pause," says Frey, "and take a second look at retrofitting our existing housing stock."

Preservationists admit there is still some fuzziness in how exactly embodied energy and carbon emissions are measured. Noting that well over 40 percent of the nation's carbon emissions come from construction and operation of buildings, The National Trust for Historic Preservation launched its Preservation Green Lab in Seattle to conduct further research.

"The goal of research at Green Lab," says Frey, "is to develop tools and resources to enable policymakers and decision-makers to get needed residential and commercial growth and at the same time protect what is already there." (Run your dwelling through their embodied energy calculator here.)

Most everyone, though, remains resistant to reusing and retrofitting buildings. Architects like to start from scratch, developers don't want the hassles of rehabbing existing buildings, and new construction is a mainstay of the U.S. economy.

"The most unenlightened in this regard are the traditional environmental advocates and the U.S. Green Building Council and their LEED certification," Rypkema jabs. "If it isn't about a waterless toilet, solar panels or saving the rain forest, those groups don't think it's about the environment."

As Rypkema sees it, the environment and historic preservation have one thing in common: to understand their importance to society, you have to think long term. But in his experience, "The myopically short-term perspective of elected officials means they focus on the next election, not the next generation.

"Fortunately, much policy on the national, state and local levels is effectively set by boards, commissions and public employees. With the right set of arguments, they are persuadable."

http://www.miller-mccune.com/environment/old-buildings-combine-sustainability-preservation-31861/?utm_source=Newsletter164&utm_medium=email&utm_content=0607&utm_campaign=newsletters

The Last Mountain: A Scary Movie About … Coal

In his film review of "The Last Mountain," Lewis Beale describes a horror flick about environmental degradation and predatory capitalism.
By Lewis Beale

Activist and West Virginia local Maria Gunnoe is seen in front of a mountaintop removal site in a scene from "The Last Mountain," a documentary writer Lewis Beale says is scarier than any horror flick. (Courtesy Uncommon Productions)

The Last Mountain is scarier than any *Saw*, *Alien* or *Friday the 13th* film ever made. It's a documentary about mountaintop coal removal in West Virginia, starring a group of locals whose environment is slowly turning into toxic sludge and an energy company whose methods are so predatory, they make Wall Street bankers look like acolytes of Mother Teresa.
"If someone tried to blow up a mountain in Utah or Colorado, they'd be put in jail. Why is that allowed in West Virginia?" asks environmental activist Robert F. Kennedy, Jr., who figures prominently in the film. "It's because the public does not know it's happening," he continues. "Investigative journalism has disappeared in this country. Americans are the best entertained and least informed people on the planet. If the people really knew, they wouldn't tolerate it."

After seeing director Bill Haney's film, it will be hard for any American to justify the environmental destruction caused by our insatiable need for coal, even though coal-burning power plants provide half of the electricity used in the U.S. One-third of all that coal comes from Appalachia, although the biggest operations in the U.S. are surface mines in Wyoming.

The Last Mountain is essentially about the fight to stop Massey Energy, a company with more than 60,000 environmental violations from 2000 to 2006, from blasting the top off of Coal River Mountain in a rural area of West Virginia. The fight pits one of America's largest coal companies, the industry lobbyists it has helped

install inside the EPA and a pro-coal governor against a group of local activists with little money and very little political clout. The locals see their beautiful, mountainous countryside being turned into a moonscape, and the statistical information the film continually flashes on the screen paints a portrait of a true horror show:

• Mountaintop removal mining has destroyed 500 mountains in West Virginia alone.
• It has decimated 1 million acres of forest.
• And buried 2,000 miles of streams.
• The mining has created 309 million gallons of sludge, contained in man-made lakes.
• Those lakes have been involved in numerous spills — 28 involving Massey, 24 in the last decade.

There are other offshoots of this mining process. Although coal companies are required to return the land back to its original state after a coal vein is exhausted, their efforts are minimal at best, creating gravel-strewn mountain tops prone to flooding. Rocks and dust from the blasting itself pour down on the local neighborhoods, and heavy metals from the process are seeping into the groundwater. And Massey has used its political muscle to break the miners' union, allowing them to replace men with machines. Massey itself is currently being acquired by Alpha Natural Resources Inc. Alpha is the fourth largest coal producer in the U.S., according to the U.S. Energy Information Administration; Massey is sixth.

The film makes clear that Massey operates practically with impunity. Although the EPA finally caught up with the company in 2007, it fined it $20 million for its numerous violations — a drop in the bucket for a multibillion-dollar corporation. And while an independent investigation recently declared the company grossly negligent in the 2010 Upper Big Branch mining disaster that killed 29 workers, history suggests Massey might get yet another slap on the wrist.

"Last year, I debated Don Blankenship [former CEO of Massey Energy] and asked if it was possible for his company to make a profit without breaking the law," says Kennedy. "And he said no. He was acknowledging this was a criminal enterprise."

But *The Last Mountain* is not just an anti-Massey screed. It also questions this country's commitment to renewable power sources like wind and solar, and the policies — like government subsidies for the coal industry — that make it difficult to move to an environmentally sound energy plan. The film does point out that wind farms are gaining more and more traction — supposedly the wind industry now employs as many people as coal — but it's just a drop in the bucket in terms of America's energy needs.

Ultimately, *The Last Mountain* is a horror story about the unholy alliance between big business and big government, with the poor citizens of places like the Coal River Valley crushed by their complicity. But although the film is a downer, Kennedy believes all is not lost.

"This has happened before in American history," he says, "where we had large corporations dismantle democracy during the Gilded Age. They owned the Congress and the Senate. But during the Progressive Era, in the beginning of our century, you had people who stood up and reclaimed democracy. There were journalists, union organizers. They put the bit in the mouths of the corporations. We've done it before, and now you see those reforms under attack. It's disheartening. Our job is to try to reconstruct democracy in this country."

http://www.miller-mccune.com/media/the-last-mountain-a-very-scary-movie-about-coal-31741/

River Mystery Solved

Scientists discover how "Didymo" algae bloom in pristine waters with few nutrients

Didymo is present in Rapid Creek, S.D., and in pristine streams and rivers worldwide.
Credit and Larger Version

June 2, 2011

The pristine state of unpolluted waterways may be their downfall, according to research results published in a paper this week in the journal *Geophysical Research Letters*.

A species of freshwater algae that lives in streams and rivers, called Didymo for *Didymosphenia geminata*, is able to colonize and dominate the bottoms of some of the world's cleanest waterways--precisely because they are so clear.

Didymo does so with a little help from its friends--in this case, bacteria--which allow it to make use of nutrients like phosphorus.

Blooms of Didymo, also known as "rock snot," says scientist P.V. Sundareshwar of the South Dakota School of Mines and Technology, are made up of stalks that form thick mats on the beds of oligotrophic, or low-nutrient, streams and rivers. Sundareshwar is the paper's lead author.

"In recent decades, human activities have led to many uncommon environmental phenomena," he says. "Now we have Didymo."

The freshwater diatom has become notorious. Didymo has taken over low-nutrient rivers in North America and Europe. It has also invaded water bodies in the Southern Hemisphere, including those in New Zealand and Chile.

Because its blooms alter food webs and have the potential to impact fisheries, "Didymo presents a threat to the ecosystem and economic health of these watercourses," says Sundareshwar.

Algae blooms are usually linked with the input of nutrients that fuel the growth of microscopic aquatic plants. Didymo's ability to grow prolifically in waters where nutrients such as phosphorus are in short supply puzzled scientists.

Environmental managers tried to mitigate Didymo blooms and predict their spread. But how the diatoms sustained such high growth in oligotrophic systems was unknown.

In a study funded by the National Science Foundation (NSF) and the State of South Dakota Carbon Scientist fund, Sundareshwar and colleagues revealed that Didymo is able to concentrate phosphorus from the water.

The scientists conducted their research in Rapid Creek, an unpolluted mountain stream in western South Dakota where Didymo was first observed in 2002. The creek regularly has Didymo blooms, with 30 to 100 percent of the streambed covered with Didymo over an area up to ten kilometers (6 miles) long.

Didymo thrives in Rapid Creek through biogeochemical processes in biofilms in the mats. As Didymo mats form, new stalks develop at the surface and older stalks--which have already bound phosphorus--are displaced to the mats' inner regions.

Phosphorus is available to Didymo thanks to the activity of the bacteria that live inside these mats.
"This study solves the puzzle of how Didymo can produce such large blooms in low-nutrient rivers and streams," says Tim Kratz, program director in NSF's Division of Environmental Biology.
"It has uncovered the fascinating mechanism by which Didymo 'scrubs' phosphorus from a stream or river," says Kratz, "then creates a microenvironment that allows microbes to make this nutrient available for Didymo's growth."
The concentration of phosphorus on Didymo mats far exceeds the level expected based on the nutrient content of surface waters, says Sundareshwar.
"The ability of the mats to store phosphorus is tied to the availability of iron in the water."
Didymo cells adsorb, or condense on their surfaces, both iron and phosphorus. Then bacterial processes in the mat interact with iron to increase the biological availability of phosphorus.
The process results in abundant phosphorus for cell division, "and hence," says Sundareshwar, "a resolution to the paradox of Didymo blooms in oliogotrophic streams and rivers."
The result will help scientists and managers identify water bodies susceptible to Didymo blooms.
"It also has the potential to lead to discoveries that may stem this organism's prolific growth in rivers around the world," says Sundareshwar.
"This is how science is supposed to work--research conducted at one small creek in South Dakota can be translated to places across the globe."
Co-authors of the paper are S. Upadhayay, M. Abessa, S. Honomichl, C. Sandvik, and A. Trennepohl of the South Dakota School of Mines and Technology; B. Berdanier of South Dakota State University and A. Spaulding of the U.S. Geological Survey in Boulder, Colo.
-NSF-

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http://www.nsf.gov/news/news_summ.jsp?cntn_id=119700&org=NSF&from=news

Moral Responses Change as People Age

Research shows morally laden scenarios get different responses from people of different ages.

Age plays a role in how people respond to moral situations, a new study says.

June 2, 2011

Moral responses change as people age says a new study from the University of Chicago.

Both preschool children and adults distinguish between damage done either intentionally or accidently when assessing whether a perpetrator has done something wrong, said study author Jean Decety. But, adults are much less likely than children to think someone should be punished for damaging an object, for example, especially if the action was accidental.

The study, which combined brain scanning, eye-tracking and behavioral measures to understand brain responses, was published in the journal *Cerebral Cortex* in an article titled "The Contribution of Emotion and Cognition to Moral Sensitivity: A Neurodevelopmental Study."

"This is the first study to examine brain and behavior relationships in response to moral and non-moral situations from a neurodevelopmental perspective," wrote Decety in the article.

Decety is the Irving B. Harris Professor in Psychology and Psychiatry at the University of Chicago and a leading scholar on affective and social neuroscience. The National Science Foundation's (NSF) Division of Behavioral and Cognitive Sciences funds the research.

"Studying moral judgment across the lifespan in terms of brain and behavior is important," said Lynn Bernstein, a program director for Cognitive Neuroscience at NSF. "It will, for example, contribute to the understanding of disorders such as autism spectrum disorder and psychopathology and to understanding how people at various times in the lifespan respond to others' suffering from physical and psychological pain."

The different responses correlate with the various stages of development, Decety said. As the brain becomes better equipped to make reasoned judgments and integrate an understanding of the mental states of others, moral judgments become more tempered.

Negative emotions alert people to the moral nature of a situation by bringing on discomfort that can precede moral judgment, said Decety. Such an emotional response is stronger in young children, he explained.

Decety and colleagues studied 127 participants, aged 4 to 36, who were shown short video clips while undergoing an fMRI scan. The team also measured changes in the dilation of the people's pupils as they watched the clips.

The participants watched a total of 96 clips that portrayed intentional harm, such as someone being shoved, and accidental harm, such as someone being struck accidentally, such as a golf player swinging a club. The clips also showed intentional damage to objects, such as a person kicking a bicycle tire, and accidental damage, such as a person knocking a teapot off the shelf.

Eye tracking revealed that all of the participants, irrespective of their age, paid more attention to people being harmed and to objects being damaged than they did to the perpetrators. Additionally, an analysis of pupil size

showed that "pupil dilation was significantly greater for intentional actions than accidental actions, and this difference was constant across age, and correlated with activity in the amygdala and anterior cingulate cortex," Decety said.

The study revealed that the extent of activation in different areas of the brain as participants were exposed to the morally laden videos changed with age. For young children, the amygdala, which is associated the generation of emotional responses to a social situation, was much more activated than it was in adults.

In contrast, adults' responses were highest in the dorsolateral and ventromedial prefrontal cortex areas of the brain that allow people to reflect on the values linked to outcomes and actions.

"Whereas young children had a tendency to consider all perpetrators malicious, irrespective of intention and targets (people and objects), as participants aged, they perceived the perpetrator as clearly less mean when carrying out an accidental action, and even more so when the target was an object," Decety said.

Joining Decety in writing the paper were Kalina Michalska, a postdoctoral scholar, and Katherine Kinzler, an assistant professor, both in the Department of Psychology.

-NSF-

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http://www.nsf.gov/news/news_summ.jsp?cntn_id=119702&org=NSF&from=news

New Map Reveals Giant Fjords Beneath East Antarctic Ice Sheet

Duncan Young discusses research in the Aurora Subglacial Basin.

June 2, 2011
View a video with Duncan Young, research scientist at the University of Texas at Austin.
Scientists from the United States, United Kingdom and Australia have used ice-penetrating radar to create the first high-resolution topographic map of one of the last uncharted regions of Earth, the Aurora Subglacial Basin, an immense ice-buried lowland larger than Texas in East Antarctica.
The map reveals some of the largest fjords or ice cut channels on Earth, providing important insights into the history of ice in Antarctica.
Data from the study will help computer modelers improve their simulations of the Antarctic ice sheet and its potential impact on global sea level.
Because the basin lies kilometers below sea level, seawater could penetrate beneath the ice, causing portions of the ice sheet to collapse and float off to sea. Indeed, this work shows that the ice sheet has been significantly smaller in the past.
Funding for this research is provided by the National Science Foundation, NASA, the Natural Environment Research Council (U.K.), the Australian Antarctic Division, the G. Unger Vetlesen Foundation (U.S.), the Antarctic Climate and Ecosystems CRC (Aus.) and the University of Texas at Austin's Jackson School of Geosciences.
For more information regarding this discovery, view the video sound bites of Duncan Young, research scientist at the University of Texas at Austin's Institute for Geophysics and lead author on the study, which appears today in the journal *Nature*.
-NSF-

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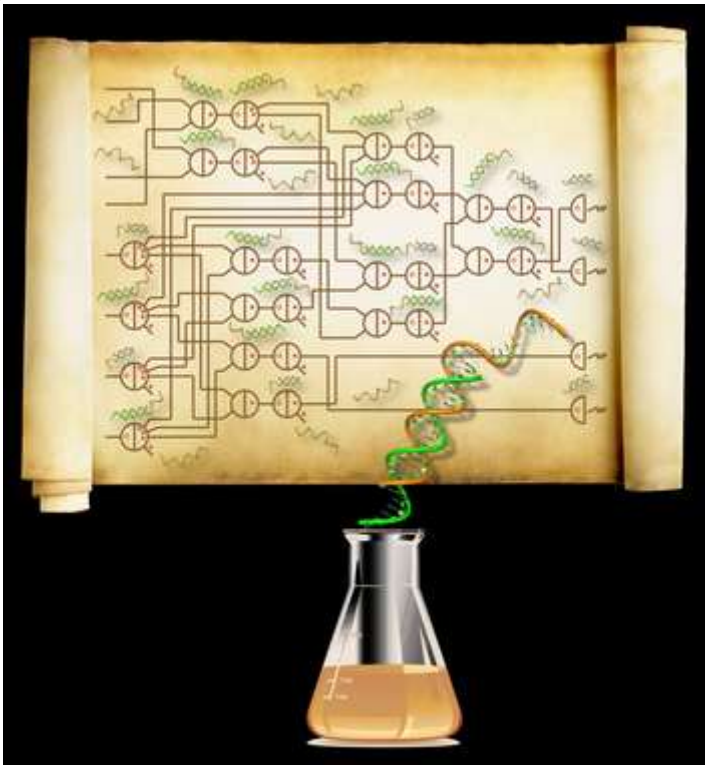
http://www.nsf.gov/news/news_summ.jsp?cntn_id=119718&org=NSF&from=news

Caltech Researchers Build Largest Biochemical Circuit Out of Small Synthetic DNA Molecules

PASADENA, Calif.—In many ways, life is like a computer. An organism's genome is the software that tells the cellular and molecular machinery—the hardware—what to do. But instead of electronic circuitry, life relies on biochemical circuitry—complex networks of reactions and pathways that enable organisms to function. Now, researchers at the California Institute of Technology (Caltech) have built the most complex biochemical circuit ever created from scratch, made with DNA-based devices in a test tube that are analogous to the electronic transistors on a computer chip.

Engineering these circuits allows researchers to explore the principles of information processing in biological systems, and to design biochemical pathways with decision-making capabilities. Such circuits would give biochemists unprecedented control in designing chemical reactions for applications in biological and chemical engineering and industries. For example, in the future a synthetic biochemical circuit could be introduced into a clinical blood sample, detect the levels of a variety of molecules in the sample, and integrate that information into a diagnosis of the pathology.



A wiring diagram specifying a system of 74 DNA molecules that constitute the largest synthetic circuit of its type ever made. The circuit computes the square root of a number up to 15 and rounds down to the nearest integer (the discrete square root of a four-bit integer).
[Credit: Caltech/Lulu Qian]
"We're trying to borrow the ideas that have had huge success in the electronic world, such as abstract representations of computing operations, programming languages, and compilers, and apply them to the biomolecular world," says Lulu Qian, a senior postdoctoral scholar in bioengineering at Caltech and lead author on a paper published in the June 3 issue of the journal *Science*.

Along with Erik Winfree, Caltech professor of computer science, computation and neural systems, and bioengineering, Qian used a new kind of DNA-based component to build the largest artificial biochemical circuit ever made. Previous lab-made biochemical circuits were limited because they worked less reliably and predictably when scaled to larger sizes, Qian explains. The likely reason behind this limitation is that such circuits need various molecular structures to implement different functions, making large systems more

complicated and difficult to debug. The researchers' new approach, however, involves components that are simple, standardized, reliable, and scalable, meaning that even bigger and more complex circuits can be made and still work reliably.

"You can imagine that in the computer industry, you want to make better and better computers," Qian says. "This is our effort to do the same. We want to make better and better biochemical circuits that can do more sophisticated tasks, driving molecular devices to act on their environment."

To build their circuits, the researchers used pieces of DNA to make so-called logic gates—devices that produce on-off output signals in response to on-off input signals. Logic gates are the building blocks of the digital logic circuits that allow a computer to perform the right actions at the right time. In a conventional computer, logic gates are made with electronic transistors, which are wired together to form circuits on a silicon chip. Biochemical circuits, however, consist of molecules floating in a test tube of salt water. Instead of depending on electrons flowing in and out of transistors, DNA-based logic gates receive and produce molecules as signals. The molecular signals travel from one specific gate to another, connecting the circuit as if they were wires.

Winfree and his colleagues first built such a biochemical circuit in 2006. In this work, DNA signal molecules connected several DNA logic gates to each other, forming what's called a multilayered circuit. But this earlier circuit consisted of only 12 different DNA molecules, and the circuit slowed down by a few orders of magnitude when expanded from a single logic gate to a five-layered circuit. In their new design, Qian and Winfree have engineered logic gates that are simpler and more reliable, allowing them to make circuits at least five times larger.

Their new logic gates are made from pieces of either short, single-stranded DNA or partially double-stranded DNA in which single strands stick out like tails from the DNA's double helix. The single-stranded DNA molecules act as input and output signals that interact with the partially double-stranded ones.

"The molecules are just floating around in solution, bumping into each other from time to time," Winfree explains. "Occasionally, an incoming strand with the right DNA sequence will zip itself up to one strand while simultaneously unzipping another, releasing it into solution and allowing it to react with yet another strand." Because the researchers can encode whatever DNA sequence they want, they have full control over this process. "You have this programmable interaction," he says.

Qian and Winfree made several circuits with their approach, but the largest—containing 74 different DNA molecules—can compute the square root of any number up to 15 (technically speaking, any four-bit binary number) and round down the answer to the nearest integer. The researchers then monitor the concentrations of output molecules during the calculations to determine the answer. The calculation takes about 10 hours, so it won't replace your laptop anytime soon. But the purpose of these circuits isn't to compete with electronics; it's to give scientists logical control over biochemical processes.

Their circuits have several novel features, Qian says. Because reactions are never perfect—the molecules don't always bind properly, for instance—there's inherent noise in the system. This means the molecular signals are never entirely on or off, as would be the case for ideal binary logic. But the new logic gates are able to handle this noise by suppressing and amplifying signals—for example, boosting a signal that's at 80 percent, or inhibiting one that's at 10 percent, resulting in signals that are either close to 100 percent present or nonexistent.

All the logic gates have identical structures with different sequences. As a result, they can be standardized, so that the same types of components can be wired together to make any circuit you want. What's more, Qian says, you don't have to know anything about the molecular machinery behind the circuit to make one. If you want a circuit that, say, automatically diagnoses a disease, you just submit an abstract representation of the logic functions in your design to a compiler that the researchers provide online, which will then translate the

design into the DNA components needed to build the circuit. In the future, an outside manufacturer can then make those parts and give you the circuit, ready to go.

The circuit components are also tunable. By adjusting the concentrations of the types of DNA, the researchers can change the functions of the logic gates. The circuits are versatile, featuring plug-and-play components that can be easily reconfigured to rewire the circuit. The simplicity of the logic gates also allows for more efficient techniques that synthesize them in parallel.

“Like Moore’s Law for silicon electronics, which says that computers are growing exponentially smaller and more powerful every year, molecular systems developed with DNA nanotechnology have been doubling in size roughly every three years,” Winfree says. Qian adds, “The dream is that synthetic biochemical circuits will one day achieve complexities comparable to life itself.”

The research described in the *Science* paper, "Scaling up digital circuit computation with DNA strand displacement cascades," is supported by a National Science Foundation grant to the Molecular Programming Project and by the Human Frontier Science Program.
View the researchers' video that explains this work.
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CMU Researchers Uncover How the Brain Processes Faces

Groundbreaking Study Identifies Neural System Responsible for Face Recognition

PITTSBURGH—Each time you see a person that you know, your brain rapidly and seemingly effortlessly recognizes that person by his or her face.

Until now, scientists believed that only a couple of brain areas mediate facial recognition. However, Carnegie Mellon University's Marlene Behrmann, David Plaut and Adrian Nestor have discovered that an entire network of cortical areas work together to identify faces. Published in the current issue of the Proceedings of the National Academy of Sciences (PNAS), their findings will change the future of neural visual perception research and allow scientists to use this discovery to develop targeted remedies for disorders such as face blindness.

"This research will change the types of questions asked going forward because we are not just looking at one area of the brain," said Nestor, a postdoctoral research fellow within CMU's Department of Psychology and lead author of the study. "Now, scientists will have to account for the system as a whole or else our ability to understand face individuation will be limited."

Behrmann, professor of psychology and a renowned expert in using brain imaging to study prosopagnosia, or face blindness, agreed.

"Faces are among the most compelling visual stimulation that we encounter, and recognizing faces taxes our visual perception system to the hilt. Carnegie Mellon has a longstanding history for embracing a full-system account of the brain. We have the computational tools and technology to push further into looking past one single brain region. And, that is what we did here to discover that there are multiple cortical areas working together to recognize faces," she said.

For the study, participants were shown images of faces while in a magnetic resonance imaging (MRI) scanner. Their task was to recognize different facial identities with varying facial expressions. Using dynamic multivariate mapping, the research team examined the functional MRI (fMRI) data and found a network of fusiform and anterior temporal regions that respond with distinct patterns to different identities. Furthermore,

they found that the information is evenly distributed among the anterior regions and that the right fusiform region plays a central role within the network.

"Not only do we have a more clearly defined architectural model of the brain, but we were able to determine the involvement of multiple brain areas in face recognition as well as in other types of processes, such as visual word recognition," Behrmann said.

This study was funded by the National Science Foundation, and Behrmann received additional support from the Weston Visiting Professorship at the Weizmann Institute of Science.

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Pictured above, Stimuli were matched with respect to low-level properties, external features and high-level characteristics. Credit: Face images courtesy of the Face-Place Database Project, Copyright 2008, Michael J. Tarr

http://www.cmu.edu/news/archive/2011/May/may31_facialrecognition.shtml

Human ancestors in Eurasia earlier than thought

Stone fragments found in Georgia suggest Homo erectus might have evolved outside Africa.

Matt Kaplan

A new find has muddied the water on the origins of Homo erectus.photolibrary.com

Archaeologists have long thought that Homo erectus, humanity's first ancestor to spread around the world, evolved in Africa before dispersing throughout Europe and Asia. But evidence of tool-making at the border of Europe and Asia is challenging that assumption.

Reid Ferring, an anthropologist at the University of North Texas in Denton, and his colleagues excavated the Dmanisi site in the Caucasus Mountains of Georgia. They found stone artefacts — mostly flakes that were dropped as hominins knapped rocks to create tools for butchering animals — lying in sediments almost 1.85 million years old. Until now, anthropologists have thought that H. erectus evolved between 1.78 million and 1.65 million years ago — after the Dmanisi tools would have been made.

Furthermore, the distribution of the 122 artefacts paints a picture of long-term occupation of the area. Instead of all the finds being concentrated in one layer of sediment, which would indicate that hominins visited the site briefly on one occasion, the artefacts are spread through several layers of sediment that span the period between 1.85 million and 1.77 million years ago. The findings are published today in the Proceedings of the National Academy of Sciences[1].

"This is indeed suggestive of a sustained regional population which had successfully adapted to the temperate environments of the southern Caucasus," explains Wil Roebroeks, an archaeologist at Leiden University in the Netherlands.

Eurasian ancestry?

The presence of a tool-using population on the edge of Europe so early hints that the northern continent, rather than Africa, may have been the evolutionary birthplace of H. erectus. Unfortunately, the fossils of the hominins responsible for making the tools are not proving very helpful to the debate.

Fossilized bone fragments found in the same sedimentary layers as the Dmanisi artefacts are too weathered to be identified as belonging to any one species, so it is impossible to say for sure whether the tools were made by H. erectus.

Neither do fossil skulls previously retrieved from later sediments at the site help to resolve the controversy. These fossils, dating from 1.77 million years ago, had brains between 600 and 775 cubic centimetres in volume, whereas H. erectus is generally thought to have had an average brain size of around 900 cubic centimetres. For comparison, modern humans have a brain capacity of around 1,350 cubic centimetres. "Many people call those Dmanisi fossils the earliest H. erectus, but there is still frequent debate about this," explains Ferring.

There and back again

Even if the ancient inhabitants of the Dmanisi site were not early members of H. erectus, there is still a problem: anthropologists have previously thought that no hominins existed outside of Africa as early as 1.85 million years ago.

"Anthropology textbooks of the 1990s often showed maps with large arrows indicating migration of early H. erectus from its inferred core area of eastern Africa to other parts of the Old World," explains Roebroeks. The findings in Dmanisi make such an explanation look faulty.

Ferring and his colleagues propose that some ancestors of H. erectus might have travelled to Asia and possibly Europe, done a bit of evolving, then wandered back to Africa.

"Remember, it would not have been obvious to the hominins they were leaving Africa. There were no signs saying 'You are leaving Africa now — come and visit us again!'" says Bernard Wood, an anthropologist at the George Washington University in Washington DC. But Wood admits that it is unclear why the hominins might have made these movements. "It perplexes me," he says.

Ferring suggests that ancient hominins might have been following their food source — animals. "My hunch is that the migrations relate to the rise of carnivory and a sudden flexibility to live and eat meat anywhere," he says. Vegetarians, he explains, are limited to the specific plants that sustain them and cannot travel from tropics to deserts to mountains nearly as easily as predators can. Wood agrees. "My guess is that hominins were following game," he says.

Other possibilities also exist. "We tend to think of hominins as living in a disease-free world, but maybe they were eliminated in some places by an epidemic, and the only healthy ones left were at the edges of their distribution", who could then move back into the vacated areas, says Wood.

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http://www.nature.com/news/2011/110606/full/news.2011.350.html

Hungarian natural history under threat

Historical collections given marching orders as government plans military university at museum site.
Marian Turner

Museum's mummies seek new resting place.N. Bauer, HNHM

Looking for a new home: 200 human mummies from the eighteenth century, the remains of rare European dinosaurs and 10 million other artefacts currently at the Hungarian Natural History Museum, which is facing eviction later this year. The Hungarian government plans to turn the historic Budapest building given to the museum after the fall of communism in 1989 into a university to train the military or the police.

Scientists in Hungary and abroad are shocked by the move because the imposing 1836 Ludovika building has been extensively renovated for the museum, and curators are still moving the collections in. They say that the museum has not been offered an alternative site, and fear that the collections will have to be stored in crates until a new home is found.

"When the government announced the new university in February, they described the Ludovika as a long-neglected building. That came as a surprise to those of us who work there," says József Pálfy, a member of a joint research team between the museum's palaeontology research group and the Hungarian Academy of Sciences. But the government justifies its decision by saying that parts of the building need further renovations and that using the Ludovika for the new university is in keeping with tradition — the building contained a military academy until 1945.

The museum employs more than 70 scientists and publishes around 50 papers a year in international journals. In addition to the mummies — which were found in a church crypt in Vac in central Hungary and used to study the history of tuberculosis — it houses fossils found in western Hungary from ceratopsian dinosaurs, which were previously thought not to have lived in Europe.

The collections, some of which date back to 1802, had been scattered around the city before the museum was granted the Ludovika buildings in the early 1990s. The buildings were in disrepair, but the Hungarian

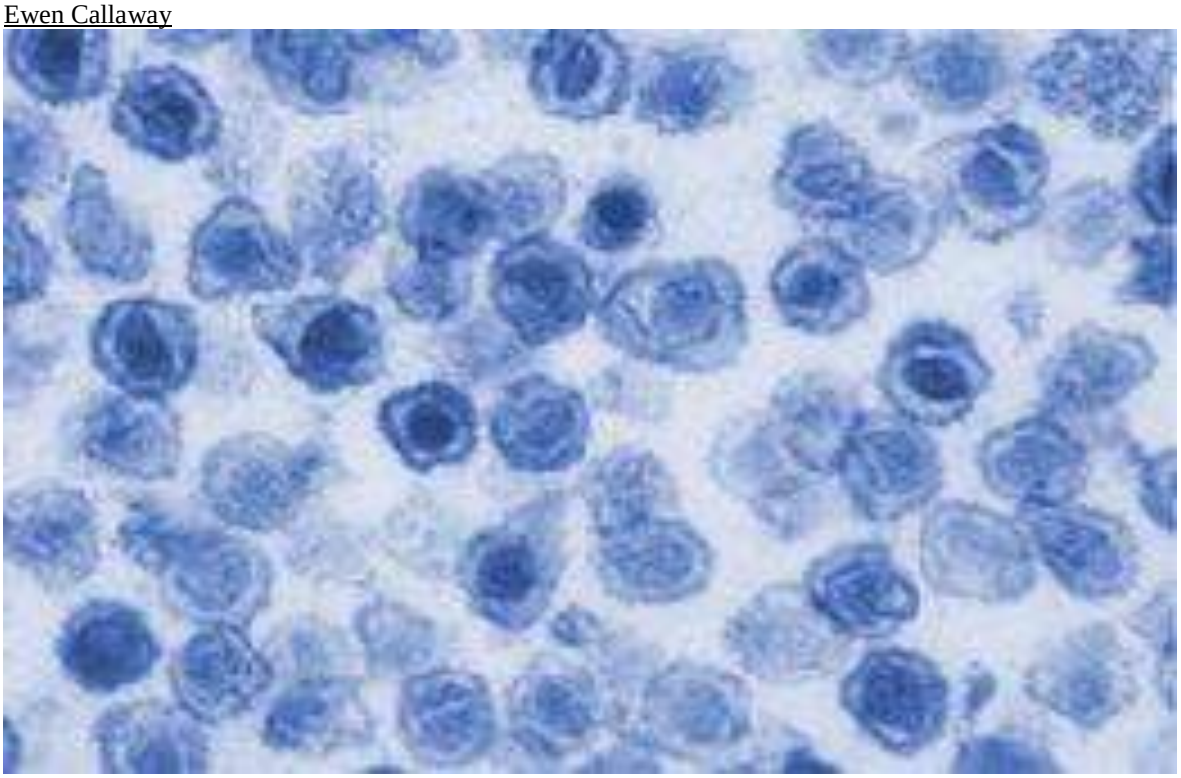
government invested around 10 billion forints (US$53 million) to refurbish them. The buildings now give the museum 5,000 square metres of exhibition space, as well as modern research laboratories and three underground levels for storage.
András Jávor, state secretary for the Hungarian Ministry of National Resources, which is responsible for the museum, says that no jobs or resources will be lost in the reorganization, and that his ministry "is consulting with the museum about its future location". But Attila Ősi, a palaeontologist in the same research group as Pálfy, whose discovery of the ceratopsian dinosaur fossils led to a Nature paper last year (A. Ősi et al. Nature **465,** 466–468; 2010), says that research will suffer if they are forced to pack up their specimens again.

About 100 international researchers use the collections every year, and those contacted by Nature echo the concerns of their Hungarian colleagues. "The collections at the museum are unique, and moving them again would create huge problems for multinational research collaborations," says Gareth Dyke, a palaeontologist at University College Dublin in Ireland, who is currently working at the museum.
Museum staff had just started to get comfortable at the Ludovika. "The scientists here are still spending time checking inventories to make sure all the objects have survived moving in," says Ősi. "After 200 years we got a central building for our museum," adds István Matskási, its director-general, "and now we do not know where we will have to go."

http://www.nature.com/news/2011/110607/full/474139a.html

Chronic fatigue syndrome: life after XMRV

As doubts about the retrovirus reach fever pitch, scientists focus on alternative directions for the field.
Ewen Callaway



The idea that chronic fatigue syndrome is caused by the XMRV virus has been largely discredited.Image courtesy of University of Utah Health Sciences Public Affairs.

XMRV's 15 minutes of fame seem to be up.

The hypothesis that the retrovirus has a role in chronic fatigue syndrome (CFS) has been dealt a serious blow by the publication of two damning papers in Science[1,2] and an "expression of concern"[3] from the journal's editor over the original report that identified signs of XMRV infection in two-thirds of people with the condition but fewer than 4% of healthy people[4]. The authors of that paper, led by Judy Mikovits at the Whittemore-Peterson Institute for Neuro-Immune Disease in Reno, Nevada, declined a request from Science to retract it, calling it "premature" in a statement.

"It's a bust," says Jonathan Stoye, a retrovirologist at the National Institute for Medical Research in London, part of the UK Medical Research Council (MRC), who was one of the fiercest critics of the association between XMRV and CFS. "People who are interested in this condition will have to move on."

Yet scientists are not yet sure what the fallout will be for the future of research into CFS, also known as myalgic encephalomyelitis (ME).

Despite affecting an estimated 17 million people worldwide, CFS has always met with scepticism from some scientists, says Anthony Komaroff, a leading CFS researcher at the Brigham and Women's Hospital in Boston, Massachusetts. The likely fall of XMRV, he worries, will drive home that point. "That, in my mind, would be an intellectually inappropriate way to respond," he says, "because beyond XMRV there's evidence of an underlying biological process and infectious triggers that we need to understand better."

Fear and loathing

Simon Wessely, a psychiatrist at King's College London who is reviled by many with CFS for emphasizing the neuropsychiatric aspects of the syndrome, worries that XMRV will have a negative effect on CFS research.

Many scientists, eager to work on a new virus linked to human disease, were castigated by some patients and advocates when they didn't find XMRV and raised the possibility that the original report could be a product of lab contamination, Wessely says.
At a recent workshop on CFS, John Coffin, a retrovirologist at Tufts University in Boston whose team showed that XMRV is a laboratory hybrid unlikely to cause a natural human infection[1], made a plea to patients. "We really went in with the idea of being able to push this field forward," He said. "Nobody went in with the idea of disproving this." He added that criticisms of his motivations from patient advocates were "painful" to read.
Wessely says although he is used to being subject to abuse, other researchers were "absolutely appalled" by their treatment. "This will convince another large group of decent scientists to say: oh no, I would rather go find the gene for homosexuality or do work on images of the prophet Mohammed than do this."
But Paul Kellam, a virologist at the Wellcome Trust Sanger Centre in Hinxton, UK, who co-authored one of the first studies pointing to contamination as an explanation for the CFS–XMRV link[5], is more hopeful. "I think we're in a transition period at the moment," he says. "We've just got to wait for the dust to settle, but I think it will galvanize people in the end."
"Nobody went in with the idea of disproving this."

John Coffin
Tufts University

Advances in biotechnology mean that scientists interested in a complex syndrome of enigmatic origin such as CFS have the right tools to tackle it, Kellam says. Microarray chips that identify differences between genes expressed in the blood of people with CFS and those without the syndrome may identify biomarkers of the condition. Meanwhile, gene scans and, soon, whole-genome sequences of patients with CFS could single out variations that make a person more likely to develop the debilitating condition.
Identifying what triggers CFS will be more difficult, Kellam acknowledges. A single infectious agent, such as XMRV, is unlikely to explain the condition, but some patients seem to develop the condition not long after being infected with agents such as Epstein–Barr virus. Comparing the genomes of people who develop post-viral fatigue with those who recover from their infections would be "a logical approach", he says.

Better diagnostics needed
But in order for such studies to bear fruit, better ways of diagnosing and classifying patients with CFS are needed, Kellam says. Current diagnostic criteria, based on excluding other conditions with similar symptoms, are more useful in the clinic than in the lab, he adds.
"This is essentially preventing us from moving forward on good solid research that deals with biomarkers, diagnosis and eventually treatment," says Dennis Mangan, who heads the CFS programme at the US National Institutes of Health (NIH) in Bethesda, Maryland.

Mangan says that the NIH spends about US$6 million a year supporting CFS research, although he estimates that another $4–14 million in annual funding for research on pain, exercise and other topics is directly relevant to the condition and its symptoms. He says the NIH is exploring ways to better support CFS research, such as by calling for grant proposals specifically devoted to the condition. "It's an illness that's not going away and the NIH is not going to turn its back on it."
In Britain, the MRC is accepting research proposals for a new programme devoted exclusively to CFS. The goal of the programme is to draw top-notch scientists into the field, says Stephen Holgate, an immunopharmacologist at the University of Southampton School of Medicine, UK. "Part of the difficulty is that we don't have very many good scientists working in the field," he says.
Proposals for the £1.5-million programme, due by 7 June, must include at least one scientist who does not currently work on CFS. "I know it's small fry, but at least it's a start," says Holgate. "We want a fresh view."

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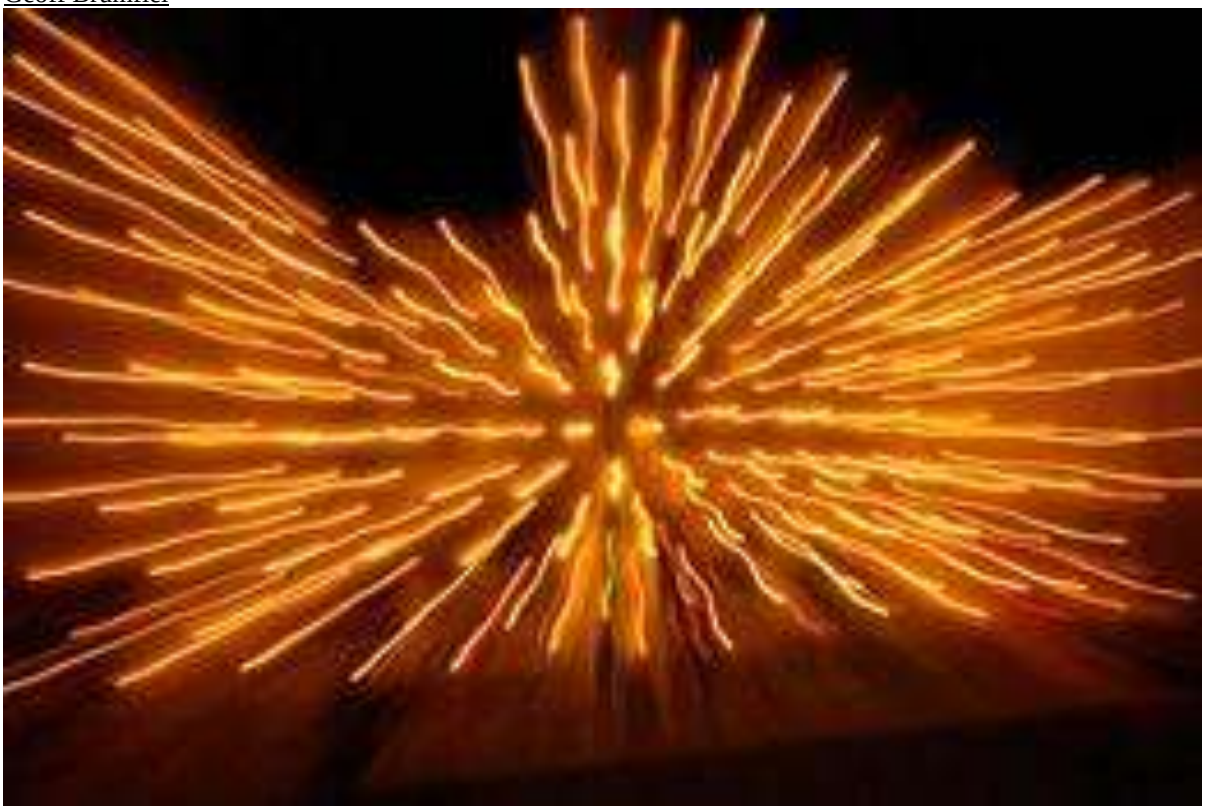
Moving mirrors make light from nothing

Researchers claim to have produced sought-after quantum effect.
Geoff Brumfiel



A moving mirror can generate light from a vacuum.Phil M Rogers / Alamy

A team of physicists is claiming to have coaxed sparks from the vacuum of empty space[1]. If verified, the finding would be one of the most unusual experimental proofs of quantum mechanics in recent years and "a significant milestone", says John Pendry, a theoretical physicist at Imperial College London who was not involved in the study.

The researchers, based at the Chalmers University of Technology in Gothenburg, Sweden, will present their findings early next week at a workshop in Padua, Italy. They have already posted a paper on the popular pre-print server arXiv.org, but have declined to talk to reporters because the work has not yet been peer-reviewed. High-profile journals, including Nature, discourage researchers from talking to the press until their findings are ready for publication.

Nevertheless, scientists not directly connected with the group say that the result is impressive. "It is a major development," says Federico Capasso, an experimental physicist at Harvard University in Cambridge, Massachusetts, who has worked on similar quantum effects.

At the heart of the experiment is one of the weirdest, and most important, tenets of quantum mechanics: the principle that empty space is anything but. Quantum theory predicts that a vacuum is actually a writhing foam of particles flitting in and out of existence.

The existence of these particles is so fleeting that they are often described as virtual, yet they can have tangible effects. For example, if two mirrors are placed extremely close together, the kinds of virtual light particles, or photons, that can exist between them can be limited. The limit means that more virtual photons exist outside the mirrors than between them, creating a force that pushes the plates together. This 'Casimir force' is strong enough at short distances for scientists to physically measure it.

From virtual to real

For decades, theorists have predicted that a similar effect can be produced in a single mirror that is moving very quickly. According to theory, a mirror can absorb energy from virtual photons onto its surface and then re-emit that energy as real photons. The effect only works when the mirror is moving through a vacuum at nearly the speed of light — which is almost impossible for everyday mechanical devices.
Per Delsing, a physicist at the Chalmers University of Technology, and his colleagues circumvented this problem using a piece of quantum electronics known as a superconducting quantum interference device (SQUID), which is extraordinarily sensitive to magnetic fields.

The team fashioned a superconducting circuit in which the SQUID effectively acted as a mirror. Passing a magnetic field through the SQUID moved the mirror slightly, and switching the direction of magnetic field several billion times per second caused it to 'wiggle' at around 5% the speed of light, a speed great enough to see the effect.
The result was a shower of microwave photons shaken loose from the vacuum, the team claims. The group's analysis shows that the frequency of the photons was roughly half the frequency at which they wiggled the mirror — as was predicted by quantum theory.
Capasso calls the experiment "very clever". He doubts that the effect has any practical use because it doesn't generate large numbers of photons, but he considers it a nice demonstration of quantum mechanics. He still hopes to see a moving piece of metal generate detectable light from the vacuum, and believes that micromechanical systems may eventually be able to reach such speeds.
Pendry says that the result, if it stands up, is bound to generate excitement. "Work in this area stirs considerable passion in the breasts of physicists."

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A molecular calculator

DNA square-root solver is biggest molecular computer yet.
Zoë Corbyn

Pop quiz, hotshot: what's the square root of 13?Science Photo Library/Alamy

DNA holds the code for all living things – and now it can solve square-root problems too. Researchers have built the largest and most sophisticated system yet that performs calculations using DNA.

The design of the latest 'DNA computer' – which uses DNA molecules rather than silicon chips to perform computations — is seen as a significant advance for the field of molecular computing. It demonstrates how biochemical circuits might be built on increasingly large and complex scales, bringing the prospect of long-touted potential applications such as disease detection a step closer.

Consisting of 130 strands of DNA, it is five times more powerful than previous molecular computers. Like a conventional computer, it uses logic gates, which process incoming signals using simple rules. However, these gates are made from carefully designed DNA molecules, not silicon. The input and output signals are also made from DNA, rather than being electrical pulses. The design is published today in Science[1].

Although researchers have been making molecular computers since the mid 1990s, this is the first one to be designed using basic rules and principles that will allow bigger and more complex circuits to be constructed in the future. Previous systems were all one-off constructions.

"What's new is we have a systematic way of building biochemical circuits that works, in practice, to build larger circuits," says Erik Winfree, a computer scientist at the California Institute of Technology (Caltech) in Pasadena, who conducted the work with colleague Lulu Qian. "We don't know exactly how this will pay off, but there are groups who are actively engaged in trying to take our circuits and embed them in other chemical environments."

Leonard Adleman of the University of Southern California in Los Angeles, who is credited with inventing molecular computing in 1994, says the result is "another important step" on a journey that is seeing the "gulf between the chemistry of the laboratory and the chemistry of life" being crossed. "I am confident that research in this field will have vast ramifications," he says."But what form these will take remains to be seen."

Roots to the future

The researchers designed their circuit to find the square root of numbers up to 15 and round the answer to the nearest whole number. To calculate the square root, four DNA strands were created that each encoded one of the four digits in the binary version of the number. These input strands were then added to a test tube of salt

water containing the system of DNA logic gates, which work together in a chemical cascade to communicate the system's answer using fluorescent colours. A set of four fluorescent colours was used to communicate the two-digit binary number that was the answer. For each digit of the answer, one colour would signal a "1" while a different colour would signal a "0".
The square root was chosen simply to demonstrate the technique, says Winfree. "If you can get chemistry to do something as utterly alien as computing the square root of a four-digit binary number, then you can probably get it to do a lot of other things too," he says.

Andrew Ellington, a biochemist at the University of Texas at Austin, is already applying the design. He is looking at how, based on the Caltech team's work, a biochemical circuit could be developed to diagnose malaria – potentially leading to the development of a device that could be deployed quickly and cheaply in the field. It could calculate its answers using chemicals found in blood. "We can look at the path Qian and Winfree used and design off that," he says.
Ehud Shapiro's team at the Weizmann Institute of Science in Rehovot, Israel, who developed a molecular computer in 2004 that was theoretically able to diagnose cancer, also praised the work, describing the molecular computing system as "astonishingly complex" compared with existing systems.
But others noted the system's limitations, such as its speed of execution (it can take up to 10 hours to compute a square root) and the difficulty of achieving success in the complex environment of living organisms. "The biggest challenge will be to get this type of construction to work inside living cells," said Martyn Amos, an expert in DNA computing based at Manchester Metropolitan University, UK.

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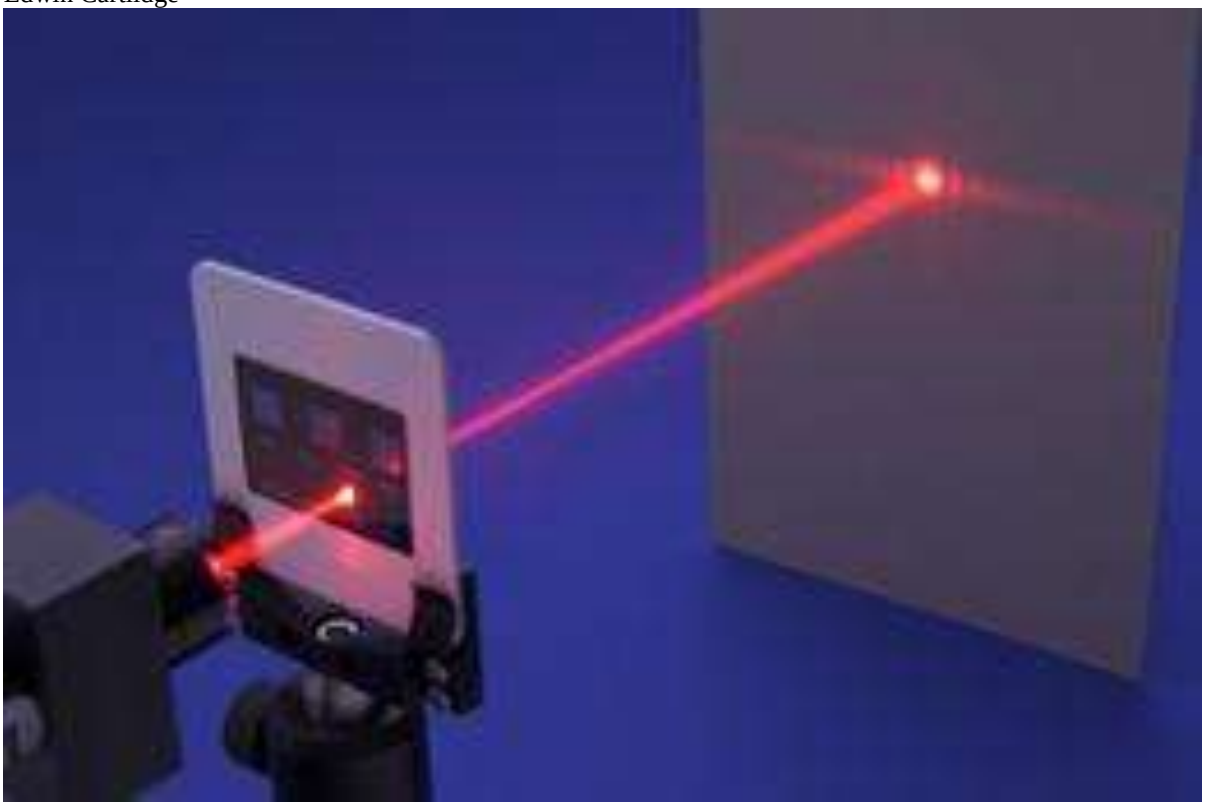
A quantum take on certainty

Physicists show that in the iconic double-slit experiment, uncertainty can be eased.

Edwin Cartlidge



The double-slit experiment shows the dual wave-particle nature of photons.GIPHOTOSTOCK/SCIENCE PHOTO LIBRARY

An international group of physicists has found a way of measuring both the position and the momentum of photons passing through the double-slit experiment, upending the idea that it is impossible to measure both properties in the lab at the same time.

In the classic double-slit experiment, first done more than 200 years ago, light waves passing through two parallel slits create a characteristic pattern of light and dark patches on a screen positioned behind the slits. The patches correspond to the points on the screen where the peaks and troughs of the waves diffracting out from the two slits combine with one another either constructively or destructively.

In the early twentieth century, physicists showed that this interference pattern was evident even when the intensity of the light was so low that photons pass through the apparatus one at a time. In other words, individual photons seem to interfere with themselves, so light exhibits both particle-like and wave-like properties.

However, placing detectors at the slits to determine which one a particle is passing through destroys the interference pattern on the screen behind. This is a manifestation of Werner Heisenberg's uncertainty principle, which states that it is not possible to precisely measure both the position (which of the two slits has been traversed) and the momentum (represented by the interference pattern) of a photon.

What quantum physicist Aephraim Steinberg of the University of Toronto in Canada and his colleagues have now shown, however, is that it is possible to precisely measure photons' position and obtain approximate information about their momentum[1], in an approach known as 'weak measurement'.

Steinberg's group sent photons one by one through a double slit by using a beam splitter and two lengths of fibre-optic cable. Then they used an electronic detector to measure the positions of photons at some distance away from the slits, and a calcite crystal in front of the detector to change the polarization of the photon, and allow them to make a very rough estimate of each photon's momentum from that change.

Average trajectory

By measuring the momentum of many photons, the researchers were able to work out the average momentum of the photons at each position on the detector. They then repeated the process at progressively greater distances from the slits, and so by "connecting the dots" were able to trace out the average trajectories of the photons. They did this while still recording an interference pattern at each detector position.

Intriguingly, the trajectories closely match those predicted by an unconventional interpretation of quantum mechanics known as pilot-wave theory, in which each particle has a well-defined trajectory that takes it through one slit while the associated wave passes through both slits. The traditional interpretation of quantum mechanics, known as the Copenhagen interpretation, dismisses the notion of trajectories, and maintains that it is meaningless to ask what value a variable, such as momentum, has if that's not what is being measured.

Steinberg stresses that his group's work does not challenge the uncertainty principle, pointing out that the results could, in principle, be predicted with standard quantum mechanics. But, he says, "it is not necessary to interpret the uncertainty principle as rigidly as we are often taught to do", arguing that other interpretations of quantum mechanics, such as the pilot-wave theory, might "help us to think in new ways".

David Deutsch of the University of Oxford, UK, is not convinced that the experiment has told us anything new about how the universe works. He says that although "it's quite cool to see strange predictions verified", the results could have been obtained simply by "calculating them using a computer and the equations of quantum mechanics".

"Experiments are only relevant in science when they are crucial tests between at least two good explanatory theories," Deutsch says. "Here, there was only one, namely that the equations of quantum mechanics really do describe reality."

But Steinberg thinks his work could have practical applications. He believes it could help to improve logic gates for quantum computers, by allowing the gates to repeat an operation deemed to have failed previously.

"Under the normal interpretation of quantum mechanics we can't pose the question of what happened at an earlier time," he says. "We need something like weak measurement to even pose this question."

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Female australopiths seek brave new world

Teeth from ancient human ancestors suggest that females joined new social groups once they reached maturity.

Ewen Callaway

"Mrs Ples", the most famous example of Australopithecus africanus from Sterkfontein cave in South Africa, probably grew up far from the cave where she died.Darryl de Ruiter

Fossilized teeth of early human ancestors bear signs that females left their families when they came of age, whereas males stayed close to home.

A chemical analysis of australopithecine fossils ranging between roughly 1.8 million and 2.2 million years old from two South African caves finds that teeth thought to belong to females are more likely to have incorporated minerals from a distant region during formation than those from males.

"What that's telling us is that the females grew up somewhere else and they died in the caves," says Julia Lee-Thorp, an archaeological scientist at the University of Oxford, UK, and a co-author on the study, published today in Nature[1]. "It's a very small clue, but it's something that is at least hard evidence for what we really didn't have before."

The shape of ancient human families has been the subject of speculation, based mainly on differences in the relative size of male and female fossils, and the behavioural patterns of our primate relatives. Female chimpanzees, for instance, typically leave their social group once they hit maturity. Among gorilla groups, which are dominated by one large male 'silverback', both males and females tend to strike out.

Modern humans, who are influenced by relatively recent cultural practices such as marriage and property ownership, are difficult to compare to our early ancestors, lead author Sandi Copeland of the University of Colorado at Boulder said in a press briefing.

Forensic dentistry

Lee-Thorp and her colleagues measured the levels of two isotopes of strontium, an element found in soil. This is taken up by plants and then snakes its way up the food chain into the growing bones of animals. The ratio of two strontium isotopes in bones or teeth provides a signature of the local environment in which an animal grew up, Lee-Thorp says. "It's a kind of forensic tool."

Her team measured the strontium isotope ratios in canine and third molar teeth — which are formed by about the age of eight — in eleven Paranthropus robustus individuals from the Swartkrans cave, as well as in teeth from eight Australopithecus africanus individuals from the nearby Sterkfontein cave, about 50 kilometres northwest of Johannesburg. The researchers also measured the strontium in 170 plants and animals currently living near the caves to get a sense of the different strontium signatures of the region, including the thin Malmani dolomite formation that includes both caves.

They discovered that larger teeth — ostensibly from bigger-bodied males — of both species were much more likely to share the strontium signature of dolomite-dwellers than the smaller teeth of female australopiths. About 90% of the larger teeth looked local, compared with less than half of the smaller teeth. The best explanation for this pattern is one in which females left their clan once they reached maturity, say Lee-Thorp and her colleagues.

Alternatively, males could also have left their home groups, but stuck to the band of dolomite that extends to the northeast and southwest of the two caves, she says.

Gorillas in the mists of time

"I must say that the hypothesis is interesting," says Jacopo Moggi-Cecchi, a palaeoanthropologist at the University of Florence in Italy, "but I think the numbers and the samples that they have are not large enough to prove it." Moggi-Cecchi's team reported in 2007 that P. robustus males develop over a longer period than females, a pattern echoing that seen in gorillas, in which large males fight for near-exclusive access to females[2].

However, Owen Lovejoy, an anatomist at Kent State University in Ohio, says that a gorilla-like society, in which both males and females join new social groups, wouldn't have worked for early human ancestors. New males are likely to turn aggressive once they join a new group, risking the lives of infants and juveniles, he says. A society in which females left their homes is much more likely for early human ancestors, he says.

Lee-Thorp says that her team would like to get its hands on more australopithecine fossils from South Africa, but the destructive nature of the strontium tests and the paucity of fossils make that unlikely. Her team is also interested in asking similar questions about human ancestors from East Africa, as well as later species of hominin, such as Homo erectus.

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Subterranean worms from hell

New species of nematode discovered more than a kilometre underground.
Nadia Drake

Halicephalobus mephisto lives deep underground where it feeds on colonies of bacteria.Property of the University of Ghent, Belgium - Gaetan Borgonie

The discovery of multicellular creatures from the deepest mines sounds like something from the pages of J. R. R. Tolkien. But scientists have now found four species of nematode, or roundworm, lurking in South Africa's gold mines at depths where only single-celled bacteria were thought to reside. And at least one of them, Halicephalobus mephisto, has never been described before.

The 0.5-millimetre-long H. mephisto, named in reference to the light-hating demon of the underworld, feeds on films of bacteria that grow more than a kilometre down within the warm walls of the Beatrix gold mine, located some 240 kilometres southwest of Johannesburg.

"It's like 1 million times the size of the bacteria it eats — sort of like finding Moby Dick in Lake Ontario," says Tullis Onstott, a geomicrobiologist at Princeton University in New Jersey and a co-author of the study, which is published today in Nature[1].

Deep dwellers

Previously, nematodes had been found nearer the surface, with only bacterial populations living deeper down[2,3]. But the authors discovered H. mephisto existing happily at 1.3 km down — at which depth the temperature reaches around 37 °C, higher than most terrestrial nematodes can tolerate.

Different South African mines revealed other deep-dwelling roundworms. Two nematode species — one identified as Plectus aquatilis and one unknown species from the Monhysterid order — were found in the Driefontein mines at a depth of 0.9 km at 24 °C. The authors also recovered DNA from a second unknown monhysterid species in the Tau Tona mine, 3.6 kilometres down, where temperatures hover around 48 °C.

Finding the worms surprised even the study's authors. "When I proposed to look in the deep underground, this was a complete 'out of the box' idea," says nematologist Gaetan Borgonie, of the University of Ghent in Belgium. "It doesn't happen often that you can redraw the boundaries of a biosphere on a planet."

"That depth? Those temperatures? This is incredible," says Diana Wall, a soil ecologist at Colorado State University in Fort Collins, who studies antarctic nematodes.

'Big snot layers'

In their mine habitat, the worms munch on bacteria living in biofilms — "big, snot layers of gelatinous goo," explains Onstott. The biofilms form in the mine walls near boreholes, where the rock is fractured using jets of water. After culturing the worms in the lab, the team found that the nematodes preferred snacking on indigenous bacteria from the mine, suggesting that the communities are well established.

"That the worms are feeding and grazing on bacteria — and not on something that's a common bacterial species — means there is a fully functioning ecosystem at this depth," Wall says. Although she notes that the phenomenon is striking, she points out it is still unclear how prevalent these communities are.

To search for these subsurface communities of organisms, the researchers filtered and trapped biological material in the water pouring from boreholes — catching nematodes, bacteria and DNA. Genetic analyses confirmed the novelty of H. mephisto, which has a ribosomal RNA sequence and body shape that differ from its closest relatives.

To rule out contamination from the surface, the team tested thousands of litres of water used in the mining operations, and analysed nematodes in the soil near the boreholes. They found no worms in the water, and different species in the soils.

Elderly residents?

Microbiologist Karsten Pedersen at the University of Gothenburg, Sweden, says that the authors have done a good job arguing that the worms are residents of the deep Earth, but points out that it is still unclear how long they've lived there.

Onstott and his team would like to continue studying Earth's deep spots for the presence of multicellular life forms, viruses and complex communities. They'd also like to sequence the genomes of the recovered South African organisms. "That could tell us a lot about evolution," Onstott says. "Is H. mephisto endowed with any special capabilities? Is it more primitive? Has it acquired attributes that imply adaptation and evolution in the subsurface?"

"I doubt this nematode sprang from hell," says evolutionary biologist Byron Adams of Brigham Young University in Provo, Utah, referring to the new worm's name. "It more likely evolved at Earth's surface with the rest of the Nematoda. At some point they made their way down and with a few genetic refinements found themselves capable of doing just fine."

The presence of multicellular life in the harsh environment of the mine walls — oxygen-starved, hot and inhospitable — not only expands the sphere in which life might exist on Earth, but on other planets as well. "Now the deep subsurface of Mars looks very interesting," says Michael Meyer, lead scientist for NASA's Mars Exploration Program. "The Universe might have many more habitats than we thought."

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Sarcasm Boosts Creativity? Yeah, Right.

New research from Israel suggests exposure to sarcasm may enhance creative thinking.
By Tom Jacobs

Can sarcastic expressions of anger help boost creativity? Uh, yeah. Duh! Or so researchers say. They found that direct expressions of anger may inhibit the ability to deal with complex tasks. (istockphoto.com)

Although it's frowned upon in business school, some managers think of anger as a motivational tool. Employees aware that an impatient customer is seething, or the boss is near the boiling point, work more quickly and efficiently, don't they?

Newly published research from Israel suggests this blow-your-stack strategy can produce the desired results — but only when workers are performing relatively simple tasks. If their job requires creative problem-solving, the catalyst you crave may be caustic contempt.

"Sarcastic expressions of anger, in contrast to direct expressions, can have a positive effect on complex thinking and on solving of creative problems," a research team led by psychologist Ella Miron-Spektor of Bar-Ilan University reports in the *Journal of Applied Psychology.* Its study suggests anger can motivate employees to think creatively, so long as it is expressed "with some irony and humor."

Evidence for this conclusion can be found in three experiments, one of which featured 184 undergraduate engineering students. They began by listening to one of three messages purportedly left on a business' customer service line. All featured customers complaining that the company only makes deliveries at an inconvenient time of day — between 9 a.m. and noon.

The first message "featured hostile language and negative intonation," including the outburst "This is an outrage!" The second message "combined positive language and negative intonation," such as "These hours are just 'perfect' for working people!" The third message featured neutral language delivered without emotion ("I am at work doing those hours").

The participants then were asked to solve a series of creative problems (in which they identified associations between three seemingly unrelated words) and analytic problems (in which they determined whether pairs of meaningless letter strings were identical).

Those who had heard the angry complaint scored highest on the analytic test, slightly ahead of the other two groups. But they came in last on the creativity test. When imaginative leaps were required, those exposed to the sarcastic message far outperformed the others.

So different ways of expressing exasperation produced different results. Exposure to direct anger can motivate people performing "simple and well-rehearsed tasks," the researchers write. But that sort of raw rage "may disable one's ability to integrate information that is seemingly unrelated to the situation at hand," inhibiting the performance of more complex work.

This counterproductive effect evaporates when the anger is expressed indirectly via thinly veiled scorn. As Miron-Spektor and her colleagues put it: "The incongruent information inherent in sarcasm appears to stimulate complex thinking and to attenuate the otherwise negative effects of anger."

Who knew Lewis Black was a management guru?

"It is improbable that anger can be completely removed from organizations," the researchers note, "so our findings call for careful attention of supervisors and customers to the way that felt anger is expressed." Of course, not everyone is a manager, but we're all customers at some point.

So the next time your bank screws up your statement, don't chew out that customer service representative — who, after all, may be able to figure out a way to fix your problem. Better to adopt a snarky tone of voice and insist you have no real need for that money, since you've always wondered what it's like to be homeless. And if that evokes a prickly response, just repeat the sage mantra of Steve Martin: "Well, excuuuuuse me!"

http://www.miller-mccune.com/culture-society/sarcasm-boosts-creativity-yeah-right-31754/

You Are What You (Think) You Eat

New research reveals why food labeled "healthy" is unsatisfying.
By Tom Jacobs

The "healthy" backlash? Research from Yale suggests a key hormone associated with the feeling of satiety responds far more dramatically when people think they are consuming an indulgent treat. These findings may help in the fight against obesity. (istockphoto.com)

After eating food marketed as "low-fat" or "guilt-free," do you still feel hungry? If so, don't blame the food: Blame the label.

A key hormone associated with the feeling of satiety responds far more dramatically when people think they are consuming an indulgent treat. That's the conclusion of newly published research from Yale University, which finds what we tell ourselves about the food we eat affects the point at which we start feeling full.

The study, tastily titled "Mind Over Milkshakes" has weighty implications for the campaign against obesity. Its findings suggest labeling foods as healthy may be counterproductive, since doing so apparently produces an unwanted and unhelpful physical response.

Writing in the journal *Health Psychology*, a research team led by Yale psychologist Alia Crum describe an experiment featuring 46 participants. A reasonably diverse group, its subjects ranged in age from 18 to 35, and in body size from normal to overweight. They participated in two 2.5-hour sessions, which took place precisely one week apart.

"At the first session, participants were told that that the metabolic kitchen at the Yale Center for Clinical Investigation was working on designing two different milkshakes with different nutrient content, and that they would taste one milkshake in the first week and another milkshake the following week," the researchers write. "They were told the goal of the study was to evaluate whether the milkshakes tasted similar, and to examine the body's reaction to the different nutrients (high versus low fat, high versus low sugar, etc.).

"Unknown to the participants, however, the contents of the two milkshakes were identical. However, the labels depicting these beverages differed."

During one of the two sessions, participants taste-tested a shake described as high fat and high calorie; the label called featured the word "indulgence" and the slogan "decadence you deserve." During the other session, the shake was described as low fat and low calorie; the label boasted about "guilt-free satisfaction."
Blood samples were drawn from each participant 20, 60 and 90 minutes into each session. "During the first interval (between 20 and 60 minutes), participants were asked to view and rate the label of the shake," Crum and her colleagues note. "During the second interval (between 60 and 90minutes), participants were asked to drink and rate the milkshake."
Via the blood samples, the researchers tested the participants' level of ghrelin, a gut peptide that has been called "the hunger hormone."
"When energy intake is low, or the stomach is empty, ghrelin is secreted from the endocrine cells of the stomach and transported in the bloodstream to the brain, where it binds with receptors … to produce the sensation of hunger," the researchers write. "As energy intake increases and nutrients are detected in the gastrointestinal tract, ghrelin levels are suppressed, thereby signaling to the brain" to produce a feeling of satiety.
At least, that's the way it's supposed to work. This study suggests our expectations can short-circuit this crucial process.
"When participants drank the indulgent shake, they had a significantly steeper decline in ghrelin than when they drank the (physically identical) sensible shake," the researchers found. "(Their) level of ghrelin reflected a moderate level of physiological craving, followed by a significant level of physiological satiety.
"On the other hand, when drinking the shake in a sensible mindset, participants exhibited flat or slightly increased levels of ghrelin over the course of consumption, suggesting that, despite consuming the same nutrient contents, they were not physiologically satisfied."
These results are "consistent with what one might observe if participants actually consumed beverages with different caloric counts," the researchers note. "Participants' satiety was consistent with what they believed they were consuming, rather than the actual nutritional value of what they consumed."
Think of it as the evil twin of the placebo effect.
While much research remains to be done, these results suggest labeling food as "good for you" may produce a destructive backlash. The researchers are particularly troubled by the not-uncommon practice of putting health claims on the labels of not-particularly-healthy foods.
"This juxtaposition … may be especially dangerous," they write. The misleading label may inhibit the onset of the feeling of fullness, prompting people to eat more of the unhealthy food.
"Perhaps if we can begin to approach even the healthiest foods with a mindset of indulgence," Crum and her colleagues conclude, "we will experience the physiological satisfaction of having had our cake and eaten it, too."
Of course, that would require a radical redefinition of a decadent dish. Anyone for a scrumptious serving of spinach?

http://www.miller-mccune.com/culture-society/you-are-what-you-think-you-eat-31406/

Can Watching 'Jackass' Turn You Into One?

Did you see that movie about the moron? If so, it may have negatively impacted your own intelligence, according to new research from Austria.
By Tom Jacobs

You are what you watch — or so suggests new research that linked a lowering of general knowledge to exposure to idiotic behavior in the narrative form. (Paramount/Wikipedia)

From reality television to dumb-and-dumber films, contemporary entertainment often amounts to watching stupid people do stupid things. New research suggests such seemingly innocuous diversions should have their own rating: LYI.
As in: Watching this may Lower Your Intelligence.
A study from Austria published in the journal *Media Psychology* found students performed less well on a general-knowledge test if they had just read a short screenplay about an idiotic thug. This suggests stupidity may indeed be contagious — particularly if it is presented in narrative form.
The research by University of Linz psychologist Markus Appel is the latest to explore the behavioral consequences of media exposure. As we've reported, a large body of scholarship has linked the playing of violent video games with increased levels of physical aggression.
With video games, of course, the player is literally in the center of the action. But as Appel points out, something similar occurs with traditional storytelling, as readers or viewers identify with the characters. His study is the first to find such identification can apparently impact cognitive performance.
Appel's experiment featured 81 students at an Austrian university (mean age of 26). Some of them read a four-page screenplay in which the characters' intellectual abilities could not be determined. Others read either a two- or four-page screenplay focused on a "xenophobic and aggressive soccer hooligan."
Half of those who read the story about the thug — who spends his time picking fights and getting drunk — were given special instructions beforehand.

"While reading this movie script," they were told, "it is your job to make clear differences between yourself and the main character." Specifically, they were asked to underline all passages in the text where the central character acted in a way they would not.

Afterward, all the participants completed a challenging multiple-choice test measuring general knowledge. The 30 questions focused on a variety of topics, from geography to physics to art.

Those who read the thug-centric story, and received no special prompting, scored significantly lower on the test than those who read the neutral story. But for those who were instructed to note the differences between themselves and the central character, this difference evaporated.

"Our results indicate that the recipients' mindset critically determines priming outcomes," Appel writes. Those who consciously distanced themselves from the character avoided the unfortunate results of identifying with him.

This was a small study, and one could argue that a test of general knowledge isn't the same as a test of intelligence. And there's no reason to think this contagion is long-lasting.

But the results support the notion, proposed by S. Christian Wheeler of Stanford University, that while a portion our self-concept is stable and unchanging, another portion fluctuates in response to environmental cues. As we noted a few months ago, exposure to cleanliness-related products such as hand sanitizers seems to prompt support for political conservatism.

The research raises the intriguing question of whether this effect would work in reverse. Does reading about or watching an extremely smart character — say, Hugh Laurie's *House* — produce a spike in intelligence? Hard to say, but if you have some complex thinking to do, you might want to pop an episode of the drama into the DVD an hour ahead of time.

"Narratives tend to make people 'walk in someone else's shoes,'" Appel notes. Since that experience can be temporarily transformative, you might want to make sure the characters you follow have IQs higher than their shoe size.

http://www.miller-mccune.com/culture-society/can-watching-jackass-turn-you-into-one-31924/

A new eye on biodiversity

Airborne observatory will use chemical clues to map and assess tropical ecosystems.
Jeff Tollefson

A three-dimensional image of a forest in Panama, based on data from the Carnegie Airborne Observatory. The retooled observatory will be far more sensitive.CAO/CARNEGIE INST. FOR SCIENCE

For tropical ecologist Greg Asner, it's all about seeing the forest through its trees. Over the past two years, he and his team at the Carnegie Institution for Science in Stanford, California, have used world-class tree climbers, bows and arrows, and even shotguns to gather samples of vegetation from forest canopies around the globe. They have created a digital catalogue of the chemical and optical properties of some 4,700 plant species in different conditions. Now comes the moment of truth.

On 2 June, Asner and his team will unveil the latest version of the Carnegie Airborne Observatory (CAO), an aircraft that will combine a state-of-the-art optical sensor with a laser capable of mapping forests in unprecedented three-dimensional detail. The system will allow Asner to build on earlier work cataloguing forest carbon stocks in support of efforts to reduce deforestation (see 'Taking stock of global carbon'), and will significantly advance the team's biodiversity research. With the digital catalogue as a reference, Asner hopes that the observatory will be able to perceive the species of many individual trees by their optical properties, while offering insights into forest health and diversity.

The team's work combines physics, biochemistry and ecology, beginning with measuring subtle differences in the way the forest canopy absorbs and reflects solar radiation. The signal varies depending on the leaves' concentrations of nutrients, minerals, pigments such as chlorophyll, and the compounds that plants use to protect themselves against the Sun and predators. In specimens from one region of the Amazon rainforest in southern Peru, Asner and his wife, Robin Martin, identified 21 spectral traits that provided identifying signals for 90% of the species. "A lot of people look at trees and just see green," says Asner. "I see a kaleidoscope."

The heart of the CAO's US$8.3-million sensing system — dubbed the Airborne Taxonomic Mapping System (AToMS) — is a spectroscopic imager designed by engineers at NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California. Capable of registering more than 400 frequencies of light, from ultraviolet to infrared, the instrument will take 60,000 measurements per second, with great accuracy. "This really has taken everything we have learned at NASA and brought it to bear in the most advanced airborne imaging spectrometer ever built," says Rob Green, lead engineer on the project at the JPL.

With data from a single flight that used an earlier version of the system, Asner and his colleagues identified more than 30 species. The latest technology, he says, will be three to six times more sensitive, and should enable the detection of many more plants.

No one can say for certain what the implications of these new data might be, but ecologists — many of whom have spent decades tramping through the jungle in muddy boots — are lining up to find out. "It is going to

change a variety of fields of tropical ecology," says Alan Townsend, an ecologist at the University of Colorado at Boulder. "How much and in what ways we don't really know, but there is no doubt that we are starting to walk down a new path."

Peter Vitousek, an ecologist at Stanford University in California, says that he started off with the same mindset as many of his colleagues: suspicion of yet another over-hyped remote-sensing technology. On his first collaboration with Asner on a project in Hawaii several years ago, however, Vitousek saw how remote-sensing data could be used to identify invasive species and to tease out relationships among plants. After the aerial data identified areas in which the canopy was unusually depleted of nitrogen, the team went in on the ground and discovered that an invasive ginger plant was competing with native trees for the nutrient. Here was a case in which the spectral data themselves led the researchers to discover an ecological interaction, rather than simply confirming data gathered on the ground, says Vitousek. "I needed to be persuaded that this was really something new, and that persuaded me."

Asner is set to fly the CAO to the Amazon later this month, with a dual research focus. One goal is to survey the rainforest to gauge the impact of last year's drought, which seems to have been even more severe and widespread than that of 2005 — the worst event of its kind for 100 years, and one that scientists are still studying. The other is to fly over plots monitored by the Amazon Forest Inventory Network (RAINFOR) to address a nagging question: how representative are the areas that scientists have been studying for decades?

RAINFOR tracks long-term data on soil and plant growth, but Asner's information will provide unprecedented detail on the chemistry of leaves in the canopy. The ground plots provide a record of how each tree in the area fared through the drought, and Asner's crew should be able to pick those trees out of their broader analysis to look for any lingering effects. "The hypothesis is that those trees that have suffered during the drought also have different canopy chemistry," says Oliver Phillips, an ecologist at the University of Leeds, UK, who coordinates RAINFOR. "It's very exciting," he says. "But we'll see how it pans out."

Asner also has his own agenda, which begins with mapping out tropical biodiversity. "One thing is for sure: the array of chemical traits in these upper canopies is amazing and radically under-appreciated," he says. "We are going to use that to our advantage to get canopy diversity mapped."

http://www.nature.com/news/2011/110601/full/474013a.html

Value of disease clues often exaggerated

Biomarkers revealed as red herrings are still treated like smoking guns.
Heidi Ledford

Researchers tend to cite the strongest evidence for their claims about biomarkers such as gene activation, while ignoring more negative results.Alan Laver, Shelley Communications

An analysis of nearly three-dozen highly cited papers has found that researchers often overstate the link between biomarkers and disease by citing papers that report the strongest association, even when subsequent analyses downplay the connection.

Biomarkers are biological characteristics, such as the activity of a gene or protein, which can be used to monitor a person's health. They are key to the success of personalized medicine: biomarkers may predict whether a person is likely to develop a disease and how they will respond to a given treatment.

But researchers have struggled to develop reliable biomarkers, and the field is riddled with biological tags that initially showed promise, only to crumble under further scrutiny.

"There is a huge literature, with thousands of studies being published every year and with lots of highly promising claims being made in prestigious journals," says John Ioannidis, an epidemiologist at Stanford University in California. "Yet very few make it to the clinic."

Now, in a study published today by the Journal of the American Medical Association[1], Ioannidis and his colleague Orestis Panagiotou of the University of Ioannina in Greece, show that researchers often perpetuate the hype surrounding a biomarker even after larger studies, or meta-analyses of multiple studies, have undercut its significance.

"This is not just anecdotal," agrees Patrick Bossuyt, an epidemiologist at the University of Amsterdam in the Netherlands who was not involved in the study. "It occurs very frequently."

Wishful thinking

Ioannidis has himself published papers linking promising biomarkers to disease, only to learn later that the association failed to hold up. The experience, he says, sensitized him to the need for rigorous testing.

In the current analysis, Ioannidis and Panagiotou focused on a set of two-dozen frequently cited biomedical journals. They selected biomarker papers that had been cited more than 400 times, and then narrowed the group down to those that had been included in a subsequent meta-analysis incorporating multiple studies of that same biomarker. These meta-analyses provided a way to compare the highly cited paper with other studies.

Of the 35 studies that met their selection criteria, 29 demonstrated a stronger link between biomarker and disease than the subsequent meta-analysis. And 30 reported a stronger association than observed in the largest single study of the same biomarker.

For example, a 1991 study that was cited 1,436 times found that patients with a high level of a compound called homocysteine in their blood had a 27.7-fold elevated risk for vascular disease. But a meta-analysis reported only a 1.58-fold increased risk.
"Many investigators are citing the studies that have the most optimistic results,"says Ioannidis. "There's clearly a very strong citation bias."

Bias cut

That is probably so, agrees Bossuyt. But, he adds, the study may have inflated the frequency with which this occurs.

Bossuyt notes that researchers often conduct meta-analyses when studies yield conflicting results. By selecting only those studies that received this treatment, Ioannidis and Panagiotou may have biased their sample towards biomarkers that did not hold up to subsequent testing.
Furthermore, Bossuyt notes that in some cases the highly cited study may have used a different patient population than other studies of the same marker. For example, an experiment comparing a biomarker in healthy controls versus patients with advanced Alzheimer's disease may find a stronger link than one involving patients with only mild cognitive impairment.
Nevertheless, Bossuyt does not doubt that researchers are biased both in what they publish and what they cite: "In all of science, there is an emphasis on the positive and the surprise."

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- http://www.nature.com/news/2011/110531/full/news.2011.334.html

Roman ship had on-board fish tank

Hand-operated pump would have kept catch alive during long trips.
Jo Marchant

This lead tube is all that remains of what could have been a tank for transporting live fish.D. Gaddi / The Nautical Archaeology Society

A Roman ship found with a lead pipe piercing its hull has mystified archaeologists. Italian researchers now suggest that the pipe was part of an ingenious pumping system, designed to feed on-board fish tanks with a continuous supply of oxygenated water. Their analysis has been published online in the International Journal of Nautical Archaeology[1].

Historians have assumed that in ancient times fresh fish were eaten close to where they were caught, because without refrigeration they would have rotted during transportation. But if the latest theory is correct, Roman ships could have carried live fish to buyers across the Mediterranean Sea.

The wrecked ship, which dates from the second century AD, was discovered six miles off the coast of Grado in northeastern Italy, in 1986. It was recovered in pieces in 1999 and is now held in the Museum of Underwater Archaeology in Grado. A small trade ship around 16.5 metres long, the vessel was carrying hundreds of vase-like containers that held processed fish, including sardines and salted mackerel.

Carlo Beltrame, a marine archaeologist at the Ca' Foscari University of Venice in Italy, and his colleagues have been trying to make sense of one bizarre feature of the wreck: a lead pipe near the stern that ends in a hole through the hull. The surviving pipe is 1.3 metres long, and 7–10 centimetres in diameter.

The team concludes that the pipe must have been connected to a piston pump, in which a hand-operated lever moves pistons up and down inside a pair of pipes. One-way valves ensure that water is pushed from one reservoir into another. The Romans had access to such technology, although it hasn't been seen before on their ships, and the pump itself hasn't been recovered from the Grado wreck.

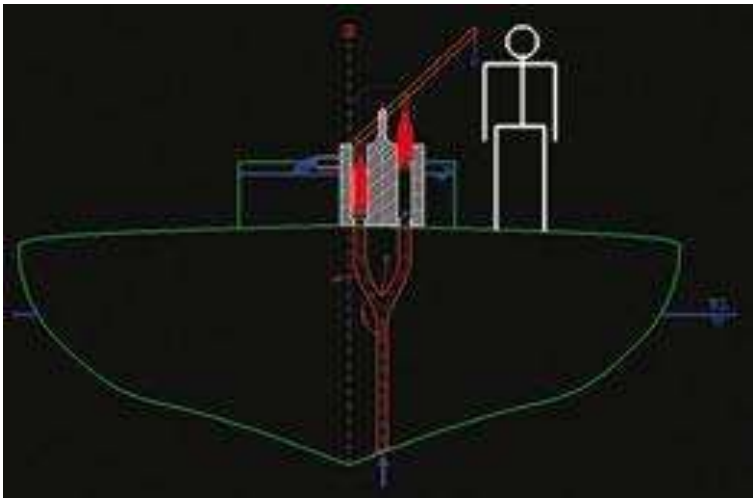
Section of the ship with the hypothetical hydraulic system to fill the vivarium.S. Parizzi / The Nautical Archaeology Society

Archaeologists have previously suggested that a piston pump could have collected bilge water from the bottom of the boat, emptying it through the hole in the hull. But Beltrame points out that chain pumps — in which buckets attached to a looped chain scooped up bilge water and tipped it over the side — were much safer and commonly used for this purpose in ancient times. "No seaman would have drilled a hole in the keel, creating a potential way for water to enter the hull, unless there was a very powerful reason to do so," he writes.

Another possible use is to pump sea water into the boat, to wash the decks or fight fires. A similar system was used on Horatio Nelson's flagship, HMS Victory, in the eighteenth and nineteenth centuries. But Beltrame and his colleagues argue that the Grado wreck wasn't big enough to make this worthwhile. They say that the ship's involvement in the fish trade suggests a very different purpose for the pump — to supply a fish tank.

Fast turnover

The researchers calculate that a ship the size of the Grado wreck could have held a tank containing around 4 cubic metres of water. This could have housed 200 kilograms of live fish, such as sea bass or sea bream. To keep the fish alive with a constant oxygen supply, the water in the tank would need to be replaced once every half an hour. The researchers estimate that the piston pump could have supported a flow of 252 litres per minute, allowing the water to be replaced in just 16 minutes.
Tracey Rihll, a historian of ancient Greek and Roman technology at Swansea University, UK, cautions that there is no direct evidence for a fish tank. The researchers "dismiss fire-extinguisher and deck-washing functions too easily in my view", she says. But although no trace of the tank itself remains, Rihll says the pipe could have been used for such a purpose in the ship's younger days. Literary and archaeological evidence suggests that live fish were indeed transported by the Greeks and Romans "on a small but significant scale", she adds.



The first-century Roman naturalist Pliny the Elder wrote that parrotfish taken from the Black Sea were transported to the Neopolitan coast, where they were introduced into the sea. And the second- and third-century Greek writer Athenaeus described an enormous ship called the Syracousia, which supposedly had a lead-lined saltwater tank to carry fish for use by the cook.
However, a fish tank on board a small cargo ship such as the Grado wreck might mean that transport of live fish was a routine part of Roman trade, allowing the rich to feast on fish from remote locations or carrying fish shorter distances from farms to local markets.
"It would change completely our idea of the fish market in antiquity," says Beltrame. "We thought that fish must have been eaten near the harbours where the fishing boats arrived. With this system it could be transported everywhere."

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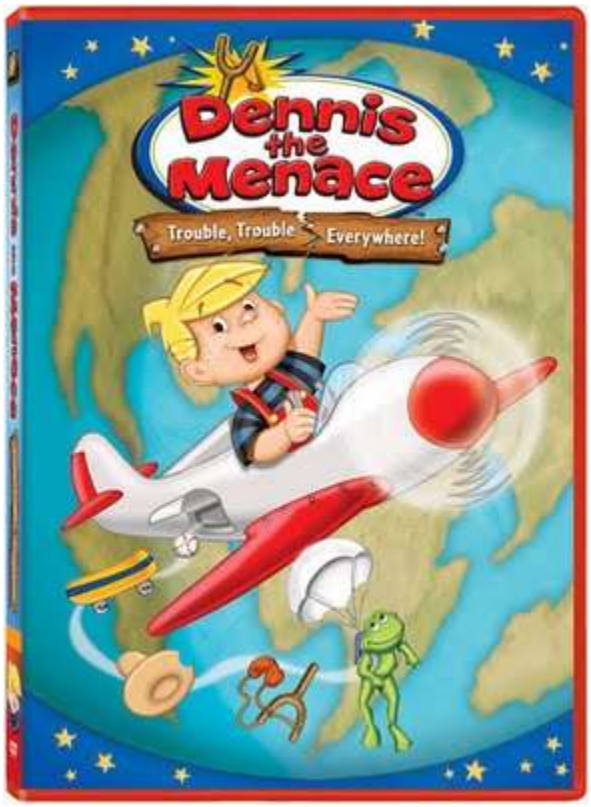
Comic Study

Posted: 06 Jun 2011 12:06 PM PDT



Scotland's Dundee University will be the first school in the United Kingdom to offer a masters degree in Comic Studies.

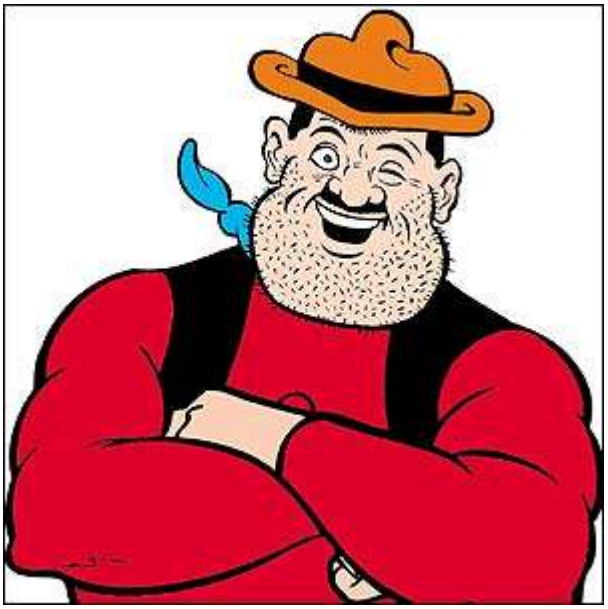
Why Dundee? For starters it is the home of the publisher DC Thomson and Co. whose creations include Dennis the Menace, Desperate Dan and the Broons.

The Broons

The program will be lead by Dr. Chris Murray, a leading authority on comics, and editor of the Studies in Comics journal.

Of the program Murray says:

"Employability is an important consideration for any postgraduate programme, and it lies at the heart of what we aim to do with this course. "There will be practical advice on publishing and developing a career as a comics scholar, writer or artist, and we hope to arrange work placements for students."



Desperate Dan

In the US the University of Florida offers advanced degrees in Comic Studies through the Department of English.

Story at the BBC, Dundee University launches degree in comic books.
Gnashing Cow Pie on Bash Street, piece written by Murray on the comic heritage of Dundee.

http://feedproxy.google.com/~r/BookPatrol/~3/hrfv6wt0PjU/comic-study.html?utm_source=feedburner&utm_medium=email

After 90 years, U. of C. completes dictionary documenting humanity's earliest days

BY KARA SPAK Staff Reporter/kspak@suntimes.com Jun 4, 2011 12:12AM

University of Chicago scholars began poring over the clay tablets 90 years ago in their quest to compile the Chicago Assyrian Dictionary. Martha Roth (right) has headed the project since 1996. | John H. White~Sun-Times photos

Love notes and divorce papers. Accounting ledgers and legal briefs. Omens, letters between kings, thoughts on the benefits of flaxseed and the fortune-telling properties of sheep livers.

All were carved in stone or written in cuneiform on clay tablets in ancient Mesopotamia — the cradle of human civilization — between 2500 BC and AD 100. Scholars at the University of Chicago have worked for nearly a century on a comprehensive guide for those reading the ancient language in which some of the earliest days of human history were written.

Ninety years in the making, the 21-volume, 28,000-word Chicago Assyrian Dictionary is complete. Started in 1921, the dictionary was created over the years by about 85 employees writing on millions of index cards in up to five large offices at the school's Oriental Institute at University Avenue and 58th Street.

The first volume was published in 1956. Forty years after that, the current editor saw the beginning of the end.

"My goal since I took over in 1996 as the editor in charge was to bring the project to an end, not keep it going," said Martha Roth. "My way of understanding my job was to complete it."

The dictionary project was started by Oriental Institute founder James Henry Breasted, a Middle Eastern archeologist who envisioned the Chicago school being able to "recover the lost story of the rise of man."

Organized more like an encyclopedia, the dictionary is a primary source used by scholars, students or any one researching ancient Mesopotamia. While it's called the Chicago Assyrian Dictionary, the Assyrian language is a dialect of Akkadian, another Semitic language. All Akkadian dialects are included in the Chicago dictionary.

While Roth has been the project's editor since 1996, she first started working on the dictionary in 1979 as a post-doctorate with a "brand new PhD in Assyriology." Her degree was from the University of Pennsylvania, where she worked on a Sumerian dictionary project inspired by the Chicago Assyrian dictionary.

Roth joined the U. of C. faculty in 1980 and in 1996, she was named the dictionary's editor. She said she never found the project overwhelming — though the end of the project came as an "abrupt jolt."

"It's hard for many people to understand the kind of stick-to-it this kind of project takes," she said. "It's not just this current world where everyone's attention span is short. Many people like to dabble in things. They don't like to sit for hours."

Or in her case, years. Spending time developing the entries brought her a rare depth of insight and diversity of scholarship, she said.

"Usually a scholar will specialize in a particular genre or period," she said. "When you work on a project like this dictionary project, it's like basically being in an intellectual smorgasbord. You're sampling things all the time."

At various points during the project's long history, scholars tried to modernize the process, including attempting to put portions of the project on IBM hole punch cards in the 1960s. Transferring all the cards onto computers would have taken decades, Roth said. Instead, they now are going into a safe archive.

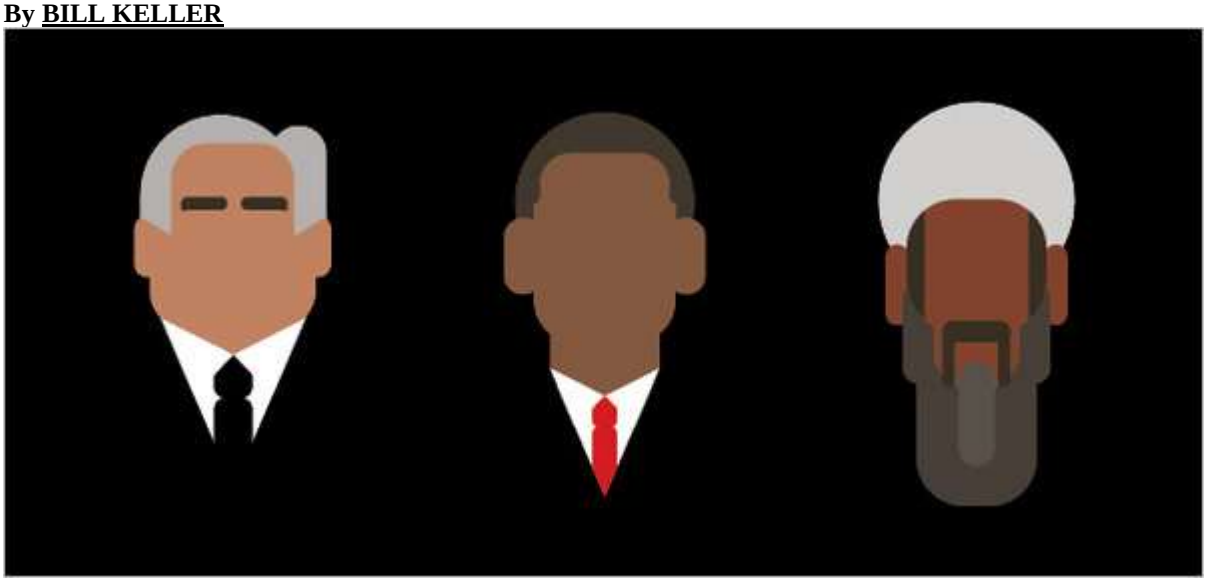
For Roth, now that the dictionary is complete, there won't be any celebratory vacation to lands near the Fertile Crescent. She's still working as a professor as well as dean of humanities and doesn't anticipate her schedule freeing up.

"You don't retire from being an Assyriologist," she said. "I've always been engaged in working in legal history and now I'm able to spend more time with that. I look forward to it."

http://www.suntimes.com/news/5737867-417/after-90-years-u.-of-c.-completes-dictionary-documenting-humanitys-earliest-days

A Theory of Conspiracy Theories

By BILL KELLER



James Joyce

Dear Mr. Keller: Last night on the "PBS NewsHour," they had a story about some Los Angeles Times reporters who uncovered corruption in a nearby, small city in California. The newspaper eventually received a Pulitzer Prize. That is what you can have if you will talk with me. Within one hour, I will convince you and your staff that Lee Oswald did not assassinate President Kennedy. Then, I will give you the evidence for the real killers, and how the cover up could be perpetrated. It is a great story, fully documented and supported with facts, many from the Warren Commission itself!!

That e-mail landed a few weeks ago. Even if you are a card-carrying member of the reality-based community, even if you regard the liberal use of exclamation points as a symptom of emotional instability, there is a little voice, a very, very little voice, that whispers, in the few seconds before you push "delete": "What if he's right? There's always been something fishy about that assassination. What if the e-mail I am reflexively sending to the trash file is the story of a lifetime?"

Humans live along a continuum from doubt to faith. Wander far enough in the direction of faith and you reach the land of Nostradamus and of the Rapture (recently postponed). Wander too far in the other direction, past cynicism, through misanthropy, and you get to more or less the same zone of credulity: Osama bin Laden isn't dead, President Obama isn't American, global warming is a hoax.

Recently we have pivoted from one conspiracy theory (the plot to hide our president's foreign birth) to another (the plot to frame Dominique Strauss-Kahn, the French banker and Socialist candidate-in-waiting known by his monogram and for his predatory eye for women). More than half of the French people surveyed in the immediate aftermath of D.S.K.'s arrest told pollsters that he was set up. This belief was held by men and women, by the most educated and the least. Among Socialists — whose ideology might suggest a little empathy for a working-class African immigrant charging assault by a rich, powerful capitalist — an astounding 70 percent believed their party darling was the real victim. People who would happily accept the label "intellectual" were quick to surmise that the scandal was somehow cooked up by President Nicolas Sarkozy (with the help of French-hating Americans) to bring down a rival on the left.

The birther controversy might be written off as a fever of racial bigotry and right-wing paranoia. But the D.S.K. case was a useful reminder that evidently rational people, educated and skeptical, liberal or conservative, can fall for beliefs that seem far-fetched at best. Think of Gore Vidal nursing the idea that 9/11 was part of a Bush administration plot to justify oil-field conquest. Or consider that Vidal's nemesis on the

right, the late William F. Buckley Jr., was once enticed by a theory that F.D.R. was complicit in Pearl Harbor. Oliver Stone, Michael Moore and Norman Mailer have all dabbled in dark intrigues, too.

And then there is Naomi Wolf, the author and feminist, who detected ominous "geopolitics by blackmail" in the coincidence that three antagonists of the establishment — Eliot Spitzer, Julian Assange and Strauss-Kahn — were sidelined by sex charges.

"This does not mean that Strauss-Kahn is innocent or that he is guilty," she blogged the other day. "It means that policy outcomes can be advanced nowadays, in a surveillance society, by exploiting or manipulating sex-crime charges, whether real or inflated." Hmm.

Richard Hofstadter, whose writings long dominated the field of conspiracy studies, hypothesized that conspiratorial thinking — what he called "the paranoid style" — festered on the political margins and often contained an anti-intellectual streak. More recent scholarship by academics like Mark Fenster, Peter Knight and Robert Goldberg suggests that conspiracy theories do not come from a particular personality type, I.Q. stratum or dispossessed fringe; they erupt wherever unfathomable news collides with unshakable beliefs.

That is what happened in France, argues Bernard-Henri Lévy, the philosopher-pundit who has been a fierce defender of Strauss-Kahn. Lévy says he does not believe his friend is the victim of a plot — just an American rush to judgment — but he thinks he understands why so many of his countrymen smell a conspiracy. "People begin to believe in a plot, to model conspiracy theories, when they are staggered, literally staggered, clobbered by astonishment," he told me.

Maybe, then, there is a little birther in all of us. Fenster, a law professor and author of "Conspiracy Theories: Secrecy and Power in American Culture," says a sense of conspiracy is "almost an instinctive response to strange events."

"I admit I was a little drawn to the D.S.K. plot at first," Fenster told me. "Then I heard Nina Totenberg explain the case on NPR, and I was ashamed of myself."

Our receptiveness to the outlandish is primed by the fact that we know of actual conspiracies. Watergate happened. Iran-contra happened. One reason so many in France are quick to suspect American perfidy is that the C.I.A. did, in fact, meddle in European affairs during the Cold War.

Suspicion hardens into full-blown conviction when people lose faith in authorities, says Knight, who edited "Conspiracy Nation: The Politics of Paranoia in Postwar America." The present day, he told me, when Internet access has sparked a proliferation of competing, self-appointed authorities, is a particularly fertile time for conspiracy theorists, who might ask: " 'Why would you believe The New York Times? Why do they have a monopoly on truth? Surely Twitter and WikiLeaks are just as trustworthy.' "

Knight added, "As soon as you lose faith that the mainstream media are telling the truth, anything is believable."

My own antidote to conspiratorial thinking is an abiding mistrust in the competence of big institutions. In American pop-culture thrillers, there is a lethal efficiency to whatever sinister organization is behind the evil doings. In my experience, governments, corporations and other powerful institutions are not usually that good at making things happen according to plan, let alone at keeping secrets.

The main lesson for those of us who are supposed to traffic in facts — journalists, academics, policy makers — is not to be too dismissive of those who hold beliefs that seem preposterous. There is, of course, a hard core for whom the very fact that The New York Times (or the 9/11 Commission or the Centers for Disease Control) is challenging their version of reality just confirms it. But evidence, laid out dispassionately, engaging without mocking, is still our best recourse.

And sometimes it works. You may have missed it, but after President Obama released his birth certificate, polls showed that belief in the birther myth fell by half. As the Strauss-Kahn case makes its way through discovery and trial, the French suspicion of a setup will surely wane.

Then again, Knight speculates that doubters may find their cynicism stoked by news that President Sarkozy's wife is pregnant with their first child, just in time for the presidential campaign.

"Carla Bruni pregnant?" Knight mused. "Now *that* is just too convenient."

Bill Keller is executive editor of The New York Times.

http://www.nytimes.com/2011/06/05/magazine/a-theory-of-conspiracy-theories.html?_r=1&ref=magazine

Meet the league of extraordinary supernovae

- 18:00 08 June 2011 by **Maggie McKee**

One of the ordinary ones: supernova remnant N 63A (Image: NASA, ESA, HEIC, and The Hubble Heritage Team (STScI/AURA))

Some of the brightest and strangest objects to grace the skies in recent years are members of a new class of supernovae. Just how they are formed remains a mystery, but their brilliance should make it easier to observe their dim host galaxies.

Supernovae come in different varieties. Type Ia blasts, for example, show no hydrogen in their spectra, and occur when the ember of a dead sun sucks in too much material from a companion. Type II explosions, which do have hydrogen, form when the core of a massive star collapses.

Now Robert Quimby of the California Institute of Technology in Pasadena and his colleagues report on six supernovae that do not fit the mould of any known type. These misfits contain oxygen but no hydrogen, and outshine type Ia blasts by a factor of 10. They also stay hot for weeks or months – longer than other supernovae.

"The peak brightness and total amount of energy released is extraordinary," says Quimby. "Change the light bulbs in your house from 100 watt to 1000 watt. Live like that for a month and your electric bill – and tan – will show the difference."

The creation of the new class was prompted by the discovery of four unusual supernovae in 2009 and 2010. "We knew they were weird, but I had the feeling that I had seen this somewhere before," says Quimby. He looked back at the spectra of two objects that had previously stumped astronomers: a supernova that smashed brightness records after it was observed in 2005 and a bizarre object that brightened over a leisurely three months before fading in 2006. "I was utterly ecstatic when I saw the match," he says.

Smoke rings

How do the rare blasts arise? One possibility is that they originate in a heavyweight star, weighing up to 130 suns. Such stars undergo violent pulsations late in life, expelling shells of material periodically, like smoke rings, for months or even decades before their cores explode. The hydrogen shell is the first to be sloughed off, so it would be the farthest away by the time the core exploded.

Debris from the explosion would initially slam into shells rich in other elements, such as oxygen, heating them up and causing them to glow. If the hydrogen shell had expanded outwards far enough, it might evade detection, says Stan Woosley, a supernova theorist at the University of California, Santa Cruz.

Another scenario begins with a normal, hydrogen-poor supernova. Instead of leaving behind a typical fast-spinning neutron star in a cloud of expanding debris, as such supernovae normally do, it gives birth to a

highly magnetised neutron star called a magnetar. The star's intense magnetic field acts as a brake that slows its spin over a period of months. The energy this liberates heats up the surrounding supernova debris, making it shine. "The magnetar releases a huge amount of energy as it slows down," says Quimby.

Rare events

Woosley favours the pulsing shell explanation but says both models can explain the objects' intensity and duration: "They're the brightest supernovae in the universe and they stay bright for months instead of weeks." Both models rely on rare sources – either very massive stars or powerful magnetars, explaining why so few of the new class have been spotted so far. Quimby estimates that in our cosmic neighbourhood there may be 1000 to 10,000 normal supernovae for every superluminous one. "But we can see these to much larger distances," he says.

That could make them useful beacons for studying their surroundings. All of the bright new supernovae have been found in dim dwarf galaxies, which are usually hard to study. "When a superluminous supernova goes off in one, we can use it as a backlight to study the gas in the host galaxy," says Quimby. "That can tell us about how galaxies form and evolve."

Journal reference: *Nature*, DOI: 10.1038/nature10095

http://www.newscientist.com/article/dn20554-meet-the-league-of-extraordinary-supernovae.html?full=true&print=true

Bulb In, Bulb Out

By ANDREW RICE

Kenji Aoki for The New York Times
A 100-year-old-technology that is essential to modern life is about to be snuffed out. Yikes.

Over the past few years, in conditions of strict secrecy, a multinational team of scientists has been making a mighty effort to change the light bulb. The prototype they've developed is four inches tall, with a familiar tapered shape, and unlighted, it resembles a neon yellow mushroom. Screw it in and switch it on, though, and it blazes with a voluptuous radiance. It represents what people within the lighting industry often call their holy grail, an invention that reproduces the soft luminance of the incandescent bulb — Thomas Edison's century-old technology — but conforms to much higher standards of energy efficiency and durability. The prototype is supposed to last for more than 22 years, maybe as long as you own your house, so you won't need to stock up at the supermarket. And that's fortunate, because one day very soon, traditional incandescent bulbs won't be available in stores anymore. They're about to be effectively outlawed.

As a consumer product, light bulbs belong to what one industry executive calls a "low-thought category," and yet, of late, they've become a surprising flash point. Conservatives like Rush Limbaugh have denounced the "light-bulb ban" — actually, a new set of federal efficiency regulations that the traditional incandescent can't meet — as a symbolic case of environmentalist overreaching, and Michele Bachmann invoked it in the Tea Party's response to the State of the Union. Wherever your political sympathies lie, you may have found yourselves nodding along with Representative Joe Barton, a Texas Republican who has lambasted the harsh glare given off by those "little, squiggly, pigtailed" compact fluorescents. When it comes to making light, a fundamental necessity of human civilization, libertarians and aesthetes are joined in an unlikely alliance. Environmental groups say the complainers are a cranky minority — that consumers will eventually get used to new light — but those in the illumination business can't afford to be so sanguine. And that is why, inside a drab Silicon Valley office building belonging to a company called Lumileds, some of the industry's most brilliant minds are plumbing the mysteries of light on an atomic level, working to devise the bulb of the future.

Lumileds, a subsidiary of the Dutch conglomerate Royal Philips Electronics, specializes in the manufacture of light-emitting diodes (L.E.D.'s), tiny semiconductor chips similar to the ones you'd find within your

computer, except that they turn electricity into photons instead of information. Behind the walls of the company's hermetically clean manufacturing facility, technicians wearing white jumpsuits, puffy caps and rubber gloves work at enormous humming reactors, combining various gases at 1,000 degrees centigrade to "grow" the crystalline substance that forms the critical element of L.E.D.'s.

Philips created its L.E.D. bulb to compete for the L Prize, a government-sponsored award meant to encourage the development of a replacement for the 60-watt incandescent before the new standards begin to go into effect in January. Traditional incandescents are extremely inefficient, giving off 90 percent of their energy as heat, not light, and over the years, the government and the lighting industry tried to move consumers on to products like halogens and compact fluorescents. But no amount of subsidy or "green" branding has managed to woo consumers away from Edison's bulb. "Not only is it in alignment with the type of light that consumers like," says David DiLaura, author of "A History of Light and Lighting." "It's commoditized and it's cheap."

So some years ago, Philips formed a coalition with environmental groups including the Natural Resources Defense Council to push for higher standards. "We felt that we needed to make a call, and show that the best-known lighting technology, the incandescent light bulb, is at the end of its lifetime," says Harry Verhaar, the company's head of strategic sustainability initiatives. Philips told its environmental allies it was well positioned to capitalize on the transition to new technologies and wanted to get ahead of an efficiency movement that was gaining momentum abroad and in states like California. Other manufacturers were more wary, but they also understood the downside to selling a ubiquitous commodity: the profit margin on a bulb that sells for a quarter is negligible. After much negotiation, the industry and environmental groups agreed to endorse tightening efficiency by 25 to 30 percent.

A bipartisan bill passed Congress with little notice in 2007, but protests have mounted as the phaseout nears, and lighting companies need to prove to the public that efficient products can also be easy on the eye. "The morality of the global threat" is one way to push people toward more-efficient lighting, Verhaar says. "But I think that a larger number of people are going to be mobilized based on the lighting benefits."

"Roughly three-quarters of the four billion light sockets in the United States still have this inefficient, 130-year-old product," says Noah Horowitz, senior scientist at the N.R.D.C. Filling those billions of sockets represents not just a technological challenge but also an opportunity the industry hasn't encountered since Edison first flipped a switch.

The notion of light as a thoughtless commodity would have seemed fanciful to our distant ancestors. Before electricity, light was expensive, a product of exhaustible sources like whale oil. It was Edison who finally took it to the masses in limitless quantities. On Dec. 31, 1879, the inventor invited a crowd of thousands to his laboratory in Menlo Park, N.J., to witness a demonstration of his fantastic innovation, described in a patent as an "electric lamp for giving light by incandescence." Building on the experimentation of others, Edison had devised a practical method for generating illumination by running a current through a rudimentary filament — a carbonized strip of cardboard — encased inside a vacuum-sealed glass bulb. When the inventor lighted the lamp, it glowed orange, "like the mellow sunset of an Italian autumn," a contemporary newspaper said.

Almost immediately, though, there were complaints. Some detractors saw electric light as unnatural and reddish, lacking the comforting attributes of a gas flame. But with further refinements — the cardboard filament was replaced by bamboo, and later tungsten — quality improved. At first, bulbs were fairly expensive: in 1891, one went for 44 cents, more than $10 when adjusted for inflation. But Edison accurately predicted that costs would plummet as electricity vanquished all competing technologies.

After that, advancement in home lighting more or less came to a halt. A century ago, incandescent lamps with tungsten filaments lasted about 1,000 hours (same as today's), were only slightly dimmer and sold in the familiar varieties of 40, 60 and 100 watts. Edison didn't worry about how many watts they consumed; after all, he also owned an electric company. Efficiency wasn't an issue until the energy crisis of the 1970s, which inspired compact fluorescents, but they went over poorly and never made much of a dent in the incandescent's market domination.

The compact fluorescent's failings were a matter of price — the first ones sold for $25 to $35 a bulb — and taste. American consumers seem to prefer incandescence, for reasons connected to the science of light. "What we term 'light' does not exist without the human eye — it's just radiation," says Nadarajah Narendran, a professor at the Lighting Research Center at Rensselaer Polytechnic Institute. "Your eye is a detector that senses this energy coming to it at different wavelengths." Those wavelengths are perceived as colors. Natural

light combines all the colors of the visual spectrum. When people complain that fluorescent light is cold, what they're really describing is an overload of radiation at the bluish wavelengths.
"I don't think it's cultural; I think it's much deeper than that, that our reaction to long-wavelength light is warm and short-wavelength light is cold," David DiLaura says. Humans don't see all wavelengths equally well; DiLaura says the eye's "sensitivity curve" is adapted to the spectral composition of light on the African savanna. The light that surrounds us can have psychological and physical effects. Research has suggested that altering wavelengths can affect students' attention and that patients on the south side of a hospital, which gets more light, recover more quickly than those on the north. So it's hardly surprising that the incandescent phaseout has prompted a visceral reaction.
Boosters say L.E.D.'s can be calibrated to create light that's just as good as — maybe better than — natural. They have long been used for low-intensity applications, like the digits on your microwave, but it was only about a decade ago that a cadre of physicists began to awaken the industry to their wider potential. Roland Haitz, a scientist associated with Lumileds, argued that just as computer chips were becoming exponentially more powerful, L.E.D.'s were getting brighter and cheaper at a predictable rate, a proposition now known as Haitz's Law. Transitioning to L.E.D.'s, Haitz forecast, would cut the amount of electricity used for lighting by more than 50 percent worldwide, eliminating some 200 million tons of carbon emissions a year.
Individual L.E.D.'s come in precise wavelengths — gradations of red, green, blue and so on — and can be combined to appeal to the way the eye assimilates light. Inside Philips's L Prize bulb, 24 red and blue L.E.D.'s are divided into four quadrants and covered by a curved yellow shell. When they are turned on, they send a stream of red and blue photons through the casing, which contains a phosphor that converts some particles to yellow, and they mix to create white light that looks nearly identical to incandescent. The bulb runs on less than 10 watts of electricity.
Much of the crucial basic research behind the bulb was done by a specialized group of about 40 Lumileds scientists. They continually work to improve the L.E.D. performance by experimenting with the closely guarded "recipe" used to cook up the diodes by combining molecules of indium, gallium and nitrogen. "The material system is not very well understood," says Ted Mihopoulos, who heads the department. Minuscule changes in temperature inside a reactor can yield significant variations in color and brightness. People sometimes say that L.E.D.'s are like diamonds; no two are exactly alike. When the time came to build an L Prize prototype, Mihopoulos said he culled the 24 brightest diodes from his lab's private stash.
"The L Prize is the Rolls-Royce," Christoph Hoelen, one of the bulb's lead developers, says. "Then the question beyond that is, how do you make a good car that is affordable?" Philips recently brought out the AmbientLED, a clunkier version of its competition design, which Hoelen called his Honda. It incorporates fewer L.E.D.'s and is a bit dimmer and less efficient, but it's still as bright as a 60-watt incandescent, and it is advertised to last 17 years. The bulb's affordability is relative, though. At the Home Depot closest to Lumileds, I saw the AmbientLED marked at $39.97.
If Haitz's Law holds true, that price will come down, but persuading consumers to pay even a fraction of it for a light bulb is going to require a serious marketing effort. "It's a different sale than we're used to," said Ed Crawford, a top executive in Philips's lighting division. Over lunch at its corporate offices in Somerset, N.J., near Edison's old lab, Crawford told me he started out with the Philips subsidiary Norelco, retailing electric razors. "The sale is really the same," he said. "You can buy a razor for a dollar that you can use to shave your face — or you can buy an appliance." An AmbientLED will last as long as an electric razor, and while that means Philips will be giving up many disposable-bulb sales, the comparatively high prices (and 20 to 30 percent margins) currently prevailing in the L.E.D. marketplace will make the tradeoff extremely profitable, at least in the short term.
The key for the industry will be getting the price below $10, generally considered the magic number for consumers, without compromising quality. Many leading L.E.D. manufacturers doubt that is feasible in the near term and have decided to focus on developing light sources for commercial settings like stores and hotels. With the phaseout, homeowners should initially move to hybrid halogen bulbs, a transitional product that only barely meets the new regulations, and compact fluorescents. But the industry is well aware that the alternatives are polarizing — Crawford said his own wife won't allow fluorescents into their home — and that's why so much R. and D. is going into L.E.D.'s and programs like the government's L Prize.
The prize is $10 million, but the real reward will come in the form of bragging rights and federal procurement contracts. For now, only one other company, the Florida-based Lighting Science Group, has produced a

prototype that claims to meet the contest's stringent performance criteria, and testing is ongoing. "The idea here was, Let's set a very high standard," says Senator Jeff Bingaman, a Democrat who was responsible for putting the L Prize program into the 2007 lighting-efficiency legislation.

Switching to new technologies, advocates claim, will save as much electricity each year as is consumed by all the homes in Texas. Opponents of the new regulations, however, question the projected environmental benefits, pointing out that lighting accounts for less than 10 percent of total U.S. energy consumption. In March, Bingaman convened a Senate committee hearing on the new standards. Two Republicans, Rand Paul of Kentucky and Jim Risch of Idaho, used the occasion to denounce free-market infringement. Paul pressed Kathleen Hogan, a D.O.E. official, to say whether she was pro-choice before going off into a long disquisition on liberty. "I find it really appalling and hypocritical . . . that you favor a woman's right to an abortion but you don't favor a woman or a man's right to choose what kind of light bulb," Paul said. "I really find it troubling, this busybody nature."

Later, the committee heard from a panel of experts, including Howard Brandston, a former professor at R.P.I.'s Lighting Research Center. Brandston's résumé includes everything from theater work to illuminating the Statue of Liberty, but lately he has become the Paul Revere of the movement to save the light bulb, giving speeches to industry conferences and a Tea Party rally in front of the White House. In his testimony, he warned of potential problems with compact fluorescents, which contain trace amounts of mercury. "Some of the most knowledgeable people I know," Brandston said, "have begun to stockpile a lifetime supply of incandescent lamps."

A few weeks later, Brandston showed me his own hoard, in the basement of his handsomely lighted farmhouse in upstate New York. "This is the world's greatest marketing scheme," he said. "You get the government to ban the competition." A slight man with an air of gray-bearded grandiloquence, Brandston contends that his root objection to the law, which he calls "immoral," is connected to his professional appreciation of incandescence, which mimics the natural spectrum. "It's what we grew up with — it's sunlight," Brandston told me earlier on the phone.

Joined by Kevin Simonson, a former student, we went out to Brandston's garage workshop, where he had set up a spectrometer above a table with three light sockets. Brandston turned on one socket, which contained an incandescent, and a readout appeared on the laptop that was hooked to the spectrometer: a smooth bell curve across the visual spectrum, running from blue on the left to red on the right. Then he switched to a compact fluorescent, and an ugly pattern of spikes appeared. "If you can live with that, O.K.," Brandston said with a huff. "But what you've done is you've taken away my choice."

From my bag I retrieved a Philips L Prize entry, which had been burning agreeably in my office for weeks. Brandston looked at the yellow thing skeptically — he'd told me he considers L.E.D.'s "a fad" — and screwed it into a socket. The bulb gave off a lustrous white light, but the computer readout showed a spectral composition very different from the incandescent's: a little bit of blue, more green and yellow and a tall peak of red — a combination engineered, according to Lumileds scientists, to the eye's sensitivities.

"That's not bad," Simonson said. But Brandston remained stubbornly unimpressed. "It lacks the vibrancy," he said, and he began to seek out faults, finding that the bulb took on a sickly green hue when it was dimmed. Anyway, the whole project seemed absurd to him: why create a technological marvel just to reproduce the light we already have? When Brandston turned on the incandescent, he beamed with satisfaction at Edison's warm and wasteful glow. "Look at that," he said. "It's a perfect thing."

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http://www.nytimes.com/2011/06/05/magazine/bulb-in-bulb-out.html?ref=magazine

Gold-mine worm shows animals could be living on Mars

- 11:16 02 June 2011 by **Zena Iovino**

Is this what a Martian would look like? (Image: University Ghent, Belgium - Gaetan Borgonie)

"It's like finding Moby Dick in Lake Ontario," says Tullis Onstott of the nematode worms his Princeton University team discovered living far beneath the Earth's surface in South Africa.

The tiny worms – just 500 micrometres long – were found at depths ranging from 900 metres to 3.6 kilometres, in three gold mines in the Witwatersrand basin near Johannesburg. That's an astonishing find given that multicellular organisms are typically only found near the surface of the Earth's crust – Onstott's best guess is in the top 10 metres.

The creatures seem to live in water squeezed between the mines' rocks, can tolerate temperatures reaching 43 °C and feed off bacteria. Carbon dating of compounds dissolved in the water suggests that the worms have been living at these depths for between 3000 and 12,000 years.

"To have complex life sustain itself for such a long period completely sealed away from everything else – from sunlight, from surface chemistry – is pretty amazing," says Caleb Scharf of the Columbia Astrobiology Center in New York City.

No place for a worm

Onstott says no one thought multicellular organisms would be found living in this so-called fracture water. He points out that microbiologists are still trying to prove and understand how even single-celled organisms can exist at these depths. "The lack of oxygen, temperature and food is a big dissuader," he says.

"We've had this preconception that there can only be certain types of organisms in certain environments," says Scharf. "But it's not true at all. There are more complex organisms in these bizarre environments."

Animals on Mars

If complex life forms are able to survive inside cracks deep inside Earth, it raises the possibility that they might have survived undetected in similar environments on Mars.
Carl Pilcher, director of NASA's Astrobiology Institute in Moffett Field, California, points out that Onstott has previously discovered a bacterium living 2.8 kilometres underground, completely isolated from all other ecosystems on Earth (*Science*, DOI: 10.1126/science.1127376). The bug gets its energy from the radioactive decay of elements in the surrounding rocks. "The significance was that you could imagine an ecosystem existing in the subsurface of a planet that didn't have a photosynthetic biosphere, like Mars," he says.
Until now, it was thought such an ecosystem could be made of bacteria only. But Onstott's new findings have completely changed that. "It has extended the [earlier] work to an animal," says Pilcher.
"These nematodes are grazing on microbes. So now you could imagine that if animal life had ever developed on a planet, and the surface of that planet became lifeless," Pilcher explains, "you could imagine that animals [small enough to fit in tiny cracks] could coexist with microbial ecosystems all powered by radioactivity."
Journal reference: *Nature*, DOI: 10.1038/nature09974

http://www.newscientist.com/article/dn20534-goldmine-worm-shows-animals-could-be-living-on-mars.html?full=true&print=true

A Chronicler of the Art-Vandal Underground

By ALAN FEUER

Piotr Redlinski for The New York Times
Mr. Seelie, center with camera, shooting Lightning Bolt, a punk band, in April.

In the windy darkness of a recent spring morning, 30 people of an arty, mostly Brooklynite persuasion gathered after midnight for an illicit get-together in a maintenance shed, high atop the Williamsburg Bridge. Billed as the "Third-Annual NYC Undercover, You-Might-Be-Arrested, Clandestine Errantry Trespassing Adventure Party," the event attracted members of a distinct, risk-taking subset of the New York art world — heights-loving writers, courageous painters, a devil-may-care guitarist, a guy lugging bongos and the Williamsburg photographer, Tod Seelie — all of whom had been quietly invited to the late-night affair by its pseudonymous organizers, Agent Verde and Agent Rojo.

After scrambling over a 10-foot-high security fence, the partygoers climbed a steel staircase — the lights of Manhattan glimmering below — as part of a vertiginous, invigorating trip that culminated in a catwalk, a ladder and finally a narrow hatchway, leading up to a low-ceilinged room of riveted metal plates. There, for more than an hour, the group made music and unauthorized public art. Light was provided by votive candles and flashlights. Mr. Seelie, a bald man sporting tattoos and a Fu Manchu mustache, camera at his eye, stood taking pictures in the middle of the room.

"When a trip takes this much effort," he said, "there's usually something worthwhile at the end."

For Mr. Seelie, who is 33 and could be called the house photographer for the Kings County art-vandal underground, something worthwhile might include: a female mud-wrestling match, a violent punk show, an illegal party in an abandoned warehouse, a guerilla theater event in the snow or a group sailing trip through New York Harbor (and beyond) on rafts made of junk. Last month, he sat down for a coffee at the Cafe Orwell, in Bushwick, Brooklyn, a few nights after shooting an art show at the Gowanus Ballroom. "It turned out pretty good," he remarked offhandedly. "The band performance ended with naked people running around with watermelons on their heads."

Mr. Seelie's work — which can be seen on four Web sites and in publications as various as Spin, Vice and The New York Times — often documents occasions that may seem weird for weirdness's sake (a randomly burning car, say, or a randomly burning drum kit still being played by the drummer). But his images at times

elevate mere weirdness to a more striking realm of visual intrigue. Strange, vivid, baffling and relentlessly unexplained, they leave their viewers transfixed by certain questions: Who are those people running down that hill in their underwear? Did someone punch that kid with the black eye? Why is that man vomiting on the street?

"He's a guy who's always had an interest in the extreme — in interesting, envelope-pushing opportunities," said Mr. Seelie's friend, Todd Patrick, a music promoter better known in Brooklyn circles as Todd P. "He's all about showing smart, sometimes privileged, people doing stuff they probably haven't done before. He likes to catch upper-middle-class white kids actually doing interesting things."

Whether that means Williamsburg eviction parties where artists can be found careering down stairs, toboggan-style, in bathtubs, or gatherings of the outlaw biker gang Skidmarxxx (which may include the decapitated head of a pig), Mr. Seelie has brought his camera — and, with it, his audience — into some of the city's most unusual and arresting (at times, literally) happenings, while remaining true to the disturbing or evanescent nature of those happenings. Unlike some photographers, he is not a tourist or a journalistic transient, calling ahead to make arrangements, then parachuting in to steal a shot. "Tod's not from the outside," said Sarah E. McMillan, an artist with the guerilla art collective, the Madagascar Institute (motto: "Fear is Never Boring"). "A lot of documentarians think the eyes of the future are more important than the eyes of the present. Not Tod. He's noninvasive. He knows where to stand."

A few weeks ago, Mr. Seelie was standing where he often stands — at the lip of a stage in Williamsburg — for a tinnitus-inducing concert by the Rhode Island band Lightning Bolt. Lightning Bolt, some years ago, achieved a kind of fame by playing on the floors, not the stages, of their venues, a practice they had to give up after being mobbed so thoroughly by an audience that they couldn't hoist their instruments. The Williamsburg concert began with the band's bassist asking the crowd not to swarm the stage once the music started. The request was disregarded by the second bar of the first song.

After gathering momentum in a mosh pit, a wave of human bodies crashed into, then onto, the stage, tumbling everywhere as entangled limbs and torsos spilled at the feet of the musicians. Mr. Seelie, crouching with his camera, was caught beneath the crest.

"Nothing serious, just a few scratches and some bruises," he wrote later that night, in a text message explaining how he fared at the concert.

The text message was written at 2:34 a.m. Most communications from him bear a similar time stamp.

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Tod Seelie was born and raised in Rocky River, Ohio, a semi-affluent suburb on the west side of Cleveland with old homes, new strip malls and lakeside views. His father was divorced from his mother when Mr. Seelie was 12. He said he and his father were estranged for many years due to Tod's refusal to attend St. Ignatius, an elite Catholic preparatory school for boys. Instead, Mr. Seelie says, he chose a more obscure religion, devoting his adolescence to the worship of Cleveland's punk rock bands. "What I remember most growing up," he told an interviewer in 2009, "are tall trees, industrial wasteland, the gray expanse of Lake Erie, the silence of a winter night and how popular Phil Collins's music was."

He came to New York City in 1997, on a scholarship, to study sculpture at the Pratt Institute, and started taking snapshots of his friends (among them the artist known as Swoon and Ian Vanek, who went on to found the band Japanther) while working as an art assistant on the side to help defray the cost of his education. "Tod and I had to work a little harder than some others did to get where we were," said Swoon, whose real name is Caledonia Curry. "But I think we both appreciated how focused and committed it made us."

After graduating from Pratt with a photography degree, Mr. Seelie joined Ms. Curry in an art collective called Toyshop, which in the early 2000s undertook a sly series of public art projects, like mud wrestling in Walter De Maria's "New York Earth Room" or dressing up in pirate garb in an attempt to confound commuters on the Staten Island Ferry. Toyshop grew out of a goofily rebellious crew of art students and art-school hangers-on who were, as Mr. Vanek put it in an e-mail, "D.I.Y. punks with adventure spirit and wanderlust — a bit criminal at the right moments and a bit flower power at others."

New York at the turn of the millennium was passing through a seemingly endless real-estate and capital-markets boom, and it appeared that every other city block was being colonized by condominiums. The art world, in particular, seemed to be defined by the glass-and-steel Chelsea galleries that specialized in transferring work from artists to well-heeled Wall Streeters in exchange for enormous sums of money. Mr. Seelie's troupe of Brooklyn-based, bicycle-riding street artists adopted tactics that placed them in opposition

to this new Gilded Age. If they wanted to make a painting, they didn't wait for gallery space to become available; they painted on the walls of a building in their neighborhood. If they wanted to stage a concert, they didn't solicit booking agents at overpriced nightclubs; they used someone's apartment, or commandeered an empty warehouse and rigged the lights and speakers by themselves.

"Most of the things I'm drawn to are done by D.I.Y. people who make what they want to happen, happen," Mr. Seelie said. "You want to put on a play? Great. Find an abandoned power plant."

Mr. Seelie and his circle of friends have known each other for many years, from bike kills (rallies of competing ganglike bicycle clubs) and from secret parties in abandoned or illegal spaces, said one of those friends, a disc jockey who goes by the nightclub moniker D. J. Dirtyfinger. "His people in New York are people who don't do stuff within the confines of standard bars or parties. They're out there being creative almost to a renegade level."

This renegade aesthetic was clearly formed in response to capitalist economics, though not necessarily in a self-conscious way. The pictures Mr. Seelie has taken over the years — of the Critical Mass bike group, of artists like Swoon, of men with lances jousting on bicycles — are arguably representative of a broader reaction to globalism and corporatism, made plain in events as diverse as the Idiot-arod, a shopping cart race based on Alaska's Iditarod sled race; or SantaCon, the raunchy Christmas costume parade; or Grub, a semimonthly, Toyshop-derived, Dumpster-diving dinner party where participants eat communally cooked food, sometimes taken from the trash.

"D.I.Y. is obviously a moving target," said Mr. Patrick, the music promoter. There are extreme cases — the "Crusties," as he called them — "who live in squats and hop trains." But then there are those, he said, "who live in the world of jobs and apartments and who simply make room in their lives for anti-establishment culture."

"Ultimately, Tod's passion is for experiences that are only really possible if you're living at the extreme," Mr. Patrick said.

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In true D.I.Y. spirit, most — if not all — of Mr. Seelie's photos can be found online at the four personally curated Web sites he maintains: the.everydayilive.com, the.ofquiet.com, suckapants.com and todseelie.com. The first he describes as a "crazy kind of place for burning cars and naked people" where, indeed, you are likely to find photographs of long-haired men on stilts and bare-breasted women against a backdrop of mud pits or graffiti. The second consists of landscape photographs: the broken roads and decaying industrial structures Mr. Seelie describes as what might result if "William Eggleston took photos of Detroit." The third is mostly a concert site, containing Mr. Seelie's shots of bands like Parts & Labor or Team Robespierre. Todseelie.com is "the professional site," he said, designed to sell the images he produces to newspapers, publishers and magazines.

Earlier this spring, Mr. Seelie was contacted — out of the blue, he said — by a video production company working with Lexus, the automaker, which wanted to use footage of him shooting his pictures for an advertising campaign. In exchange for a few hours' work, he received a payment of $10,000. There were two unlikely aspects to this transaction. First, Mr. Seelie doesn't drive a car, let alone a Lexus. (He actually gets around on a Raleigh bicycle he salvaged from the street.) Second, the assignment paid him, in one lump sum, more than what he had made in all of 2010.

Mr. Seelie currently makes ends meet by installing other artists' gallery shows — a friend unwittingly invited him last month to the opening of a show he helped to hang — a job which pays about $20 an hour. Over the years he has designed calendars (of puppies, kittens and golfers) for Workman Publishing and served as a handyman at the Bowery Poetry Club. He once caulked sinks for the artist Dorothea Rockburne, and Cindy Sherman, the photographer, hired him one day to paint a chair.

"He works hard as a photographer, but he's also incredibly handy as a crew person," said Jeff Stark, a producer of guerilla theater and the editor of the strange-happenings newsletter, Nonsense NYC. "Tod's the kind of person who will take pictures and then jump in and help wire up your electrical."

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Mr. Seelie's personal distillation of the art-versus-commerce conundrum goes something like this: "It's less about trying to make money and more about figuring out ways not to spend money." He travels frequently — he has worked on projects in Haiti, Chernobyl and Detroit — and usually pays for his expeditions by subletting his Williamsburg walkup and living cheaply.

That maddening aspiration of most working artists — the big break — has so far eluded him, but the seeds of such a break may be found in his latest and most ambitious project: a book-length collection of images documenting the last 10 years of the underground art scene. Stored in boxes and on hard-drives, the photographs depict, Mr. Seelie said, the dawning of the New York street-art movement, the birth of the local chapter of the Black Label Bike Club and the early years of bands like Black Dice, Japanther and Matt & Kim. While the material may not mean much to those unfamiliar with these groups and events, Mr. Seelie speaks with a historian's pride when he says, "I've got shots of the Yeah Yeah Yeahs literally playing in an auto parts garage."

In the meantime, he moves about nocturnally, showing up at performances by Big Freedia, the self-styled "Queen Diva" of New Orleans hip-hop, and at Cerebral Ballzy concerts. Late this winter, Mr. Seelie found himself at an art show at the Clocktower Gallery in lower Manhattan. The event featured the So So Glos, an indie band from Bay Ridge, Brooklyn, and was called— unironically — "Puttin' on the Ritz." The evening's producer, Joe Ahearn, had thought it would be clever and refreshing if the habitually sneaker-shod denizens of the alt-arts world were forced to attend an event in formalwear. (Mr. Ahearn was himself dressed in a morning coat with tails.)

In the top-floor gallery space, undernourished men in bowties mixed with women whose metallic-colored ball gowns matched their dyed hair. People made fun of the wooden "spaceship" in the corner, sculptured, it was said, by the actor James Franco. As the So So Glos accompanied them, two Russian dancers from a local studio waltzed.

Throughout the evening, people could be heard whispering to one another that there was something vaguely recognizable about the space — or more correctly, about the building that contained the space. At some point, word went around that a lower floor of the building housed the summons part of the Manhattan Criminal Court, where misdemeanor offenders — pot smokers, trespassers, traffic violators — went to pay their fines. Judging by the number of knowing smiles and chuckles, half the room had visited the building before, in its judicial capacity. "I thought it looked familiar," Mr. Seelie said.

Colin Moynihan contributed reporting.

http://www.nytimes.com/2011/06/05/nyregion/a-chronicler-of-the-creative-underground.html

When the multiverse and many-worlds collide

- 01 June 2011 by **Justin Mullins**
- Magazine issue 2815.

Welcome to Parallel Alley (Image: Meyer/Tendance Floue)

TWO of the strangest ideas in modern physics - that the cosmos constantly splits into parallel universes in which every conceivable outcome of every event happens, and the notion that our universe is part of a larger multiverse - have been unified into a single theory. This solves a bizarre but fundamental problem in cosmology and has set physics circles buzzing with excitement, as well as some bewilderment.

The problem is the observability of our universe. While most of us simply take it for granted that we should be able to observe our universe, it is a different story for cosmologists. When they apply quantum mechanics - which successfully describes the behaviour of very small objects like atoms - to the entire cosmos, the equations imply that it must exist in many different states simultaneously, a phenomenon called a superposition. Yet that is clearly not what we observe.

Cosmologists reconcile this seeming contradiction by assuming that the superposition eventually "collapses" to a single state. But they tend to ignore the problem of how or why such a collapse might occur, says cosmologist Raphael Bousso at the University of California, Berkeley. "We've no right to assume that it collapses. We've been lying to ourselves about this," he says.

In an attempt to find a more satisfying way to explain the universe's observability, Bousso, together with Leonard Susskind at Stanford University in California, turned to the work of physicists who have puzzled over the same problem but on a much smaller scale: why tiny objects such as electrons and photons exist in a superposition of states but larger objects like footballs and planets apparently do not.

This problem is captured in the famous thought experiment of Schrödinger's cat. This unhappy feline is inside a sealed box containing a vial of poison that will break open when a radioactive atom decays. Being a quantum object, the atom exists in a superposition of states - so it has both decayed and not decayed at the same time. This implies that the vial must be in a superposition of states too - both broken and unbroken. And if that's the case, then the cat must be both dead and alive as well.
To explain why we never seem to see cats that are both dead and alive, and yet can detect atoms in a superposition of states, physicists have in recent years replaced the idea of superpositions collapsing with the idea that quantum objects inevitably interact with their environment, allowing information about possible superpositions to leak away and become inaccessible to the observer. All that is left is the information about a single state.

Physicists call this process "decoherence". If you can prevent it - by tracking all the information about all possible states - you can preserve the superposition.
In the case of something as large as a cat, that may be possible in Schrödinger's theoretical sealed box. But in the real world, it is very difficult to achieve. So everyday cats decohere rapidly, leaving behind the single state that we observe. By contrast, small things like photons and electrons are more easily isolated from their environment, so they can be preserved in a superposition for longer: that's how we detect these strange states.
The puzzle is how decoherence might work on the scale of the entire universe: it too must exist in a superposition of states until some of the information it contains leaks out, leaving the single state that we see, but in conventional formulations of the universe, there is nothing else for it to leak into.
What Bousso and Susskind have done is to come up with an explanation for how the universe as a whole might decohere. Their trick is to think of the volume of space that encompasses all the information in our universe and everything it might possibly interact with in the future. In previous work, Susskind has dubbed this region a causal patch. The new idea is that our universe is just one causal patch among many others in a much bigger multiverse.

Many physicists have toyed with the idea that the cosmos is made up of regions which differ so profoundly that they can be thought of as different universes inside a bigger multiverse. Bousso and Susskind suggest that information can leak from our causal patch into others, allowing our part of the universe to decohere into one state or another, resulting in the universe that we observe.

But while decoherence explains why we don't see cats that are dead and alive at the same time, or our own universe in a huge superposition of states, it does not tell us which state the cat, or the universe, should eventually end up in. So Bousso and Susskind have also linked the idea of a multiverse of causal patches to something known as the "many worlds" interpretation of quantum mechanics, which was developed in the 1950s and 60s but has only become popular in the last 10 years or so.

According to this strange idea, when a superposition of states occurs, the cosmos splits into multiple parallel but otherwise identical universes. In one universe we might see the cat survive and in another we see it die. This results in an infinite number of parallel universes in which every conceivable outcome of every event actually happens.

Bousso and Susskind's contention is that the alternative realities of the many worlds interpretation are the additional causal patches that make up the multiverse. Most of these patches would have split from other universes, perhaps even ancestors of our own. "We argue that the global multiverse is a representation of the many-worlds in a single geometry," they say. They call this idea the multiverse interpretation of quantum mechanics and in a paper now available online they have proposed the mathematical framework behind it (arxiv.org/abs/1105.3796).

One feature of their framework is that it might explain puzzling aspects of our universe, such as the value of the cosmological constant and the apparent amount of dark energy.

The paper has caused flurry of excitement on physics blogs and in the broader physics community. "It's a very interesting paper that puts forward a lot of new ideas," says Don Page, a theoretical physicist at the University of Alberta in Edmonton, Canada. Sean Carroll, a cosmologist at the California Institute of Technology in Pasadena and author of the Cosmic Variance blog, thinks the idea has some merit. "I've gone from a confused skeptic to a tentative believer," he wrote on his blog. "I realized that these ideas fit very well with other ideas I've been thinking about myself!"

However, most agree that there are still questions to iron out. "It's an important step in trying to understand the cosmological implications of quantum mechanics but I'm sceptical that it's a final answer," says Page. For example, one remaining question is how information can leak from a causal patch, a supposedly self-contained volume of the multiverse.

Susskind says it will take time for people to properly consider their new approach. And even then, the ideas may have to be refined. "This is not the kind of paper where somebody does a calculation and confirms that we're correct," says Bousso. "It's the sort of thing that will take a while to digest."

http://www.newscientist.com/article/mg21028154.200-when-the-multiverse-and-manyworlds-collide.html?full=true&print=true

Into the breeches: A makeover for Longitude's villain

- 30 May 2011 by **Stephanie Pain**
- Magazine issue 2814.

Sitting comfortably (Image: Royal Society)

History has been unkind to astronomer Nevil Maskelyne – but the bizarre suit he wore in the cause of science tells a different story

IT WAS yet another bone-chilling winter's night in Greenwich and Nevil Maskelyne steeled himself for a spell in his hilltop observatory, a few miles downriver from London. Clear skies and the position of the moon and stars dictated when he must drag himself from his fireside to spend an hour or two at the telescope. With the observatory roof open to the night sky, it was cold enough to freeze the blood...

For Maskelyne, Britain's Astronomer Royal from 1765 to 1811, duty and observations came before comfort. But why suffer unnecessarily? Since his appointment, he had endured some appalling winters. Ever practical, Maskelyne's response to plummeting temperatures was to climb into his specially tailored "observing suit". Standing by the fire, he pulled on his breeches. Outside, they were fashionable Indian silk striped in bright yellow, red and white. Inside, they were warm flannel and between the two was a layer of wadding. Even stranger, they had built-in feet and an enormous cushioned bottom for sitting on something cold and hard. Next came the jacket. Made from matching silk, it buttoned to the neck in the style of the day, but was padded and quilted and cut unfashionably short - too short to hide his bulging bottom. Finally, Maskelyne slipped his outsized padded feet into a pair of wooden overshoes, or pattens, for the short walk to the observatory.

It's a far cry from the popular view of Maskelyne today. Now he is best known as the arch-enemy of John Harrison, the self-educated genius who invented the sea-going clock that enabled mariners to find a ship's longitude at sea - a view that began to take shape in the 1930s after Harrison's early timekeepers were rediscovered and restored. The idea of Maskelyne the villain gained even wider currency when writer Dava Sobel took up the story in her bestselling book *Longitude*. Harrison became the hard-done-by hero and Maskelyne the arrogant, vindictive man who abused his position to deny Harrison the reward he deserved.

"It is unfortunate that he is known only for his role in the Harrison story," says Rebekah Higgitt, curator for the history of science and technology at the National Maritime Museum in Greenwich. "He was so much more than that."

As Astronomer Royal, Maskelyne was the driving force behind many improvements in astronomy and navigation. He was a leading light of the Royal Society and organised the scientific side of some of its most famous voyages of exploration, including James Cook's. In 1774, Maskelyne travelled to Scotland to carry out a famous experiment to "weigh the world", calculating Earth's density by measuring the gravitational pull of the mountain Schiehallion. But his greatest achievement was the *Nautical Almanac*, which proved such a vital source of astronomical data for navigators and astronomers that it is still in print today. "He was a hugely significant figure in the scientific world for more than four decades," says Higgitt.

Two hundred years after his death, historians at the museum would like Maskelyne's good name to be restored. They hope the image of him in his eccentric observing suit will help to banish the perception that he was a snobbish and mean-hearted villain. The suit is part of a collection of Maskelyne's personal possessions and private notebooks donated to the museum in 2009, which together reveal a character at odds with the one fixed in the public imagination.

The question of longitude

By the time Maskelyne embarked on his career as an astronomer, some of the finest minds in Europe had spent many years puzzling over the problem of finding longitude at sea. In 1714, the British government passed the Longitude Act, which offered a prize of £20,000 (well over £1 million today) for any method accurate to within half a degree that would be "found practicable and useful at sea". It also established a Board of Longitude "for examining, trying and judging of all proposals, experiments, and improvements relating to the same".

By the mid-18th century, the two front-runners were a technological solution and an astronomical one. The key to calculating longitude was to know what time it was locally and at a second reference point such as Greenwich: every hour's difference equals 15° of longitude. Mariners could easily tell the time at sea by observing the sun and measuring its altitude. The challenge was working out the time at Greenwich. Harrison aimed to solve the problem with a timepiece so accurate that it would keep Greenwich time over long ocean voyages, and began work on a sea clock in 1730. The astronomical solution was the "lunar distance method", which used the daily predicted movement of the moon across the sky to calculate the time at Greenwich.

By 1761, when Maskelyne entered the picture, the Board of Longitude was considering Harrison's fourth timekeeper, the brilliantly innovative watch that eventually scooped him the longitude prize, and a new improved version of the lunar distance method submitted by German astronomer Tobias Mayer. That year, the 28-year-old Maskelyne sailed to St Helena in the South Atlantic to observe the transit of Venus for the Royal Society. Although cloud obscured the sun at the crucial moment, Maskelyne's trip was not wasted. He spent his months at sea experimenting with Mayer's improved lunar method and reported it was sufficiently accurate to find longitude to within 1° - though it took a marathon 4 hours of calculations to work out the time at Greenwich.

Nonetheless, Maskelyne believed that with improvements in accuracy and simpler mathematics, the lunar method would be a cheap and practical solution to the longitude problem. Perhaps not surprisingly, when Maskelyne was sent to Barbados by the Board of Longitude to assess the reliability of Harrison's sea watch in 1763, the clock-maker and his son William suspected him of bias. His enthusiasm for the lunar distance method prompted William to suggest that Maskelyne had sabotaged the trial of his father's watch to bolster the case for astronomy. When Maskelyne was made Astronomer Royal in 1765, a job that automatically put him on the Board of Longitude, the Harrisons were convinced he was the main obstacle standing between them and the prize.

Harrison did eventually receive the full prize but not before waging a very public campaign against Maskelyne, accusing him of coveting the prize for himself. Official records of events make it clear that the Harrisons' concerns were unfounded. As Astronomer Royal, Maskelyne was ineligible for the prize. Nor is there any evidence of prejudice against Harrison. Maskelyne thought Harrison "a genius of the first rate" and his sea watch a brilliant but very expensive invention. Based on price and practicality, he felt the lunar distance method was a better bet.

The lunar method's drawback was the need for time-consuming calculations to find Greenwich time. But Maskelyne had a brainwave - he hired a network of mathematically minded people to do the routine sums in advance and published ready-worked lunar tables in the *Nautical Almanac*. All mariners had to do then was measure the angle between the moon and a star, look the figures up in the tables and do 30 minutes of relatively simple mathematics. If Harrison was a mechanical genius, Maskelyne was the ultimate pragmatist. Marine clocks and later chronometers were expensive rarities not widely used until the early 19th century. Maskelyne's *Nautical Almanac* was an immediate success. Within a few years, he was publishing tables several years ahead to cater for long voyages.

All the evidence suggests Maskelyne was no villain, but what about the other slurs on his character? Documents and letters portray him as a sociable man with a network of friends and contacts. Records also show he was fair-minded and did not hold grudges. Even while the Harrisons were accusing him of what amounted to corruption, he recommended William for election to the Royal Society.

The charges of elitism and snobbery don't hold up either. In 1784, the Royal Society was rocked by the "mathematicians' mutiny", in which engineers, surveyors and astronomers rebelled against the dominance of the gentleman elite, in particular the society's president Joseph Banks, who they regarded as a dandified dabbler in botany. "Maskelyne was on the side of those who used their mathematical expertise to make a living, what the mutineers called the scientific side of the society," says Higgitt.

With access to Maskelyne's notebooks, the museum's scholars now have the opportunity to learn something of his private side. "He was a meticulous, almost compulsive observer and jotted down extraordinary details of his day-to-day life - things he's done, lists of things to do, things he's read or heard," says Amy Miller, curator of decorative arts and material culture.

One moment he records ordering linen for six shirts, the next he's jotted down the longitude of some far-flung outpost of the colonies. Between lists of tradesmen and handy household hints ("how to make a powder of soap" and "how to hide a hole in a black silk stocking"), he sketches the optics of a new astronomical instrument. Remedies for all manner of ailments, from colds to nosebleeds, feature regularly. In the 1780s, he was obsessed with stomach remedies, says Miller. "He had a major issue with his bowels. There are pages of rhubarb recipes."

Food for thought

Food also loomed large in his life. Norfolk dumplings, he noted immediately after the longitude of Pondicherry, are "only milk and flour stirred together but not too hard and boiled in a strainer without salt or anything else". He often received gifts of food and sometimes liked something so much he started to buy it for himself, says Miller. "He'd get chocolate. Then it would be Lapsang souchong and green tea. And then he took a liking to tomato ketchup which was just coming into vogue."

Some of his enthusiasms lasted longer than others. Cider was a long-term interest. He was initiated into the art of cider-making on a trip to Somerset, and from then on made it in vast quantities. His notebooks record the day he made 300 gallons - and a little later, the day when only half was left.

After almost 20 years at the observatory, Maskelyne married. He doesn't mention the marriage, but 10 months later makes a note to engage a midwife. His only child, Margaret, was born in June 1785. "We start to see a more intimate side of him when he writes about his wife and daughter," says Miller. When Margaret was very ill as a child, he is clearly upset. "He obsessively logs the course of her illness as if it helps him through it."

While Maskelyne's jottings do not prove he was sweet and saintly they do paint a more three-dimensional and human picture of him. The real convincer is the observing suit. "He was short and a bit podgy and with his pattens on he would have waddled with his bottom sticking out," says Miller. It's hard to imagine there weren't a few giggles - but if the state of his much-mended breeches is any guide, he wasn't too bothered. He carried on waddling to work on bitter winter nights for 30 years or more.

Stephanie Pain *is a consultant for New Scientist and editor of our latest book Farmer Buckley's Exploding Trousers: And other odd events on the way to scientific discovery (Profile, 2011)The National Maritime Museum is displaying some of Nevil Maskelyne's personal effects from 14 July (bit.ly/fRc46k) and will hold a symposium on his life on 15 October (bit.ly/l7d0wY)*

http://www.newscientist.com/article/mg21028141.500-into-the-breeches-a-makeover-for-longitudes-villain.html?full=true&print=true

Comics

By DOUGLAS WOLK

Gilbert Hernandez is one of the great craftsmen of modern comics, the writer and artist of elegant, fiery, carefully controlled graphic novels like "Palomar" and "Luba." Over the past few years, though, he's been doing his best to break away from (or at least expand on) that highbrow reputation with a series of short, pungent thrillers whose conceit is that they're adapted from B movies starring one of his recurring characters: the tragic, top-heavy bombshell Fritz Martinez.

Hernandez's new Fritz book, **LOVE FROM THE SHADOWS (Fantagraphics, $19.99),** is as bracing as a slug of bottom-shelf rotgut. It's a crime story with a touch of sci-fi, involving a mysterious cave, a contested inheritance, some family drama, a sex-change operation that inexplicably reverses itself, and a whole lot of sex scenes that seem grafted on, as if to a slim little art film. The book's constant refrain is that what you see is probably not what you get — beginning with its cover, a schlock-movie-poster painting by Steve Martinez. Hernandez artfully approximates the broad, thrilling badness of late-night movies and their inept special effects, and uses it as an excuse to show off some of his gifts: spacious compositions built around texture as well as forms, pauses heavy with foreboding, a sense of body language and facial expressions so acute that we can recognize both the story's characters and the "actors" playing those characters.

Tony Harris actually does use actors for the characters he draws in the political superhero drama "Ex Machina" — he creates almost the entire cast from photo reference, which grounds even the high-octane action scenes in a sort of surveillance-camera realism. **EX MACHINA: The Deluxe Edition, Book 5 (Wildstorm, $29.99),** written by Brian K. Vaughan and drawn mostly by Harris, wraps up the story of a civil engineer named Mitchell Hundred, who, in a mysterious accident, gained the ability to command machines; became a superhero called the Great Machine; and was elected mayor of New York after he saved the second tower on 9/11.

Vaughan has been playing a long game with this series. Its conclusion was foreshadowed from its first page, as a political tragedy amplified through the conventions of superhero stories, and its timeline veers back and forth between the Great Machine's short-lived career in costume and, in this volume, the final months of his mayoral term. Hundred spends his days contending with press inquiries and staff leaks, public-health crises and energy issues (he's a hard-line centrist), and occasionally demonic creatures from the beyond. Even in the story's final chapters, Vaughan keeps unspooling plot threads, some of which he never bothers to tie up (mostly the ones about superhero stuff). The point of this story, it emerges, isn't the secret of Hundred's powers, but the relationship between public service and the unquenchable thirst for glory: as so often happens

in politics, everyone around the Great Machine ends up taking the fall, one way or another, and the victory he ultimately achieves is also a moral disaster.

Matt Fraction is one of the high-profile superhero comics writers of the moment — he's currently writing "Iron Man" and "Thor," among other marquee titles. The project on which he made his bones, though, is something different: "Casanova," an ultradensely packed psychedelic sci-fi espionage salmagundi, liberally larded with sex, mayhem and allusions to seemingly every bit of media that's ever knocked Fraction for a loop, from Michael Moorcock's Jerry Cornelius stories to Lesley Gore records and Vito Acconci performances. Casanova Quinn, Fraction's sharply dressed and erotically irresistible protagonist, is a loose cannon in the conflict between a pair of espionage agencies, W.A.S.T.E. (yes, as in "The Crying of Lot 49") and E.M.P.I.R.E. (short for "Extra-Military Police, Intelligence, Rescue and Espionage"). "Sabine Seychelle is a data-pimp that loves three things: crime, computers and having sex with his crime computers," runs one typical line of dialogue, in a panel that incorporates images of the Eiffel Tower, Picasso's "Guernica" and what looks like a MacBook Pro.

The series's opening volume, **CASANOVA: LUXURIA (Icon, paper, $14.99),** is drawn by the Brazilian artist Gabriel Bá, whose perspectives and figures stretch and compress like rubber in midbounce. Originally serialized in 2006 and 2007, when it was printed in two-tone black and green, "Luxuria" has been expanded and recolored for its new edition — fleshing out a love-story subplot that makes it clearer that a heart is beating inside the book's skeleton of clones, alternate timelines and "retroviral data payloads."

The central theme of Ben Katchor's comics is the unstoppable presence of minor consumer goods: widgets, ankle-sock elastics, broiled-lamb-chop dinners. (Katchor is pretty unstoppable himself. In the mid-'90s, when his comic strip "Julius Knipl, Real Estate Photographer" was briefly without a newspaper to call home, he displayed a new strip every week in a vitrine at a Papaya King hot-dog joint on 86th Street in Manhattan.) His latest book, **THE CARDBOARD VALISE (Pantheon, $25.95),** begins in typically batty fashion: "xenophiliac" traveler Emile Delilah takes a trip to Tensint Island, a vacation spot that inverts received ideas about tourism. Its main attraction is "the crumbling ruins of a once-great public restroom"; Delilah's father reminisces about having "introduced the native dishwashers to the concept of steel-wool scouring pads," which supplanted the local habit of letting "dirty pots and pans soak for days in the soapy inlet waters." Before he gets around to resolving Delilah's story, though, Katchor repeatedly wanders away from it, to other imaginary locations (like Outer Canthus, one of 15 countries that "exist solely in two dimensions"), and occasionally to whatever he feels like exploring for a page. ("On April 17th of 1992, we decided to close our home to all further cultural influences," begins one memorable strip.) Katchor's hand-lettering always seems to be a bit tilted; so do his characters, drawn with too-broad foreheads and too-short legs, features assembled from perfectly good pen lines and swatches of ink-wash that almost fit together.

KISS AND TELL (Harper Perennial, paper, $15.99), subtitled "A Romantic Résumé, Ages 0 to 22," is a chronological catalog of everyone its creator, MariNaomi, ever had funny feelings about during her youth, from the boy who kissed her on the cheek in kindergarten up through her nervous teenage fumblings, intoxicated hookups and a long-term relationship or two. Some are dispensed with in a page; others get much more space. MariNaomi discovered boys early, and as a teenager she drank, did drugs and ran away from home for a while. Mostly, she gravitated toward guys who weren't exactly prizes. Her one true love, she decides, was a model and petty criminal who ended up getting sent to jail. (She points out that she realized, many years after the fact, that the distinctive and romantically charged scent of the blanket he left with her was in fact cat urine.)

"Kiss and Tell" provides a gossipy frisson, but the book's charm lies in MariNaomi's amused and loving perspective on her curious, tough, occasionally foolish younger self: she knows she may have misunderstood the dynamics of her relationships, but she can still evoke the intensity of her feelings. Her simple, bold-lined drawings seem to be carved into the page, or rolled onto it, with big, raw chunks of black space behind them. Every love she's had gets a title page with a portrait in a circle, like a saint in her personal shrine.

John Porcellino's skinny, slightly tremulous freehand line reduces everything and everyone to their simplest forms, as in a small child's drawing if the child in question happened to be a devastatingly expressive minimalist. Porcellino is known for his autobiographical comics (collected in several volumes, most recently "Map of My Heart"), but **THE NEXT DAY (Pop Sandbox, paper, $16.95; available in comics stores; on sale in general-interest bookstores this fall)** covers new and darker ground. Written by Paul Peterson and Jason Gilmore, it's based on interviews with four people who attempted to kill themselves.

Their stories are each edited down to a few lines that suggest the rest: what drove them toward suicide, how they tried to do it, what came afterward, how they regard that time now. One woman describes how, at 18, she lay in bed crying for three days, "until my parents took me to the doctor." Porcellino draws her as a set of closed-in curves, squirming just a little, for five consecutive panels; in the page's sixth panel, the bed is empty. Every few pages, Porcellino presents a silent scene — rain falling on a tree and a house — as the book pauses to breathe. Then, finally, the rain abates, and we see the house again, the four narrators together outside of it, alive.

Douglas Wolk is the author of "Reading Comics: How Graphic Novels Work and What They Mean." He writes frequently about comics for The Times.

http://www.nytimes.com/2011/06/08/books/review/book-review-comics-roundup.html?ref=design

Land speed record bid could make space flight safer

- 16:20 27 May 2011 by **Paul Marks**

Bloodhound will have a rocket and a jet engine (Image: Dave Stock)

The team that hopes to break the world land speed record in a rocket-assisted jet car could create an important spin-off for the nascent space tourism market: a safer rocket engine.

So says Daniel Jubb, who is the founder of military rocket motor company Falcon Project Limited (FPL), based in Mojave, California, and chief rocket engineer for the Bloodhound SuperSonic Car, which aims to reach a speed of 1600 kilometres per hour (1000 miles per hour) on the salt flats in Hakskeen Pan, South Africa, sometime in 2013. The current record is 1227 km/h, and was set in 1997 by the Bloodhound team's driver Andy Green, in a car called Thrust SSC.

Bloodhound SSC looks like a wingless aircraft and will be powered by an engine from a Eurofighter Typhoon fighter jet as well as a hybrid liquid/solid fuel rocket motor designed by FPL. To keep the rocket fed with fuel, the vehicle uses a Cosworth Formula 1 racing car engine as a fuel pump.

Outsize fireworks

FPL considered many rocket engine options before settling for a hybrid. Solid fuel motors containing a powdered metal fuel were ruled out because they cannot be turned off in an emergency: they have to burn out fully, like outsized fireworks. They then investigated bipropellant liquid-fuelled engines burning a variety of fuels, such as kerosene, hydrogen and alcohol, with a liquid oxidiser such as nitric acid, nitrogen tetroxide, hydrogen peroxide or liquid oxygen.

"We looked at every combination of liquid fuels," says Jubb. "But we needed a very compact system to provide Bloodhound with the impulse it needs to get to 1000 mph and none could provide that." Basically, the all-liquid options were all too heavy. "The cryogenic temperatures that liquid oxygen needed would have placed an extreme risk to our driver Andy Green, too," Jubb adds.

A key performance indicator with a rocket engine is its "specific impulse" – the change in momentum it can achieve per unit of propellant mass burned, a quantity measured in seconds. "We need a specific impulse of 200 seconds for Bloodhound to reach 1000mph. That brought us into the range that can be delivered by a hybrid rocket motor," says Jubb.

SpaceShipOne

FPL originally planned to give Bloodhound a hybrid rocket similar to that used by commercial spaceflight company Scaled Composites, whose SpaceShipOne was the first commercial craft to reach the edge of space in 2004, famously winning the $10 million Ansari X-Prize. Its motor used a mixture of solid fuel – an aviation rubber called polybutadiene – and a liquid oxidiser: nitrous oxide. The oxidiser is the source of oxygen for fuel combustion.

However, in 2007, Scaled Composites was testing how liquid nitrous oxide flows, at its headquarters in Mojave, when a tank exploded, killing three of its rocket engineers.

Members of Jubb's team nearby were about to begin work on their own nitrous oxide-based motor when they heard the explosion. "We were very concerned," Jubb says. "We immediately went to look for other instances of nitrous oxide accidents."

Poring over reams of records dating back to the 1930s, they found that the compound has a history of explosive decomposition in the presence of contaminants, heat and/or high pressure. This had been a surprise to the Scaled team, too.

Dangerous oxidiser

"The body of knowledge about nitrous oxide (N2O) used as a rocket motor oxidiser did not indicate to us even the possibility of such an event," Scaled Composites said in a statement after the conclusion of the investigation into the accident a year later. The investigation could not pinpoint a precise cause for the explosion.

After identifying the potential risks with NASA's help – and publishing them online for other rocket makers – Scaled Composites is sticking with nitrous oxide for SpaceShipTwo, the craft it is developing for Virgin Galactic. Bloodhound will not be using it, though, says Jubb.

Scaled won't be drawn on its decision too stick with nitrous oxide. "We have a policy of not responding to questions on rocketry, structures or aerodynamics, since invariably we would inadvertently provide useful information to our competitors," says Scaled's founder and chairman emeritus Burt Rutan.

In their search for an alternative, the Bloodhound team re-examined one of the liquid propellants that lifted the UK's Prospero satellite into orbit in 1971 on the fourth and last launch of the Black Arrow rocket, part of the abortive British space programme. The propellant was concentrated hydrogen peroxide, known as high-test peroxide or HTP, and in Black Arrow it was burned with kerosene.

Future space vehicles

HTP is liquid at room temperature, unlike nitrous oxide, which must be stored at high pressure. This makes HTP less likely to build up high pressures that can cause an explosion, Jubb says. It is also a more potent oxidiser. Rather than using Black Arrow's heavy all-liquid fuel combination, Bloodhound will use a mixture of HTP and solid polybutadiene fuel. Just under half the thrust will come from the Typhoon jet engine.

But HTP is no panacea, warns David Gibbon, a propulsion engineer at Surrey Satellite Technology in Guildford, UK. "It just has different risks," he says. "It is susceptible to decomposition [which could lead to an explosion] if stored for a long time in the presence of contaminants."

Still, Jubb and his team think the HTP mixture is the best one for their purposes. The car's hybrid rocket motor is due to be tested on a static rig somewhere in the UK within the next three months.

Whether or not the car breaks the land speed record, Jubb believes a version of their HTP motor could power future commercial space vehicles. Indeed, FPL already has a foot in the civilian spaceflight door: "We're already working on a liquid-fuelled engine for a spaceplane customer," Jubb says.

http://www.newscientist.com/article/dn20520-land-speed-record-bid-could-make-space-flight-safer.html?full=true&print=true

Bipolar kids: Victims of the 'madness industry'?

- 08 June 2011 by **Jon Ronson**
- Magazine issue 2815.

Kids' stuff? (Image: Bloomberg/Getty)

THERE'S a children's picture book in the US called *Brandon and the Bipolar Bear*. Brandon and his bear sometimes fly into unprovoked rages. Sometimes they're silly and overexcited. A nice doctor tells them they are ill, and gives them medicine that makes them feel much better.

The thing is, if Brandon were a real child, he would have just been misdiagnosed with bipolar disorder. Also known as manic depression, this serious condition, involving dramatic mood swings, is increasingly being recorded in American children. And a vast number of them are being medicated for it.

The problem is, this apparent epidemic isn't real. "Bipolar emerges from late adolescence," says Ian Goodyer, a professor in the department of psychiatry at the University of Cambridge who studies child and adolescent depression. "It is very, very unlikely indeed that you'll find it in children under 7 years."

How did this strange, sweeping misdiagnosis come to pass? How did it all start? These were some of the questions I explored when researching *The Psychopath Test*, my new book about the odder corners of the "madness industry".

Freudian slip

The answer to the second question turned out to be strikingly simple. It was really all because of one man: Robert Spitzer.

I met Spitzer in his large, airy house in Princeton, New Jersey. In his eighties now, he remembered his childhood camping trips to upstate New York. "I'd sit in the tent, looking out, writing notes about the lady campers," he said. "Their attributes." He smiled. "I've always liked to classify people."

The trips were respite from Spitzer's "very unhappy mother". In the 1940s, the only help on offer was psychoanalysis, the Freudian-based approach of exploring the patient's unconscious. "She went from one psychoanalyst to another," said Spitzer. He watched the psychoanalysts flailing uselessly. She never got better.

Spitzer grew up to be a psychiatrist at Columbia University, New York, his dislike of psychoanalysis remaining undimmed. And then, in 1973, an opportunity to change everything presented itself. There was a job going editing the next edition of a little-known spiral-bound booklet called *DSM* - the *Diagnostic and Statistical Manual of Mental Disorders*.

DSM is simply a list of all the officially recognised mental illnesses and their symptoms. Back then it was a tiny book that reflected the Freudian thinking predominant in the 1960s. It had very few pages, and very few readers.

What nobody knew when they offered Spitzer the job was that he had a plan: to try to remove human judgement from psychiatry. He would create a whole new *DSM* that would eradicate all that crass sleuthing around the unconscious; it hadn't helped his mother. Instead it would be all about checklists. Any psychiatrist could pick up the manual, and if the patient's symptoms tallied with the checklist for a particular disorder, that would be the diagnosis.

For six years Spitzer held editorial meetings at Columbia. They were chaos. The psychiatrists would yell out the names of potential new mental disorders and the checklists of their symptoms. There would be a cacophony of voices in assent or dissent - the loudest voices getting listened to the most. If Spitzer agreed with those proposing a new diagnosis, which he almost always did, he'd hammer it out instantly on an old typewriter. And there it would be, set in stone.

That's how practically every disorder you've ever heard of or been diagnosed with came to be defined. "Post-traumatic stress disorder," said Spitzer, "attention-deficit disorder, autism, anorexia nervosa, bulimia, panic disorder..." each with its own checklist of symptoms. Bipolar disorder was another of the newcomers. The previous edition of the *DSM* had been 134 pages, but when Spitzer's *DSM-III* appeared in 1980 it ran to 494 pages.

"Were there any proposals for mental disorders you rejected?" I asked Spitzer. "Yes," he said, "atypical child syndrome. The problem came when we tried to find out how to characterise it. I said, 'What are the symptoms?' The man proposing it replied: 'That's hard to say because the children are very atypical'."

He paused. "And we were going to include masochistic personality disorder." He meant battered wives who stayed with their husbands. "But there were some violently opposed feminists who thought it was labelling the victim. We changed the name to self-defeating personality disorder and put it into the appendix."

DSM-III was a sensation. It sold over a million copies - many more copies than there were psychiatrists. Millions of people began using the checklists to diagnose themselves. For many it was a godsend. Something was categorically wrong with them and finally their suffering had a name. It was truly a revolution in psychiatry.

It was also a gold rush for drug companies, which suddenly had 83 new disorders they could invent medications for. "The pharmaceuticals were delighted with *DSM*," Spitzer told me, and this in turn delighted him: "I love to hear parents who say, 'It was impossible to live with him until we gave him medication and then it was night and day'."

Spitzer's successor, a psychiatrist named Allen Frances, continued the tradition of welcoming new mental disorders, with their corresponding checklists, into the fold. His *DSM-IV* came in at a mammoth 886 pages, with an extra 32 mental disorders.

Now Frances told me over the phone he felt he had made some terrible mistakes. "Psychiatric diagnoses are getting closer and closer to the boundary of normal," he said.

"Why?" I asked. "There's a societal push for conformity in all ways," he said. "There's less tolerance of difference. Maybe for some people having a label confers a sense of hope - previously I was laughed at but now I can talk to fellow sufferers on the internet."

Part of the problem is the pharmaceutical industry. "It's very easy to set off a false epidemic in psychiatry," said Frances. "The drug companies have tremendous influence."

One condition that Frances considers a mistake is childhood bipolar disorder. "Kids with extreme temper tantrums are being called bipolar," he said. "Childhood bipolar takes the edge of guilt away from parents that maybe they created an oppositional child."

"So maybe the diagnosis is good?"

"No," Frances said. "And there are very good reasons why not." His main concern is that children whose behaviour only superficially matches the bipolar checklist get treated with antipsychotic drugs, which can succeed in calming them down, even if the diagnosis is wrong. These drugs can have unpleasant and sometimes dangerous side effects.

Knife edge

The drug companies aren't the only ones responsible for propagating this false epidemic. Patient advocacy groups can be very fiery too. The author of *Brandon and the Bipolar Bear*, Tracy Anglada, is head of a childhood bipolar advocacy group called BP Children. She emailed me that she wished me all the best with my project but she didn't want to be interviewed. If, however, I wanted to submit a completed manuscript to her, she added, she'd be happy to consider it for review.

Anglada's friend Bryna Hebert has also written a children's book: *My Bipolar, Roller Coaster, Feelings Book*.
"Matt! Will you take your medicines please?" she called across the kitchen when I visited her at home in Barrington, Rhode Island. The medicines were lined up on the kitchen table. Her son Matt, 14 years old, took them straight away.
The family's nickname for baby Matt had been Mister Manic Depressive. "Because his mood would change so fast. He'd be sitting in his high chair, happy as a clam; 2 seconds later he'd be throwing things across the room. When he was 3 he'd hit and not be sorry that he hit. He was obsessed with vampires. He'd cut out bits of paper and put them into his teeth like vampire teeth and go up to strangers. Hiss hiss hiss. It was a little weird."
"Were you getting nervous?" I asked. "Yeah," said Hebert. "One day he wanted some pretzels before lunch, and I told him no. He grabbed a butcher knife and threatened me."
"How old was he?"
"Four. That was the only time he's ever done anything that extreme," she said. "Oh, he's hit his sister Jessica in the head and kicked her in the stomach."
"She's the one who punched *me* in the head," called Matt from across the room.
It was after the knife incident, Hebert said, they took him to be tested. As it happened, the paediatric unit at what was then their local hospital, Massachusetts General, was run by Joseph Biederman, the doyen of childhood bipolar disorder. According to a 2008 article in the *San Francisco Chronicle*, "Biederman's influence is so great that when he merely mentions a drug during a presentation, tens of thousands of children will end up taking it." Biederman has said bipolar disorder can start, "from the moment the child opens his eyes".
"When they were testing Matt he was under the table, he was on top of the table," said Hebert. "We went through all these checklists. One of Dr Biederman's colleagues said, "We really think Matt meets the criteria in the *DSM* for bipolar disorder."
That was 10 years ago and Matt has been medicated ever since. So has his sister Jessica, who was also diagnosed by Biederman's people as bipolar. "We've been through a million medications," said Hebert. "There's weight gain. Tics. Irritability. Sedation. They work for a couple of years then they stop working."
Hebert was convinced her children were bipolar, and I wasn't going to swoop into a stranger's home for an afternoon and tell her they were normal. That would have been incredibly patronising and offensive. Plus, as the venerable child psychiatrist David Shaffer told me when I met him in New York later that evening, "These kids can be very oppositional, powerful kids who can take years off your happy life. But they aren't bipolar."
"So what are they?"
"Attention-deficit disorder?" he said. "Often with an ADD kid you think: 'My God, they're just like a manic adult.' But they don't grow up manic. And manic adults weren't ADD when they were children. But they're being labelled bipolar.
"That's an enormous label that's going to stay with you for the rest of your life. You're being told you have a condition which is going to make you unreliable, prone to terrible depressions and suicide."
The debate around childhood bipolar is not going away. In 2008, *The New York Times* published excerpts from an internal hospital document in which Biederman promised to "move forward the commercial goals of Johnson & Johnson", the firm that funds his hospital unit and sells the antipsychotic drug Risperdal. Biederman has denied the allegations of conflict of interest.
Frances has called for the diagnosis of childhood bipolar to be thrown out of the next edition of *DSM*, which is now being drawn up by the American Psychiatric Association.
This article shouldn't be read as a polemic against psychiatry. There are a lot of unhappy and damaged people out there whose symptoms manifest themselves in odd ways. I get irritated by critics who seem to think that because psychiatry has elements of irrationality, there is essentially no such thing as mental illness. There is. Childhood bipolar, however, seems to me an example of things having gone palpably wrong.
On the night of 13 December 2006, in Boston, Massachusetts, 4-year-old Rebecca Riley had a cold and couldn't sleep. Her mother, Carolyn Riley, gave her some cold medicine, and some of her bipolar medication, and told her she could sleep on the floor next to the bed. When she tried to wake Rebecca the next morning, she discovered her daughter was dead.

The autopsy revealed that Rebecca's parents had given her an overdose of the antipsychotic drugs she had been prescribed for her bipolar disorder. They had got into the habit of feeding her the medicines to shut her up when she was being annoying. They were both convicted of Rebecca's murder.
Rebecca had been diagnosed as bipolar at 2-and-a-half, and given medication by an upstanding psychiatrist who was a fan of Biederman's research into childhood bipolar. Rebecca had scored high on the *DSM* checklist, even though like most toddlers she could barely string a sentence together.
Shortly before her trial, Carolyn Riley was interviewed on CBS's *60 Minutes* show by Katie Couric:
KC: Do you think Rebecca really had bipolar disorder?
CR: Probably not.
KC: What do you think was wrong with her now?
CR: I don't know. Maybe she was just hyper for her age.
Jon Ronson is a writer and documentary maker living in London. He is the author of five books, including The Men Who Stare at Goats. His latest book, The Psychopath Test, is about the psychiatry industry

http://www.newscientist.com/article/mg21028151.900-bipolar-kids-victims-of-the-madness-industry.html