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The incomplete art of brand imagery

CHESTNUT HILL, MA – *The visual power of a brand can be the first breakthrough companies make with their customers.*

But efforts to artistically manipulate the typeface of a corporate logo can backfire for firms, according to a Boston College researcher. Consumers may perceive companies that use incomplete typeface logos - such as the horizontal baby blue stripes that form the letters IBM - as innovative. However, these firms run the risk of being viewed as untrustworthy, according to a report forthcoming in the July issue of the Journal of Marketing.

Henrik Hagtvedt, a marketing professor in Boston College's Carroll School of Management, surveyed nearly 500 participants who viewed a series of logos with parts of the characters of the company name intentionally missing or blanked out. While the intent is to create interest in a brand, Hagtvedt found that these stylized logos can have a double-edged effect on consumer perceptions.

"Incompleteness is a device that is often used in paintings and drawings," explained Hagtvedt, whose background is in fine arts. "It sparks the viewers' interest. When applied to a logo, the resulting perceptual ambiguity is interesting and causes the firm to be perceived as innovative."

On the other hand, "Incompleteness may be interpreted as unclear communication, which can lead to the perception that the firm is untrustworthy," Hagtvedt said.



Companies have used incomplete typefaces to create brand logos, but these stylized approaches intended to generate visual interest have positive and negative influences on consumer perceptions about a company, according to surveys conducted by a Boston College professor. Altered typefaces can result in a firm being perceived as inventive, but also raise questions about the company's trustworthiness, according to Henrik Hagtvedt, a professor of marketing at the Carroll School of Management. Journal of Marketing

Further, incomplete typeface logos have an unfavorable influence on the overall attitude toward the firm among consumers who are focused on preventing bad outcomes rather than on achieving good ones. Therefore, although such stylized logos might be a good idea for an entertainment firm, they might be a bad idea for an insurance company.

According to Hagtvedt, the findings suggest that firms should avoid incomplete typeface logos if perceptions of trustworthiness are critical, or if their customers are likely to have a prevention focus. However, such logos may be successfully employed with promotion-focused consumers, and they may be used as a tool to position a firm as innovative.

Hagtvedt, who had an international career as a visual artist before becoming a marketing scholar, believes "Aesthetic devices like incompleteness are tied to universal principles of human perception, and as such they are applicable to both art and marketing. However, while this device has been successfully used by artists for millennia, corporations attempting the same should be aware of both the risks and the rewards."

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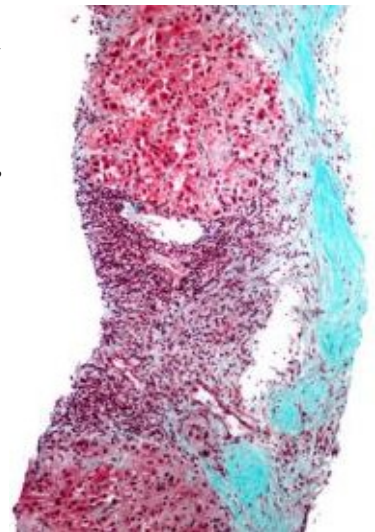
A gene that fights cancer, but causes it too

Over-activation of a single gene promotes leukemia, but its loss causes liver cancer

An international team of researchers, led by scientists at the University of California, San Diego School of Medicine, and the Eastern Hepatobiliary Surgery Hospital in China, say a human gene implicated in the development of leukemia also acts to prevent cancer of the liver.

Writing in the May 17 issue of the journal Cancer Cell, Gen-Sheng Feng, PhD, UCSD professor of pathology, and colleagues in San Diego, Shanghai and Turin report that an enzyme produced by the human gene PTPN11 appears to help protect hepatocytes (liver cells) from toxic damage and death. Conversely, the same enzyme, called Shp2, is a known factor in the development of several types of leukemia.

"The new function for PTPN11/Shp2 as a tumor suppressor in hepatocellular carcinoma (HCC) stands in contrast to its known oncogenic effect in leukemogenesis," said Feng. "It's a surprising finding, but one that we think provides a fresh view of oncogenesis. The same gene can have oncogenic or anti-oncogenic effects, depending upon cellular context."



In this low-magnification micrograph, normal liver architecture is disrupted by hepatocellular carcinoma, the most common type of liver cancer. Fibrotic late-stage cirrhosis is stained blue; tell-tale Mallory bodies (keratin filament proteins) are stained pink. UC San Diego School of Medicine

Previous studies had determined that PTPN11 was a proto-oncogene. That is, dominant active mutations in the gene had been identified in several types of leukemia patients, as was an over-expression of the gene product Shp2. Feng and colleagues looked to see what happened when Shp2 was knocked out specifically in hepatocytes in a mouse model. The result wasn't good: The mice got liver cancer.

Strikingly, deficient or low expression of PTPN11 was detected in a sub-fraction of human HCC patient samples by researchers at the Eastern Hepatobiliary Surgery Hospital in Shanghai, China. That work was led by Hongyang Wang, MD, PhD and a professor of molecular biology.

"The liver is a most critical metabolic organ in mammals, including humans," said Feng. "It has a unique regenerative capacity that allows it to resist damage by food toxins, viruses and alcohol. Shp2 normally acts to protect hepatocytes. Removing Shp2 from these liver cells leads to their death, which in turn triggers compensatory regeneration and inflammatory responses. That results in enhanced development of HCC induced by a chemical carcinogen."

Feng said the findings highlight the unique mechanism underlying HCC, but more broadly, they reveal new complexities in how different types of cancer begin. Indeed, the researchers say their work also uncovered pro- and anti-oncogenic activities in a gene transcription factor called Stat3.

"Our results indicate a requirement for Stat3 in promoting HCC development, which is consistent with the literature saying Stat3 is pro-oncogenic. But we also found that deletion of Stat3 in hepatocytes resulted in a modest, but significant, increase in HCC."

Feng said the findings underscore the need for caution in designing therapeutic strategies for treating HCCs and other types of cancers because the answer might also be the problem.

Funding for this study came, in part, from the National Institute of Diabetes and Digestive and Kidney Diseases, the National Institutes of Health and the National Natural Science Foundation of China.

Co-authors of the paper include Emilie A. Bard-Chapeau, UCSD Department of Pathology and Division of Biological Sciences and Sanford/Burnham Medical Institute, La Jolla; Shuangwei Li, Sharon S. Zhang, Helen H. Zhu, Diane D. Fang and Nissi M. Varki, UCSD Department of Pathology and Division of Biological Sciences; Jin Ding, Tao Han and Hongyang Wang, Laboratory of Signal Transduction, Eastern Hepatobiliary Surgery Hospital, Second Military Medical University, Shanghai, China; Frederic Princen and Beatrice Bailly-Maitre, Sanford/Burnham Medical Research Institute; Valeria Poli, Department of Genetics, Biology and Biochemistry, University of Turin, Italy.

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Happiness has a dark side

It seems like everyone wants to be happier and the pursuit of happiness is one of the foundations of American life. But even happiness can have a dark side, according to the authors of a new review article published in Perspectives on Psychological Science, a journal of the Association for Psychological Science.

They say that happiness shouldn't be thought of as a universally good thing, and outline four ways in which this is the case. Indeed, not all types and degrees of happiness are equally good, and even pursuing happiness can make people feel worse.

People who want to feel happier can choose from a multitude of books that tell them how to do it. But setting a goal of happiness can backfire, says June Gruber of Yale University, who co-wrote the article with Iris Mauss of the University of Denver and Maya Tamir of the Hebrew University of Jerusalem. It's one of the many downsides of happiness – people who strive for happiness may end up worse off than when they started.

The tools often suggested for making yourself happy aren't necessarily bad - like taking time every day to think about things you're happy about or grateful for, or setting up situations that are likely to make you happy. "But when you're doing it with the motivation or expectation that these things ought to make you happy, that can lead to disappointment and decreased happiness," Gruber says. For example, one study by Mauss and colleagues found that people who read a newspaper article extolling the value of happiness felt worse after watching a happy film than people who read a newspaper article that didn't mention happiness - presumably because they were disappointed they didn't feel happier. When people don't end up as happy as they'd expected, their feeling of failure can make them feel even worse.

Too much happiness can also be a problem. One study followed children from the 1920s to old age and found that those who died younger were rated as highly cheerful by their teachers. Researchers have found that people who are feeling extreme amounts of happiness may not think as creatively and also tend to take more risks. For example, people who have mania, such as in bipolar disorder, have an excess degree of positive emotions that can lead them to take risks, like substance abuse, driving too fast, or spending their life savings. But even for people who don't have a psychiatric disorder, "too high of a degree of happiness can be bad," Gruber says.

Another problem is feeling happiness inappropriately; obviously, it's not healthy to feel happy when you see someone crying over the loss of a loved one or when you hear a friend was injured in a car crash. Yet research by Gruber and her colleagues has found this inappropriate happiness also occurs in people with mania. Happiness also can mean being short on negative emotions - which have their place in life as well. Fear can keep you from taking unnecessary risks; guilt can help remind you to behave well toward others.

Indeed, psychological scientists have discovered what appears to really increase happiness. "The strongest predictor of happiness is not money, or external recognition through success or fame," Gruber says. "It's having meaningful social relationships." That means the best way to increase your happiness is to stop worrying about being happy and instead divert your energy to nurturing the social bonds you have with other people. "If there's one thing you're going to focus on, focus on that. Let all the rest come as it will."

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New solar product captures up to 95 percent of light energy MU engineer plans to make solar panels more effective in collecting energy

Efficiency is a problem with today's solar panels; they only collect about 20 percent of available light. Now, a University of Missouri engineer has developed a flexible solar sheet that captures more than 90 percent of available light, and he plans to make prototypes available to consumers within the next five years.

Patrick Pinhero, an associate professor in the MU Chemical Engineering Department, says energy generated using traditional photovoltaic (PV) methods of solar collection is inefficient and neglects much of the available solar electromagnetic (sunlight) spectrum. The device his team has developed – essentially a thin, moldable sheet of small antennas called nantenna – can harvest the heat from industrial processes and convert it into usable electricity. Their ambition is to extend this concept to a direct solar facing nantenna device capable of collecting solar irradiation in the near infrared and optical regions of the solar spectrum.

Working with his former team at the Idaho National Laboratory and Garrett Moddel, an electrical engineering professor at the University of Colorado, Pinhero and his team have now developed a way to extract electricity from the collected heat and sunlight using special high-speed electrical circuitry. This team also partners with Dennis Slafer of MicroContinuum, Inc., of Cambridge, Mass., to immediately port laboratory bench-scale technologies into manufacturable devices that can be inexpensively mass-produced.

"Our overall goal is to collect and utilize as much solar energy as is theoretically possible and bring it to the commercial market in an inexpensive package that is accessible to everyone," Pinhero said. "If successful, this product will put us orders of magnitudes ahead of the current solar energy technologies we have available to us today."

As part of a rollout plan, the team is securing funding from the U.S. Department of Energy and private investors. The second phase features an energy-harvesting device for existing industrial infrastructure, including heat-process factories and solar farms.

Within five years, the research team believes they will have a product that complements conventional PV solar panels. Because it's a flexible film, Pinhero believes it could be incorporated into roof shingle products, or be custom-made to power vehicles.

Once the funding is secure, Pinhero envisions several commercial product spin-offs, including infrared (IR) detection. These include improved contraband-identifying products for airports and the military, optical computing, and infrared line-of-sight telecommunications.

A study on the design and manufacturing process was published in the Journal of Solar Energy Engineering.

http://www.eurekalert.org/pub_releases/2011-05/osu-wia051611.php

What's in a simple line drawing? Quite a lot, our brains say COLUMBUS, Ohio – A new study using sophisticated brain scans shows how simple line drawings can capture the essence of a beach or a mountain for viewers just as well as a photograph would.

Researchers found that viewing a "beach" scene depicted in a line drawing activated nearly the same patterns of brain activity in study participants as did viewing an actual color photograph of a beach. The same was true when people viewed line drawings and photographs of other natural scenes including city streets, forests, highways, mountains and offices.

Even when researchers removed up to 75 percent of the pixels in a line drawing, people still did better than chance at determining what the lines represented - as long as the remaining lines showed the broad contours of the scene.

"Our results suggest that our brains can recreate whole detailed scenes from just a few lines, said Dirk Bernhardt-Walther, lead author of the study and assistant professor of psychology at Ohio State University.

"The representations in our brain for categorizing these scenes seem to be a bit more abstract than some may have thought – we don't need features such as texture and color to tell a beach from a street scene," he said.

Walther conducted the study with Barry Chai and Li Fei-Fei of Stanford University and Eamon Caddigan and Diane Beck with the University of Illinois. Their results appear in the online early edition of the Proceedings of the National Academy of Sciences.

For the study, 10 participants viewed color photographs and line drawings of six categories of scenes -- beaches, city streets, forests, highways, mountains and offices -- while their brains were scanned using functional magnetic resonance imaging (fMRI).

The fMRI images showed the researchers what was going on in several areas of the participants' brains when they viewed the photos and line drawings. The most significant results occurred in the parahippocampal place area (PPA), an area of the brain that scientists know plays an important role in the encoding and recognition of scenes (rather than faces or objects). Using the data from when participants viewed the color photos, the researchers trained a software-based decoder to tell what type of scene the participants viewed -- a beach, mountain, etc., -- based on the patterns of brain activity in the PPA revealed in the fMRI.

The decoder was far from perfect, but it did better than chance at predicting what scene a person was viewing in a particular fMRI image. Most importantly, the decoder could do just as well at predicting which scene a person viewed when it was focused on line drawings as it was on photographs. In fact, the decoder did slightly better -- although not significantly so -- at predicting line drawings compared to photographs in the primary visual cortex.

"We expected that line drawings would be good enough to allow some decoding, but it was surprising that there was no benefit to photographs -- the decoder was no better when it was used on photos than it was on line drawings," Walther said.

Findings showed that when the decoder was trained on photographs, it still did equally well at predicting which scenes people were viewing in line drawings, and vice versa. "That suggests the brain uses the same information to decode which scene it is viewing when it is presented with line drawings or photos," he said.

In addition, results showed that when the decoder did make errors, it made similar errors in both photographs and line drawings. For example, if the decoder thought people were looking at a photo of a mountain when they were really looking at a photo of a forest, it would make the same mistake when it was analyzing line drawings.

"The patterns of error match incredibly well, so that's an additional piece of evidence that the representations for photos and line drawings are very similar in the brain," Bernhardt-Walther said.

But what is it about line drawings that allow people to recognize what they represent? As part of the study, the researchers removed some of the lines in the line drawings and asked participants if they could still tell what scene was depicted. In some cases, they removed up to 75 percent of the pixels in the drawing.

If the researchers left the long contours in the drawings, which represented global structure -- such as sky, water or sand -- participants could still correctly predict what kind of scene was depicted about 60 percent of the time. However, when researchers took out these long contours and left only short ones -- representing details like leaves, windows in buildings or individual ridges in a mountainside -- the accuracy of participants went way down.

These findings cast doubt on some models of human visual perception which argue that people need specific information that is found in photographs -- such as color, shading and texture -- to classify a scene.

"Of course, we use the rich sources of information found in a photograph when it is available, but the brain is an opportunist -- it uses what is available," Walther said. "We can get a lot of information from a line drawing."

The results also suggest why line drawings have played such an important role in human history, both as an art form and a way of presenting information simply.

"Imagine the astonishment of early man when he discovered he could draw shapes on a rock wall and it resembled the actual animal he had just killed. Line drawings have been with us since prehistoric times," Walther said.

The research was funded with a grant from the National Institutes of Health.

http://www.eurekalert.org/pub_releases/2011-05/osu-cac051611.php

Common anti-inflammatory coaxes liver cancer cells to commit suicide

COLUMBUS, Ohio – The anti-inflammatory drug celecoxib, known by the brand name Celebrex, triggers liver cancer cell death by reacting with a protein in a way that makes those cells commit suicide, according to a new study.

Researchers also found that the combination of celecoxib with each of two chemotherapy drugs killed more liver cancer cells in culture, making those combinations more effective than either drug on its own.

"Each chemotherapy drug alone will reduce the growth of cancer cells, but when each single drug is combined with Celebrex, a greater growth suppression effect was observed," said Jiayuh Lin, senior author of the study and an associate professor of pediatrics at Ohio State University. "For clinicians, this research suggests the possibility of a new therapeutic strategy."

Celecoxib has this effect by acting on STAT3, a gene inside liver cancer cells that, when activated, allows those cancer cells to resist the effects of chemotherapy drugs. The researchers determined that the celecoxib molecule binds to STAT3 on so-called "hot spots," effectively blocking its ability to function.

Powerful computing techniques were employed before the researchers ever considered celecoxib as a potential treatment for cancer. Celebrex is a nonsteroidal anti-inflammatory drug, or NSAID, and a Cox-2 inhibitor, meaning it helps control inflammation by inhibiting an enzyme known as cyclooxygenase-2. It is most commonly prescribed to treat the pain of arthritis.

Chenglong Li, an assistant professor of medicinal chemistry and pharmacognosy at Ohio State, has developed computer simulations to identify optimal drug fragment combinations that attach simultaneously to proteins in ways that block the proteins' functions. By searching a database of existing federally approved drugs, he found that celecoxib was structurally similar to a template molecule that he had determined would most effectively bind to STAT3 and inhibit its function.

"Normally, STAT3 is persistently activated in cancer cells. If you have a good molecule that sticks to STAT3, it will prevent its activation," Li said. And when STAT3 is inhibited, cellular survival pathways are blocked that cause the cancer cell to chop itself up and die.

The research appears online and is scheduled for later print publication in the journal *Cancer Prevention Research*.

The biological portion of the study further defined the role of a pro-inflammatory protein in liver cancer's development. The protein, called interleukin-6, or IL-6, is a cytokine, a chemical messenger that causes inflammation, which can have both beneficial and damaging effects in the body. Previous research by other scientists has shown that high levels of IL-6 in the blood are associated with hepatocellular carcinoma, the most common type of liver cancer.

Lin and colleagues determined that IL-6 initiates a chemical reaction called phosphorylation of STAT3. That reaction activates STAT3 inside liver cancer cells, where STAT3 in turn activates at least three other known genes that allow the cells to resist the effects of chemotherapy.

The scientists treated five different types of hepatocellular carcinoma cells with two different doses of celecoxib for two hours, and followed by giving them IL-6 for 30 minutes. The pre-treatment with the lower dose of celecoxib inhibited IL-6's ability to start the reaction that activates STAT3. The higher dose blocked STAT3 altogether.

The researchers then treated a line of liver cancer cells with celecoxib in combination with two chemotherapy drugs: doxorubicin, which is used to treat breast, ovarian, gastric, thyroid and several other cancers, and sorafenib, which is the only chemotherapy medication approved by the Food and Drug Administration for liver cancer treatment. Its brand name is Nexavar.

With both drugs, the addition of celecoxib treatment reduced the number of viable liver cancer cells by anywhere from approximately 50 percent to more than 90 percent, depending on the doses. The combination of celecoxib and sorafenib also significantly limited the cancer cells' ability to form colonies, a key element of tumor growth and survival after the drug treatment.

"Because liver cancer has a very low five-year survival rate, it is most likely that even sorafenib alone may not be effective to cure the cancer," said Lin, also an investigator in Ohio State's Comprehensive Cancer Center and the Center for Childhood Cancer at Nationwide Children's Hospital. "We hope that using both drugs together could be more effective. Both celecoxib and sorafenib are already approved by the FDA, so we think this combined treatment should be able to be used in the clinic pretty quickly."

The fifth most common cancer in humans, liver cancer remains one of the most difficult to successfully treat. Patients' overall five-year survival rate is about 10 percent, according to the American Cancer Society.

These experiments were conducted in cell cultures. Further testing would be needed to determine celecoxib's effectiveness in human cancers, Lin noted.

And the powerful computational work led by Li, also an investigator in Ohio State's Comprehensive Cancer Center, is likely to lead to the development of new molecules with even more precise structural relationships with the proteins they are designed to block.

Li's method is called Multiple Ligand Simultaneous Docking. In this work, he used computer simulations to identify "hot spots" on the STAT3 protein – tiny pockets to which molecules could most successfully attach to inhibit the protein's activity. He then searched through drug banks containing more than 7,500 existing and

experimental medications to find the most suitable molecular fragments that could be pieced together to produce a new molecule shaped in such a way that it would fit into those pockets.

After designing a template molecule that would most effectively bind to STAT3, he compared that template to the 1,400 federally approved drugs already on the market.

"Celecoxib is almost identical to the molecule template. It attaches to STAT3 in three places. We can optimize celecoxib, and that is expected to come soon. But applying our technique to find those pieces and determining that they come from an existing drug makes the discovery process much faster," said Li, a key co-author of the paper and frequent research collaborator with Lin.

Li has termed this approach as *in silico* (computer-driven) drug repositioning or repurposing.

The discovery that celecoxib can bind to STAT3 also appears to apply to other cancers. Both Lin and Li were key authors on a recent paper that suggested that celecoxib's ability to block STAT3's function might also make it effective as a treatment for rhabdomyosarcoma, the most common soft tissue cancer in children and adolescents. This research was published in the April 15 issue of the journal *Biochemical and Biophysical Research Communications*.

Co-authors of the liver cancer and rhabdomyosarcoma studies include Yan Liu, Aiguo Liu and Suzanne Reed of the Center for Childhood Cancer at Nationwide Children's Hospital (Aiguo Liu is also affiliated with Tongji Hospital at Huazhong University of Science and Technology in Wuhan, China); and Huameng Li of Ohio State's Division of Medicinal Chemistry and Pharmacogenosy and the Biophysics Graduate Program.

http://www.eurekalert.org/pub_releases/2011-05/seri-so051611.php

Sections of retinas regenerated and visual function increased with stem cells from skin
Boston, MA - Scientists from Schepens Eye Research Institute are the first to regenerate large areas of damaged retinas and improve visual function using IPS cells (induced pluripotent stem cells) derived from skin.

The results of their study, which is published in PLoS ONE this month, hold great promise for future treatments and cures for diseases such as age-related macular degeneration, retinitis pigmentosa, diabetic retinopathy and other retinal diseases that affect millions worldwide.

"We are very excited about these results," says Dr. Budd A. Tucker, the study's first author. "While other researchers have been successful in converting skin cells into induced pluripotent stem cells (iPSCs) and subsequently into retinal neurons, we believe that this is the first time that this degree of retinal reconstruction and restoration of visual function has been detected," he adds. Tucker, who is currently an Assistant Professor of Ophthalmology at the University of Iowa, Carver College of Medicine, completed the study at Schepens Eye Research Institute in collaboration with Dr. Michael J. Young, the principle investigator of the study, who heads the Institute's regenerative medicine center.

Today, diseases such as retinitis pigmentosa (RP) and age-related macular degeneration (AMD) are the leading causes of incurable blindness in the western world. In these diseases, retinal cells, also known as photoreceptors, begin to die and with them the eye's ability to capture light and transmit this information to the brain. Once destroyed, retinal cells, like other cells of the central nervous system have limited capacity for endogenous regeneration.

"Stem cell regeneration of this precious tissue is our best hope for treating and someday curing these disorders," says Young, who has been at the forefront of vision stem cell research for more than a decade.

While Tucker, Young and other scientists were beginning to tap the potential of embryonic and adult stem cells early in the decade, the discovery that skin cells could be transformed into "pluripotent" cells, nearly identical to embryonic cells, stirred excitement in the vision research community. Since 2006 when researchers in Japan first used a set of four "transcription factors" to signal skin cells to become iPSCs, vision scientists have been exploring ways to use this new technology. Like embryonic stem cells, iPSCs have the ability to become any other cell in the body, but are not fraught with the ethical, emotional and political issues associated with the use of tissue from human embryos.

Tucker and Young harvested skin cells from the tails of red fluorescent mice. They used red mice, because the red tissue would be easy to track when transplanted in the eyes of non-fluorescent diseased mice.

By forcing these cells to express the four Yamanaka transcription factors (named for their discoverer) the group generated red fluorescent iPSCs, and, with additional chemical coaxing, precursors of retinal cells. Precursor cells are immature photoreceptors that only mature in their natural habitat - the eye.

Within 33 days the cells were ready to be transplanted and were introduced into the eyes of a mouse model of retina degenerative disease. Due to a genetic mutation, the retinas of these recipient mice quickly degenerate, the photoreceptor cells die and at the time of transplant electrical activity, as detected by ERG (electroretinography), is absent.

Within four to six weeks, the researchers observed that the transplanted "red" cells had taken up residence in the appropriate retinal area (photoreceptor layer) of the eye and had begun to integrate and assemble into healthily looking retinal tissue.

The team then retested the mice with ERG and found a significant increase in electrical activity in the newly reconstructed retinal tissue. In fact, the amount of electrical activity was approximately half of what would be expected in a normal retina. They also conducted a dark adaptation test to see if connections were being made between the new photoreceptor cells and the rest of the retina. In brief, the group found that by stimulating the newly integrated photoreceptor cells with light they could detect a signal in the downstream neurons, which was absent in the other untreated eye.

Based on the results of their study, Tucker and Young believe that harvesting skin cells for use in retinal regeneration is and will continue to be a promising resource for the future.

The two scientists say their next step will be to take this technology into large animal models of retinal degenerative disease and eventually toward human clinical trials.

<http://www.bbc.co.uk/news/business-13359354>

Bedbugs bite into the US economy

By Theo Leggett Business reporter, BBC News, New York

In popular culture, New York is the city that never sleeps, the concrete jungle in which dreams are made, a place to walk on the wild side.

The reality is the US financial capital is, above all, a crowded and bustling pool of humanity, in which about nine million people live and work cheek by jowl. Such proximity makes it the perfect breeding ground for a creature that certainly causes its residents to lose sleep, and for many is the stuff of nightmares.

For the past few summers, New York has been struggling with an epidemic of bedbugs - tiny bloodsucking insects that hide during the day, but come out to feed at night. An infestation of bedbugs is very easy to acquire, and very difficult to eradicate. They can be picked up in taxis or cinemas, on subway trains or in hotel rooms.

Last year, some of the city's flagship retailers were affected. Lingerie retailer Victoria's Secret and teen fashion store Hollister were among those that had to close outlets while pest controllers were called in.

'PR nightmare'

For businesses, finding bedbugs can be very bad news indeed. Getting rid of them can be very expensive, with treatment of commercial premises sometimes costing tens of thousands of dollars.

But damage to reputations can be even harder to rectify, according to Scott Bermack of New York legal firm LeClair Ryan. "It's a public relations nightmare," he says. "There's a perception among the public that one bug is an infestation. "You hear about one bug in a store or a hotel and the customers are going to run out and tell their friends and tell all the websites."

Disgruntled customers are also likely to take legal action. When bedbugs are found, says Mr Bermack, the writs soon follow. "You have people suing for damage to furniture, damage to clothing. You have people suing for pain and suffering, for emotional damages or psychological damages.

"There's really no limit to the creativity of the plaintiffs' lawyers in terms of the claims they'll make."

Because companies are anxious to limit bad publicity, many of these cases are settled out of court - adding thousands of dollars to the bills they already face for getting rid of the bugs.

Cracking down

Lawyers, of course, are making money out of the bedbug epidemic, but they are not the only ones. "It's been terrific in terms of revenue," says Timothy Wong, director of pest control firm M&M Environmental.

His office in Manhattan's Lower East Side is packed with the bulky equipment needed to eradicate bedbugs, and a pervasive smell of insecticide hangs in the air. "Six or seven years ago, bedbug-related services made up less than 1% of our total revenue. Today, it's more than 25%," he says.

"We're treating almost everything, from commercial offices to retail stores, hotels, giant department stores, airlines - just about everybody."

His company makes its money not only from getting rid of bedbugs, but also from preventing them getting established in the first place.

Battling bedbugs

- ***Do not take in second-hand beds or mattresses***
- ***Do not allow clutter to build up where you sleep - it is a perfect nesting place for bedbugs***
- ***When looking around rented accommodation, watch out for tell-tale blood spots or smears on sheets, and in the seams of furniture and upholstery***
- ***Do not wait to report a problem - nip an infestation in the bud before it grows***
- ***Bedbugs are not thought to be able to bite through clothing - as a last resort, you can zip yourself into a sleeping bag or all-over body suit***
- ***Call pest control to deal with an infestation***

Inevitably, the surge in demand for pest control services has prompted many entrepreneurs to try their luck in the market. But according to Mr Wong, few have succeeded. "There were a lot of new players who came in. In 2010, there were more than 125 new entrants into the market." "But the funny thing is, 60 or 70% of them have already left. They came into an industry that they're not familiar with. The overheads are huge, the equipment is expensive, and the training is expensive. "So people jumping into the business thinking they can turn up and cash in... well, it's difficult. And I think they're proving that's the case."

Getting tougher

But for Mr Wong's own company, business is booming - a fact made all too obvious by the row of sales staff crammed into a narrow corridor, taking calls from anxious homeowners and businesses.

It's a line of work that looks unlikely to dry up any time soon. Insecticides that used to be effective against bedbugs, such as DDT, have been banned, while the insects have steadily become immune to others.

Bedbug activity increases during warm weather, and experts say this summer will be no exception. New York is bracing itself for another irritating onslaught.

But the uncomfortable fact is that, as in so many areas, where New York leads, other cities look set to follow.

Bedbugs are notoriously good travellers, and signs of similar epidemics are already emerging in Philadelphia, Los Angeles, Washington, London and Paris. Good business for some, sleepless nights for others.

<http://www.nytimes.com/2011/05/17/health/17first.html>

M.R.I., 1974

By NICHOLAS BAKALAR

The technology for measuring the magnetic properties of atomic nuclei goes back to the 1930s. But it took decades for scientists to put it to medical use.

On Feb. 9, 1974, The New York Times reported in its Patents of the Week column that Dr. Raymond V. Damadian, a physician and biophysicist at Downstate Medical Center in Brooklyn, had patented a method for distinguishing normal from cancerous tissue by what was then called nuclear magnetic resonance.

The apparatus was "still under development," the article said, and it mentioned several other patents recorded that week, including one for a new kind of no-iron all-cotton fitted bedsheet.

On Oct. 12, 1975, The Times described one of world's most powerful N.M.R. spectrometers, built at Stanford University. The article said nothing about its potential use in medical diagnoses.

On July 21, 1977, Dr. Damadian was in the news again. He had announced a new technique for detecting cancer, using a one-and-a-half-ton, 10-foot-high device equipped with what he called "the world's largest magnet." His news release apparently exaggerated a bit, and Dr. Damadian later retracted a contention that his technique had already been used to discover cancerous tissue in a living patient.

By late 1978 other imaging techniques - positron emission tomography (PET scans), computed tomography (CT or CAT scans) and ultrasound - were already being used in humans, and on Nov. 14, the lead article in the first issue of Science Times described the new procedures. Mention of nuclear magnetic resonance was relegated to the last two paragraphs, where it was called "one of the newest methods of imaging, and probably furthest from clinical application."

But in the early 1980s magnetic scans were being performed on humans, and hospitals had begun buying the devices. As the machines became more widely used, the word "nuclear" in the name frightened some patients with its suggestion that nuclear radiation was involved. An article on March 17, 1985, explained that now most doctors were calling both the procedure and the machines "magnetic resonance imaging," or M.R.I. It was the first time The Times used the term that is universally accepted today.

On Oct. 7, 2003, The Times reported that Paul C. Lauterbur and Sir Peter Mansfield had won the Nobel Prize in Physiology or Medicine for "discoveries of imaging with magnetic resonance," in the citation's words, that "have played a seminal role in the development of one of the most useful imaging modalities in medicine today." Dr. Damadian took out full-page newspaper ads to complain that he had been unfairly denied the prize.

http://www.eurekalert.org/pub_releases/2011-05/uog-avs051711.php

A virus similar to herpes could be a risk factor for multiple sclerosis

The Epstein-Barr (EBV) virus –belonging to the herpesviruses family, which also includes the herpes simplex virus and the cytomegalovirus– is one of the environmental factors that might cause multiple sclerosis, a condition affecting the central nervous system, which causes are unknown.

This has been confirmed by University of Granada scientists that analyzed the presence of this virus in patients with multiple sclerosis. Researchers analyzed antibody levels, that is, antibodies that are produced within the central nervous system and that could be directly involved in the development of multiple sclerosis.

Multiple sclerosis is a demyelinating condition affecting the central nervous system. Although the cause for this condition is unknown, patients with MS seem to have genetic vulnerability to certain environmental factors that could trigger this condition.

While other studies have tried to elucidate whether infection with the Epstein-Barr virus could be considered a risk factor in multiple sclerosis, what University of Granada researchers did was conducting a meta-analysis of observational studies including cases and controls, aimed at establishing such association.

A 151-patient sample

In a sample of 76 healthy individuals and 75 patients with multiple sclerosis, researchers sought a pattern that would show an association between this virus and multiple sclerosis. Thus, they determined the presence of antibodies to Epstein-Barr virus antigens synthesized within the central nervous system. Simultaneously, they identified viral DNA to measure antibody levels to EBV within the central nervous system, and the presence of EBV DNA respectively.

This piece of research was conducted by Olivia del Carmen Santiago Puertas at the Department of Microbiology, University of Granada, and coordinated by professors José Gutiérrez Fernández, Antonio Sorlózano Puerto and Óscar Fernández Fernández.

The researchers found a statistically significant association between viral infection and multiple sclerosis starting from the detection of markers that essentially indicate an infection in the past, while markers that indicate recent infection or reactivation are not relevant.

The researcher Olivia del Carmen Santiago Puertas state that, as the factors triggering this condition are still unknown "studying them is important to try to develop a prevention method".

This study found an association between MS and some viral infection markers "but, to obtain a definitive conclusion, further research is needed with a significant number of patients that combine different microbiological techniques, where the different viral infection markers are recorded, and assessing patients' clinical state even years before the onset of the first symptoms of multiple sclerosis".

References:

- *Relation between Epstein-Barr virus and Multiple Sclerosis. Analytic study of scientific production. European Journal of Clinical Microbiology and Infectious Diseases. 2010.*

- *New Strategies and Patent Therapeutics in EBV-Associated Diseases. Mini-Reviews in Medicinal Chemistry. 2010.*

http://www.eurekalert.org/pub_releases/2011-05/uota-sce051711.php

Sodium channels evolved before animals' nervous systems, research shows

AUSTIN, Texas - An essential component of animal nervous systems - sodium channels - evolved prior to the evolution of those systems, researchers from The University of Texas at Austin have discovered.

"The first nervous systems appeared in jellyfish-like animals six hundred million years ago or so," says Harold Zakon, professor of neurobiology, "and it was thought that sodium channels evolved around that time. We have now discovered that sodium channels were around well before nervous systems evolved."

Zakon and his coauthors, Professor David Hillis and graduate student Benjamin Liebeskind, published their findings this week in PNAS.

Nervous systems and their component neuron cells were a key innovation in the evolution of animals, allowing for communication across vast distances between cells in the body and leading to sensory perception, behavior and the evolution of complex animal brains.

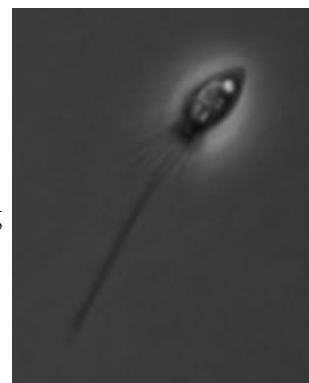
Sodium channels are an integral part of a neuron's complex machinery. The channels are like floodgates lodged throughout a neuron's levee-like cellular membrane. When the channels open, sodium floods through the membrane into the neuron, and this generates nerve impulses.

Zakon, Hillis and Liebeskind discovered the genes for such sodium channels hiding within an organism that isn't even made of multiple cells, much less any neurons. The single-celled organism is a choanoflagellate, and it is distantly related to multi-cellular animals such as jellyfish and humans.

The researchers then constructed evolutionary trees, or phylogenies, showing the relationship of those genes in the single-celled choanoflagellate to multi-cellular animals, including jellyfish, sponges, flies and humans.

*University of Texas at Austin researchers discovered the genes for sodium channels that occur in animal neurons in the single-celled choanoflagellate, *Monosiga brevicollis*, showing that the sodium channels evolved before neurons.*

Mark J. Dayel, University of California, Berkeley.



Because the sodium channel genes were found in choanoflagellates, the scientists propose that the genes originated not only before the advent of the nervous system, but even before the evolution of multicellularity itself.

"These genes were then co-opted by the nervous systems evolving in multi-cellular animals," says Hillis, the Alfred W. Roark Centennial Professor in Natural Sciences. "This study shows how complex traits, such as the nervous system, can evolve gradually, often from parts that evolved for other purposes."

"Evolutionarily novel organs do not spring up from nowhere," adds Zakon, "but from pre-existing genes that were likely doing something else previously."

Liebeskind, a graduate student in the university's ecology, evolution and behavior program, is directing his next research efforts toward understanding what the sodium channels do in choanoflagellates.

http://www.eurekalert.org/pub_releases/2011-05/uop-pri051711.php

Penn researchers identify the roots of memory impairment resulting from sleep deprivation

PHILADELPHIA - From high-school students to surgeons, anyone who has pulled an all-nighter knows there is a price to be paid the next day: trouble focusing, a fuzzy memory and other cognitive impairments. Now, researchers at Penn have found the part of the brain and the neurochemical basis for sleep deprivation's effects on memory.

Ted Abel, a professor of biology in Penn's School of Arts and Sciences and director of the University's interdisciplinary Biological Basis of Behavior program, led the research team. His partners included Cédric Florian, a postdoctoral fellow in biology, and Christopher Vecsey, a neuroscience graduate student, as well as researchers from the Massachusetts Institute of Technology and Tufts University.

Their research was published in *The Journal of Neuroscience*.

Abel's group aimed to better understand the role of the nucleoside adenosine in the hippocampus, the part of the brain associated with memory function.

"For a long time, researchers have known that sleep deprivation results in increased levels of adenosine in the brain, and has this effect from fruit flies to mice to humans." Abel said. "There is accumulating evidence that this adenosine is really the source of a number of the deficits and impact of sleep deprivation, including memory loss and attention deficits. One thing that underscores that evidence is that caffeine is a drug that blocks the effects of adenosine, so we sometimes refer to this as 'the Starbucks experiment.'"

Abel's research actually involved two parallel experiments on sleep-deprived mice, designed to test adenosine's involvement in memory impairment in different ways.

One experiment involved genetically engineered mice. These mice were missing a gene involved in the production of glial transmitters, chemicals signals that originate from glia, the brain cells that support the function of neurons. Without these gliatransmitters, the engineered mice could not produce the adenosine the researchers believed might cause the cognitive effects associated sleep deprivation.

The other experiment involved a pharmacological approach. The researchers grafted a pump into the brains of mice that hadn't been genetically engineered; the pump delivered a drug that blocked a particular adenosine receptor in the hippocampus. If the receptor was indeed involved in memory impairment, sleep-deprived mice would behave as if the additional adenosine in their brains was not there.

To see whether these mice showed the effects of sleep deprivation, the researchers used an object recognition test. On the first day, mice were placed in a box with two objects and were allowed to explore them while being videotaped. That night, the researchers woke some of the mice halfway through their normal 12-hour sleep schedule. On the second day, the mice were placed back in the box, where one of the two objects had been moved, and were once again videotaped as they explored to see how they reacted to the change.

"Mice would normally explore that moved object more than other objects, but, with sleep deprivation, they don't," Abel said. "They literally don't know where things are around them."

Both sets of treated mice explored the moved object as if they had received a full night's sleep.

"These mice don't realize they're sleep-deprived," Abel said.

Abel and his colleagues also examined the hippocampi of the mice, using electrical current to measure their synaptic plasticity, or how strong and resilient their memory-forming synapses were. The pharmacologically and genetically protected mice showed greater synaptic plasticity after being sleep deprived than the untreated group.

Combined, the two experiments cover both halves of the chemical pathway involved in sleep deprivation. The genetic engineering experiment shows where the adenosine comes from: glia's release of adenosine

triphosphate, or ATP, the chemical by which cells transfer energy to one another. And the pharmacological experiment shows where the adenosine goes: the A1 receptor in the hippocampus.

The knowledge that interrupting the pathway at either end results in mice that show no memory impairments is a major step forward in understanding how to manage those impairments in humans.

"To be able to reverse a particular aspect of sleep-deprivation, such as its effect on memory storage, we really want to understand the molecular pathways and targets," Abel said. "Here, we've identified the molecule, the cellular circuit and the brain region by which sleep deprivation affects memory storage."

Such treatments would be especially enticing, given how sensitive the brain is to sleep deprivation's effects.

"Our sleep deprivation experiments are the equivalent of losing half of a night sleep for a single night," Abel said. "Most of us would think that's pretty minor, but it shows just how critical the need for sleep is for things like cognition."

In addition to Abel, Florian and Vescey, the research was conducted by Michael M. Halassa of the Department of Psychiatry at Massachusetts General Hospital and the Department of Brain and Cognitive Science at MIT, as well as Philip G. Haydon, of the Department of Neuroscience at the Tufts University School of Medicine.

The research was supported by the National Institutes of Health.

<http://latimesblogs.latimes.com/greenspace/2011/05/la-ev-charging-stations.html>

\$25,000, 350-mile-per-charge electric car could be reality by 2017, DOE says

In an event flanked with all the electric cars that have recently come to market, and a handful of those that are poised for sale later this year, U.S. Energy Secretary Steven Chu and L.A. Mayor Antonio Villaraigosa flipped the switch today on the 500th electric-vehicle charging station installed by Coulomb Technologies as part of its ChargePoint America network.

Coulomb, based in Campbell, Calif., received \$15 million last year from the Department of Energy, and \$22 million in private funds, to install 4,600 chargers across the country by the end of 2011. About 1,600 are slated for California, 210 of which have so far been installed. L.A. currently has 71 Coulomb charging stations, including the one installed today in the California Science Center parking lot.

"The Department of Energy is happy to be a part of this [event], but more importantly we're very happy to be really trying to push for the electrification of vehicles in the U.S.," Chu said. "The reason is very simple. We have to diversify our transportation energy."

Oil prices may be in flux right now, he said, but developing countries' demand for limited oil resources will continue to push prices higher. He noted that China sold 16.7 million vehicles in 2010 and will sell 20 million cars annually within the next couple of years. The U.S. sold 12 million cars last year.

"Because of increased demand, we've got to think of all the other things we can do in transportation. The best is efficiency," Chu said.

Batteries are the "heart" of electric vehicles, he said, adding that the Department of Energy is funding research that will drop the cost of electric-vehicle batteries 50% in the next three or four years and double or triple their energy density within six years so "you can go from Los Angeles to Las Vegas on a single charge," he said. "These are magical distances. To buy a car that will cost \$20,000 to \$25,000 without a subsidy where you can go 350 miles is our goal."

Chu said he is working to change the \$7,500 federal tax credit for electric vehicle purchases to a \$7,500 rebate, so EV buyers can get an immediate discount on an EV purchase. Currently, they have to wait until they file their tax returns.

Three years ago, the U.S. made less than 1% of advanced batteries in the world, Chu said. Investments in battery research through the American Recovery and Reinvestment Act will help build 30 new U.S. battery manufacturing plants, aiding energy security as well as job creation.

"Every time we ship one of these [charging stations], three people go to work for a day: one to build it and two people to install it," said Coulomb Technologies President Richard Lowenthal. "It's a great job creation benefit to all of us.... Not just jobs, but creating an industry."

According to Villaraigosa, "What L.A. has made crystal clear is that the American Recovery Act has helped us put people back to work. It's created jobs, and invested in technology and infrastructure."

L.A.'s infrastructural improvements will continue with the upgrades of 90 existing electric charging stations owned by the city. As many as 400 others are also slated for upgrades in L.A. and surrounding cities, Villaraigosa said.

<http://news.discovery.com/dinosaurs/dinosaurs-extinct-again-110517.html>

Dinosaurs May Soon Go Extinct - Again

Analysis by Jennifer Viegas

Certain dinosaurs may go extinct -- again -- since they may have only existed in the minds of paleontologists.

Dino expert John Horner and others suspect that at least 50 dinosaurs on the record books now have been incorrectly identified. According to a Science journal report, "it's time to start culling the herd."

Here are just a few dinosaur species that may soon get the axe:

Horner, a paleontologist at Montana State University, suspects the remains of *Nanotyrannus* may belong to a young *Tyrannosaurus rex*. Here at Discovery News we recently reported on the incredible differences between *Tyrannosaurus* toddlers and their parents. Juvenile *tyrannosaurs* looked and behaved differently than adults did, so it's no wonder that paleontologists at first thought they belonged to an entirely new species.



Nanotyrannus Wikia image

It's possible that *Dracorex* could actually be *Pachycephalosaurus*.



I would hate to see this one go. *Styгимoloch* means "horned devil from the Styx." It could again just be *Pachycephalosaurus*, according to Horner.

Paleontologist Michael J. Benton, at the University of Bristol, told Science that up to 51.7 percent of all dinosaur species are miscategorized. He said that's a "frightening figure. This means that more than half the species of dinosaurs ever



named were in error."

***Dracorex* Nobu Tamura**

Horner added that at present, "new" dinosaurs are discovered and named at a rate of one every two weeks. Thousands of dinosaurs are now on record, with many of them probably being duplicates of animals already on the books.

***Styгимoloch spinifer* skull. North Dakota, USA; 66 million years old; Haplochromis**

Horner, who has two dinosaurs named after him, is proposing that paleontologists follow a rigorous set of procedures known as the Unified Frame of Reference (UFR) when attempting to identify fossils. The UFR will take into account microscopic analysis of the fossils, which uses technologies not available in the past. It will also require detailed analysis of where the remains were found, how they appeared when first observed pre-excavation, how they compare to existing species, and more.

"The proposals by Horner are very important as a reminder of a problem paleontologists are aware of," Benton says, "but we still don't know if it will provide a 100 percent watertight solution that means we will never make mistakes about dinosaur species ever again."

***Torosaurus* may actually be an adult *Triceratops*, as we recently reported. Nobu Tamura**

<http://medicalxpress.com/news/2011-05-treatment-chronic-pain-reverse-abnormal.html>



Treatment of chronic low back pain can reverse abnormal brain activity and function
It likely comes as no surprise that low back pain is the most common form of chronic pain among adults. Lesser known is the fact that those with chronic pain also experience cognitive impairments and reduced gray matter in parts of the brain associated with pain processing and the emotional components of pain, like depression and anxiety.

In a longitudinal study published this week in the *Journal of Neuroscience*, a group of pain researchers from McGill University and the McGill University Health Centre (MUHC) posed a fundamental question: If you can alleviate chronic low back pain, can you reverse these changes in the brain?

The answer is, Yes.

The team began by recruiting, through the Orthopedic Spine Clinic and the Alan Edwards Pain Management Unit at the MUHC, patients who have had low back pain for more than six months and who planned on undergoing treatment – either spinal injections or spinal surgery – to alleviate their pain. MRI scans were conducted on each subject before and six months after their procedures. The scans measured the cortical thickness of the brain and brain activity when the subjects were asked to perform a simple cognitive task.

"When they came back in, we wanted to know whether their pain had lessened and whether their daily lives had improved," said the study's senior author, Laura S. Stone from McGill's Alan Edwards Centre for Research on Pain. "We wanted to see if any of the pain-related abnormalities found initially in the brain had at least slowed down or been partially reversed."

Not only did the team observe recovery in the anatomical function of the brain, but also in its ability to function. After the subjects were treated, researchers found increased cortical thickness in specific areas of the brain that were related to both pain reduction and physical disability. And the abnormal brain activity observed initially during an attention-demanding cognitive task was found to have normalized after treatment.

While more research would be needed to confirm whether chronic pain actually causes these changes in the brain, Stone hypothesizes that chronic low back pain, at the very least, maintains these differences.

"If you can make the pain go away with effective treatment," she added, "you can reverse these abnormal changes in the brain." *Provided by McGill University*

http://www.eurekalert.org/pub_releases/2011-05/pu-tha051811.php

Temperature, humidity affect health benefits of green tea powders

WEST LAFAYETTE, Ind. - The beneficial compounds in green tea powders aren't as stable as once thought, according to a Purdue University study that will give industry guidelines on how to better store those powders.

"People drink green tea for health benefits, so they want the catechins to be present," said Lisa Mauer, a professor of food science. "The instant powder beverages are becoming more popular for consumers, and it's important to know how storage can influence nutrition of your products."

Catechins are the source of antioxidants thought to fight heart disease, cancer, diabetes and other health problems. Green tea powders are often used as ingredients in products that are flavored like green tea or tout the health benefits of the tea. U.S. imports of green tea increased more than 600 percent from 1998 to 2007, according to the U.S. Department of Agriculture.

Mauer found that increased temperature \downarrow and humidity, to a smaller degree \downarrow speed catechin degradation. She said it had been believed that the powders were stable below the glass transition temperature, the temperature at which an amorphous solid changes from a rigid, glassy state to a rubbery, viscous state. In that rubbery state, compounds may start reacting with each other faster due to increased molecular mobility, leading to significant chemical degradation.

But Mauer's findings, reported in the early online version of the Journal of Agricultural and Food Chemistry, showed that green tea powder degrades at lower temperatures, even below the glass transition temperature.

"Tea powders are not infinitely stable below their glass transition temperature. They degrade more slowly below that temperature, but they can still degrade," Mauer said.

Catechin concentrations were tracked using high-performance liquid chromatography. The method involved dissolving the green tea powder into a solution, which then passed through a column. Compounds moved at different rates and could be measured.

More than 1,800 powder samples were stored at varying temperature and humidity combinations for up to 16 weeks and then measured for catechin loss. Those at the highest temperatures and humidities lost the most catechins.

From those results, models were built to predict the rates at which catechins would be lost at different storage conditions. Mauer said those in the food industry could use the models to predict the amount of catechins \downarrow and the likely health benefits \downarrow in green tea powder at the time it is used.

"Knowing what's happening to the ingredients is extremely important for understanding the quality of a food or beverage product," she said.

Mauer said she would next look at what the catechins become once they degrade and how those new compounds affect nutritional qualities.

The U.S. Department of Agriculture and the China Scholarship Council funded the research.

Abstract on the research in this release is available at:

<http://www.purdue.edu/newsroom/research/2011/110518MauerCatechins.html>

http://www.eurekalert.org/pub_releases/2011-05/usgs-lma051811.php

Lichens may aid in combating deadly chronic wasting disease in wildlife

MADISON, Wis. – Certain lichens can break down the infectious proteins responsible for chronic wasting disease (CWD), a troubling neurological disease fatal to wild deer and elk and spreading throughout the United States and Canada, according to U.S. Geological Survey research published today in the journal PLoS ONE.

Like other "prion" diseases, CWD is caused by unusual, infectious proteins called prions. One of the best-known of these diseases is "mad cow" disease, a cattle disease that has infected humans. However, there is no evidence that CWD has infected humans. Disease-causing prions, responsible for some incurable neurological diseases of people and other diseases in animals, are notoriously difficult to decontaminate or kill. Prions are not killed by most detergents, cooking, freezing or by autoclaving, a method used to sterilize medical instruments.

"When prions are released into the environment by infected sheep or deer, they can stay infectious for many years, even decades," said Christopher Johnson, Ph.D., a scientist at the USGS National Wildlife Health Center and the lead author of the study. "To help limit the spread of these diseases in animals, we need to be able to remove prions from the environment."

The researchers found that lichens have great potential for safely reducing the number of prions because some lichen species contain a protease enzyme (a naturally produced chemical) capable of significantly breaking down prions in the lab.

"This work is exciting because there are so few agents that degrade prions and even fewer that could be used in the environment without causing harm," said Jim Bennett, Ph.D., a USGS lichenologist and a co-author of the study.

CWD and scrapie in sheep are different than other prion diseases because they can easily spread in sheep or deer by direct animal-to-animal contact or through contact with contaminated inanimate objects like soil. Chronic wasting disease was first diagnosed in the 1960s and has since been detected in 19 states and two Canadian provinces. CWD has been detected in wild elk, mule deer, white-tailed deer and moose in North America.

Lichens, said Johnson, produce unique and unusual organic compounds that aid their survival and can have antibiotic, antiviral and other chemotherapeutic activities. In fact, pharmaceutical companies have been examining the medicinal properties of lichens more closely in recent years.

Lichens - which are often mistaken for moss - are unusual plant-like organisms that are actually a symbioses of fungi, algae and bacteria living together. They usually live on soil, bark, leaves and wood and can live in barren and unwelcoming environments, including the Arctic and in deserts.

Future work will examine the effect of lichens on prions in the environment and determine if lichen consumption can protect animals from acquiring prion diseases.

The study, "Degradation of the disease-associated prion protein by a serine protease from lichens," was published in PLoS ONE and is freely accessible to the public at <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0019836>.

The study was authored by USGS scientists Christopher Johnson, James Bennett and Tonie Roche, as well as authors from Montana State University and the University of Wisconsin.

http://www.eurekalert.org/pub_releases/2011-05/msu-vwp051811.php

Virtual workout partners spur better results

Researcher analyzes Kohler effect in health video games

EAST LANSING, Mich. - Can't find anyone to exercise with? Don't despair: New research from Michigan State University reveals working out with a virtual partner improves motivation during exercise.

The study led by Deborah Feltz, chairperson of MSU's Department of Kinesiology, is the first to investigate the Kohler effect on motivation in health video games; that phenomenon explains why inferior team members perform better in a group than they would by themselves.

The research, to be published in an upcoming edition of the Journal of Sport and Exercise Psychology, was funded by a \$150,000 grant from Health Games Research, a national program of the Robert Wood Johnson Foundation's Pioneer Portfolio.

"Our results suggest working out with virtually present, superior partners can improve motivation on exercise game tasks," Feltz said. "These findings provide a starting point to test additional features that have the potential to improve motivational gains in health video games."

By incorporating design features based on the Kohler effect, health video games could motivate vigorous exercise, she added.

"One of the key hurdles people cite in not working out is a lack of motivation," Feltz said. "Research has shown working out with a partner increases motivation, and with a virtual partner, you are removing the social anxiety that some people feel working out in public."

As part of the study, Feltz and her research team used the Eye Toy camera and PlayStation 2 to measure if a virtual partner motivated people to exercise harder, longer or more frequently. A plank exercise (which strengthens a person's core abdominal muscles) was used for nearly all 200 participants.

Participants performed the first series of five exercises alone holding each position for as long as they could. After a rest period, they were told they would do the remaining trials with a same-sex virtual partner whom they could observe during their performance. The partner's performance was manipulated to be always superior to the participant's.

Results showed that task persistence was significantly greater in all experimental conditions; those who exercised with a more-capable virtual partner performed the exercise 24 percent longer than those without.

"The fact that this effect was found with a virtual partner overcomes some of the practical obstacles of finding an optimally-matched partner to exercise with at a particular location," Feltz said.

Also, researchers have found live exercise partners are not always the most helpful. "Individuals can become discouraged if they believe they can never keep up with their partner, or on the other hand, become bored if their partner is always slower," Feltz said. "With a virtual partner, this can be addressed."

<http://www.bbc.co.uk/news/science-environment-13445951>

Protein flaws responsible for complex life, study says

By Jason Palmer Science and technology reporter, BBC News

Tiny structural errors in proteins may have been responsible for changes that sparked complex life, researchers say.

A comparison of proteins across 36 modern species suggests that protein flaws called "dehydrons" may have made proteins less stable in water. This would have made them more adhesive and more likely to end up working together, building up complex function.

The Nature study adds weight to the idea that natural selection is not the only means by which complexity rises. Natural selection is a theory with no equal in terms of its power to explain how organisms and populations survive through the ages; random mutations that are helpful to an organism are maintained while harmful ones are bred out. But the study provides evidence that the "adaptive" nature of the changes it wreaks may not be the only way that complexity grew. Single-celled life gave rise to more complex organisms, and with them came ever-more complicated networks of gene and protein interactions.

Michael Lynch, an evolutionary theorist at Indiana University, teamed up with Ariel Fernandez of the University of Chicago, both in the US, to look specifically at protein structure. They considered 106 proteins shared among 36 modern-day organisms of widely varying complexity, from single-celled protozoa up to humans. The pair were studying "dehydrons" - regions of proteins that make them more unstable in watery environments. These dehydrons - first discovered by Dr Fernandez - make the proteins more sticky in water, thereby raising the probability that they will adhere to other such proteins.

The analysis showed that organisms with smaller populations - such as humans - had accumulated more of these defects than simpler organisms with vastly higher population numbers. The suggestion is that it is the acquisition of these defects, with sticky proteins more likely to work together in ever-more complex protein-protein interactions, that nudged cellular complexity upward.

"We've tried to bridge the gap between protein structure and evolution and believe we've uncovered evidence that proteins develop mild defects in organisms with smaller population sizes, over the great divide from bacteria to unicellular eukaryotes to invertebrates up to us vertebrates," said Professor Lynch.

These slight defects may decrease protein function even as they increase protein cooperation. The authors suggest then that other adaptations occur that "undo" the deleterious effects of the sticky proteins.

For example, the protein haemoglobin that carries oxygen in our blood, is made of four identical subunits, each with a range of dehydron flaws; simpler organisms have globin molecules that accomplish the same job with just one subunit. But the overlap of the four subunits actually masks the flaws in each one.

The authors stress that they are not arguing against natural selection as a process; they say rather that it can be aided by "non-adaptive" mechanisms.

"There's been this general feeling that complexity is a good thing and evolves for complexity's sake - that it's adaptive," Professor Lynch told BBC News. "We've opened up the idea that the roots of complexity don't have to reside in purely adaptational arguments. "It's opening up a new evolutionary pathway that didn't exist before."

'A mess'

Ford Doolittle of Dalhousie University agrees that this mechanism, separate from Darwin's vision of natural selection, is an important consideration. "Darwinists are a little bit like the pre-Darwinists before them, who would have marveled at the perfection of God's creation," he told BBC News.

"We tend to marvel at the Darwinian perfection of organisms now, saying 'this must have been highly selected for, it's a tuned and sophisticated machine'. "In fact, it's a mess - there's so much unnecessary complexity."

While he called the Nature study "important and interesting", he disagrees with the mechanism that allows organisms to recover from the protein flaws. He has long argued for a "presuppression" mechanism, in which some organisms may have a way to overcome the limited functionality of the slightly damaged proteins, and those that do survive best. "He's putting the cart before the horse," Professor Doolittle said of Professor Lynch's idea that subsequent mutations solve the problems raised by the protein changes.

"But we both agree that much of complexity does not have an adaptive explanation."

<http://news.nationalgeographic.com/news/2011/05/110518-planets-jupiters-worlds-space-science-nature/>

Alien Planets Outnumber Stars, Study Says

"Important" discovery: Jupiter-like runaways common in our galaxy.

Ker Than for National Geographic News

If you look to the stars tonight, consider this: No matter how innumerable they may seem, there are far more planets than stars lurking out there in the darkness, a new study suggests. The study uncovered a whole new class of worlds: Jupiter-like gas giants that have escaped the gravitational bonds of their parent stars and are freely roaming space. What's more, "our results indicate that such planets are quite common," said study team member David Bennett, an astronomer at Notre Dame University in Indiana. "There's a good chance that the closest free-floating planet is closer to Earth than the closest star."

Ohio State University astronomer Scott Gaudi added, "It's not surprising that free-floating planets are out there" - they've been predicted by planet-formation theories for years - "it's just how many of them that they're finding." The findings, detailed in this week's issue of the journal Nature, indicate there are about two free-floating planets per star in our galaxy - and perhaps in other galaxies, too.

Scientists estimate there are about 200 billion stars in the Milky Way, so that means there could be at least 400 billion drifting planets in space. And that's not even counting the planets that orbit stars, or smaller, rocky free-floaters that can't yet be detected. "These are just the ones that we found," study co-author Bennett said. "If we could see lower-mass planets, then presumably the number would be even larger."

Planet Discovery Came in a Flash of Light

The team spotted ten runaway planets - with an average mass similar to Jupiter's - using a technique called gravitational microlensing. Gravitational lensing takes advantage of the fact that large celestial objects such as stars or planets warp the fabric of space-time such that light rays passing nearby are bent. One effect of this is that a star can appear to brighten temporarily as its light bends around a passing planet - an effect visible only if the planet passes directly in front of the star, as seen from a telescope. Such planet-star alignments are rare and usually last less than two days.

Using a telescope with a nearly 6-foot (1.8-meter) lens at New Zealand's Mount John University Observatory, astronomers scanned more than a hundred million stars at the center of the Milky Way galaxy for two years in search of such alignments. The survey found ten brief microlensing events, which the team says are evidence of planets of roughly Jupiter's mass. The precise distance of these planets from Earth is unknown but could range from 1,000 to 20,000 light-years - the distances scanned during the survey - Bennett said.

Rogue Planets Could Be Tamed

Each runaway planet is zipping through the galaxy at speeds of more than 450,000 miles an hour (200 kilometers a second). Even at these speeds, the rogue worlds could be corralled into orbit again, under the right conditions. "A runaway planet can't be caught by a single star. It will have too much energy," Bennett said. But a binary star - two gravitationally locked stars that orbit each other - "could do it, and a star that already has at least one planet," he said. "However, if a star with planets captures another one, then one of its existing planets must change its orbit, and this could make the system unstable. So, a capture might lead to another ejection."

New Planets Not Free-Floating After All?

The team said that it can't rule out the possibility that some of the planets are just orbiting their stars at very far distances and that the parent stars just don't show up in the data. But they say previous observations by other groups suggest that Jupiter-mass planets in such distant orbits are rare.

University of Heidelberg astronomer Joachim Wambsganss, who was not involved in the research, said more studies will be needed to confirm that the new planets are indeed drifters.

"Whether they're really freely floating planets or just in really wide orbits is not yet proven, I would say," said Wambsgans, who wrote an accompanying article in Nature about the discovery.

Planets Bullied Out of Orbit?

Ohio State's Gaudi called the results "important and exciting" and said they raise interesting new questions about so-called extrasolar planets, or "exoplanets" - worlds outside our solar system.

For instance, astronomers think free-floating planets can get kicked out of their star systems after being perturbed by the gravity of another passing star or of "bully" planets in the same system.

In the latter scenario, "the biggest bullies kick out the smaller guys," explained Gaudi, who wasn't part of the study. "In our solar system, Jupiter is the biggest bully," he said. But bigger gas giants have been detected in other star systems, and it's perhaps such "super Jupiters" that sent the newfound rogue planets packing.

Life on the Run?

Just because rogue planets orbit no life-giving star, they're not necessarily lifeless - particularly rocky ones - the University of Heidelberg's Wambsgans said.

"If you think about free-floating planets, there's no nearby star that can produce heat and energy ... but even in our solar system, there are [externally frigid worlds] that have hot cores," he said.

"So it's not entirely impossible that free-floating planets have hot cores, cold surfaces, and an intermediate layer, where water could exist in some fluid form. This is only speculation, of course."

A second microlensing survey group, the Optical Lensing Experiment (OGLE) also contributed to the discovery reported in Nature. The OGLE group observed many of the same microlensing events observed by MOA and these observations indecently confirmed MOA's analysis. NASA and the NSF funded Bennett's work on this project.

http://www.eurekalert.org/pub_releases/2011-05/uol-tec051611.php

The Earth's core is melting ... and freezing

The inner core of the Earth is simultaneously melting and freezing due to circulation of heat in the overlying rocky mantle, according to new research from the University of Leeds, UC San Diego and the Indian Institute of Technology.

The findings, published tomorrow in Nature, could help us understand how the inner core formed and how the outer core acts as a 'geodynamo', which generates the planet's magnetic field.

"The origins of Earth's magnetic field remain a mystery to scientists," said study co-author Dr Jon Mound from the University of Leeds. "We can't go and collect samples from the centre of the Earth, so we have to rely on surface measurements and computer models to tell us what's happening in the core."

"Our new model provides a fairly simple explanation to some of the measurements that have puzzled scientists for years. It suggests that the whole dynamics of the Earth's core are in some way linked to plate tectonics, which isn't at all obvious from surface observations. "If our model is verified it's a big step towards understanding how the inner core formed, which in turn helps us understand how the core generates the Earth's magnetic field."

The Earth's inner core is a ball of solid iron about the size of our moon. This ball is surrounded by a highly dynamic outer core of a liquid iron-nickel alloy (and some other, lighter elements), a highly viscous mantle and a solid crust that forms the surface where we live. Over billions of years, the Earth has cooled from the inside out causing the molten iron core to partly freeze and solidify. The inner core has subsequently been growing at the rate of around 1mm a year as iron crystals freeze and form a solid mass.

The heat given off as the core cools flows from the core to the mantle to the Earth's crust through a process known as convection. Like a pan of water boiling on a stove, convection currents move warm mantle to the surface and send cool mantle back to the core. This escaping heat powers the geodynamo and coupled with the spinning of the Earth generates the magnetic field.

Scientists have recently begun to realise that the inner core may be melting as well as freezing, but there has been much debate about how this is possible when overall the deep Earth is cooling. Now the research team believes they have solved the mystery.

Using a computer model of convection in the outer core, together with seismology data, they show that heat flow at the core-mantle boundary varies depending on the structure of the overlying mantle. In some regions, this variation is large enough to force heat from the mantle back into the core, causing localised melting. The model shows that beneath the seismically active regions around the Pacific 'Ring of Fire', where tectonic plates are undergoing subduction, the cold remnants of oceanic plates at the bottom of the mantle draw a lot of heat from the core. This extra mantle cooling generates down-streams of cold material that cross the outer core and freeze onto the inner core.

Conversely, in two large regions under Africa and the Pacific where the lowermost mantle is hotter than average, less heat flows out from the core. The outer core below these regions can become warm enough that it will start melting back the solid inner core.

Co-author Dr Binod Sreenivasan from the Indian Institute of Technology said: "If Earth's inner core is melting in places, it can make the dynamics near the inner core-outer core boundary more complex than previously thought.

"On the one hand, we have blobs of light material being constantly released from the boundary where pure iron crystallizes. On the other hand, melting would produce a layer of dense liquid above the boundary. Therefore, the blobs of light elements will rise through this layer before they stir the overlying outer core.

"Interestingly, not all dynamo models produce heat going into the inner core. So the possibility of inner core melting can also place a powerful constraint on the regime in which the Earth's dynamo operates."

Co-author Dr Sebastian Rost from the University of Leeds added: "The standard view has been that the inner core is freezing all over and growing out progressively, but it appears that there are regions where the core is actually melting. The net flow of heat from core to mantle ensures that there's still overall freezing of outer core material and it's still growing over time, but by no means is this a uniform process.

"Our model allows us to explain some seismic measurements which have shown that there is a dense layer of liquid surrounding the inner core. The localised melting theory could also explain other seismic observations, for example why seismic waves from earthquakes travel faster through some parts of the core than others."

The paper: 'Melting of the Earth's inner core' by David Gubbins, Binod Sreenivasan, Jon Mound and Sebastian Rost, is published in Nature on 19 May 2011 (DOI: 10.1038/nature10068).

http://www.eurekalert.org/pub_releases/2011-05/uou-sut051311.php

Standing up to fight

Does it explain why we walk upright and why women like tall men?

SALT LAKE CITY – A University of Utah study shows that men hit harder when they stand on two legs than when they are on all fours, and when hitting downward rather than upward, giving tall, upright males a fighting advantage. This may help explain why our ape-like human ancestors began walking upright and why women tend to prefer tall men.

"The results of this study are consistent with the hypothesis that our ancestors adopted bipedal posture so that males would be better at beating and killing each other when competing for females," says David Carrier, a biology professor who conducted the study. "Standing up on their hind legs allowed our ancestors to fight with the strength of their forelimbs, making punching much more dangerous."

"It also provides a functional explanation for why women find tall men attractive," Carrier adds. "Early in human evolution, an enhanced capacity to strike downward on an opponent may have given tall males a greater capacity to compete for mates and to defend their resources and offspring. If this were true, females who chose to mate with tall males would have had greater fitness for survival." Carrier's new study is being published Wednesday, May 18 in the online Public Library of Science journal PLoS ONE.

The idea is not new that fighting and violence played a role in making human ancestors shift from walking on all fours to walking on two legs. But Carrier's new study physically demonstrates the advantage of fighting from an upright, two-legged posture. Carrier measured the force of punches by male boxers and martial arts practitioners as they hit in four different directions: forward, sideways, down and up.

A punching bag fitted with a sensor measured the force of forward and sideways punches. For strikes downward and upward, the men struck a heavy padded block on the end of a lever that swung up and down because it was suspended from an axle. In either case, the men struck the target as hard as they could both from a standing posture and on their hands and knees.

The findings: for all punching angles, men hit with far more force when they were standing, and from both postures they could hit over twice as hard downward as upward.

Humans: Two-Legged Punching Apes?

The transition from four-legged to two-legged posture is a defining point in human evolution, yet the reason for the shift is still under debate. Darwin thought that our ancestors stood up so they could handle tools and weapons. Later scientists have suggested that bipedalism evolved for a host of other reasons, including carrying food, dissipating heat, efficient running and reaching distant branches while foraging in trees.

"Others pointed out that great apes often fight and threaten to fight from bipedal posture," says Carrier. "My study provides a mechanistic explanation for why many species of mammals stand bipedally to fight."

Carrier says many scientists are reluctant to consider an idea that paints our ancestors as violent.

"Among academics there often is resistance to the reality that humans are a violent species. It's an intrinsic desire to have us be more peaceful than we are," he says. Nevertheless, human males and their great ape cousins – chimpanzees, gorillas and orangutans – frequently fight each other for territory and access to females.

The most popular theories about why we became bipedal are based on locomotor advantages – increases in the efficiency of walking and running. However, research shows upright posture is worse for locomotion, contrary to what Carrier initially believed.

"If you're a chimpanzee- or gorilla-type ancestor that is moving on the ground, walking bipedally has a cost," he says. "It's energetically more expensive, it's harder to speed up and slow down, and there are costs in terms of agility. In every way, going from four legs to two is a disadvantage for locomotion. So the selective advantage for becoming bipedal, whatever it was, must have been important."

Nearly all mammals, including chimps and gorillas, move on all fours when they run or cover long distances on the ground. On the other hand, all sorts of four-legged animals stand up and use their front legs to fight. They include anteaters, lions, wolves, bears, wolverines, horses, rabbits and many rodents and primates.

Carrier believes that the usefulness of quadruped forelegs as weapons is a side effect of how forelegs are used for walking and running. When an animal is running with its body positioned horizontally, the forelegs strike down at the ground. By lifting the body to a vertical posture, animals can direct that same force toward an opponent.

In addition, quadrupeds are stronger pulling back with their forelimbs than pushing forward. That translates to a powerful downward blow when they rear up on their hind legs. These advantages, which grow directly out of four-legged movement, can be used most effectively by an animal that can stand easily on two legs.

Carrier predicted that animals would hit harder with their forelegs when their bodies were held upright than when they were horizontal, and that they would hit harder downward than upward. Although it would be ideal to test these hypotheses with four-legged animals, humans should still possess the advantages that led our ancestors to stand upright, and they are more practical test subjects.

The results were exactly what Carrier expected. Men's side strikes were 64 percent harder, their forward strikes were 48 percent harder, their downward strikes were 44 percent harder, and their upward strikes were 48 percent harder when they were standing than when they were on their hands and knees. From both postures, subjects delivered 3.3 times as much force when they hit downward rather than upward.

Do Women Want Men Who Can Fight?

While Carrier's study primarily deals with the evolution of upright posture, it also may have implications for how women choose mates. Multiple studies have shown that women find tall men more attractive. Greater height is also associated with health, social dominance, symmetrical faces and intelligence in men and women. These correlations have led some scientists to suggest that women prefer tall men because height indicates "good genes" that can be passed on to offspring. Carrier believes there is more to it.

"If that were the whole story, I would expect the same to be true for men – that men would be attracted to tall women. But it turns out they're not. Men are attracted to women of average height or even shorter," he says.

The alternative explanation is that tall males among our ancestors were better able to defend their resources, partners and offspring. If males can hit down harder than they can hit up, a tall male has the advantage in a fight because he can punch down to hit his opponent's most vulnerable targets.

Carrier certainly isn't saying women like physically abusive men or those who get into fights with each other. He is saying that women like tall men because tallness is a product of the evolutionary advantage held by our ancestors who began standing upright to fight.

"From the perspective of sexual selection theory, women are attracted to powerful males, not because powerful males can beat them up, but because powerful males can protect them and their children from other males," Carrier says. "In a world of automatic weapons and guided missiles, male physical strength has little relevance to most conflicts between males," he adds. "But guns have been common weapons for less than 15 human generations. So maybe we shouldn't be surprised that modern females are still attracted to physical traits that predict how their mates would fare in a fight."

<http://www.newscientist.com/article/mg21028136.600-wind-is-japans-strongest-alternative-to-nuclear.html>

Wind is Japan's strongest alternative to nuclear

18 May 2011 by Andy Coghlan

TWO months after the explosions and radiation leaks at the Fukushima Daiichi nuclear power plant in Japan, the prime minister, Naoto Kan, has announced that the country will not build any new reactors.

If Kan really means it, the government will have to abandon the plans for expanding nuclear power it adopted only last year. To make up the energy shortfall, Kan has set the ambitious goal of using renewables.

That is most likely to mean wind, according to a report released last month by the Ministry of the Environment. There is "an extremely large introduction potential of wind power generation", it says, especially in the tsunami-hit north-east of the country.

"The potential of wind is huge because of the contribution from offshore generation with Japan's long coastline," agrees Tetsunari Iida, founder of the Institute for Sustainable Energy Policies in Tokyo, who advocates a 100 per cent switch to renewable energy by 2050. At present, Japan produces just 3 per cent of its electricity from renewables: solar, wind and geothermal. Nuclear contributes 30 per cent.

Taking into account wind strength, available land and the potential for offshore farms, the report estimates that Japan could install wind turbines with a capacity of up to 1500 gigawatts. More realistic estimates in the report suggest that with appropriate financial incentives, turbines with a capacity of 24 to 140 GW could be installed. Assuming the turbines operate a quarter of the time, this would provide up to 35 GW of electricity on average, matching the combined output of about 40 of Japan's existing 54 nuclear reactors.

Next in line is solar energy, which the report estimates could provide between 69 and 100 GW without taking up any productive agricultural land.

Perhaps surprisingly, given Japan's 120 active volcanoes and the 28,000 hot springs associated with them, geothermal energy scarcely figures in the ministry's report. At best, it says, only 14 GW is available, but much of that is inaccessible because of restrictions on development in national parks. At other sites, exploiting geothermal energy would disrupt springs currently used as spas.

A switch to renewables will require huge amounts of new infrastructure. This will need to be paid for by offering special tariffs as incentives for providers to feed energy from renewable sources into the grid. By coincidence, on the morning of 11 March - the day of the earthquake - the Japanese cabinet approved proposals that would achieve this. "It's under review by the parliament, and could provide a really big push for renewables if it's passed," says Iida.

The contribution from renewables to Japan's electricity supply is currently almost static, having increased from 3.1 to 3.3 per cent between 2008 and 2009. Iida blames "poor policy support" for this lack of growth. So it is possible that as the shock of Fukushima fades, support for renewables will go the same way. However, polls reported this week suggest that two-thirds of Japanese back a shift away from nuclear power.

<http://www.physorg.com/news/2011-05-japanese-electric-car-300km.html>

Japanese electric car 'goes 300km' on single charge

Japanese developers have unveiled an electric car they said Wednesday can travel more than 300 kilometres before its battery runs flat.

Electric vehicle specialist SIM-Drive, which hopes to take the car to market by 2013 but gave no projected cost, said its four-seater "SIM-LEI" had motors inside each wheel and a super-light frame, allowing for 333 kilometres (207 miles) of motoring on one charge in a test.

Its designers say they hope the prototype, a joint project among 34 organisations including Mitsubishi Motors and engineering firm IHI, will be sold to car manufacturers for mass production.

Japan's auto venture SIM-DRIVE's prototype model of the electric vehicle SIM-LEI, which is expecting to go on sale in 2013, is unveiled in Tokyo.

Japan's auto venture SIM-DRIVE's prototype model of the electric vehicle SIM-LEI is unveiled

Automakers such as Nissan, which launched its all-electric Leaf last year with a 160-kilometre range, are gambling that electric cars with zero tailpipe emissions will catch on and, some time in the future, start to drive traditional petrol-guzzlers off the road. Electric cars still face key hurdles such as costly batteries and the lack of conveniently-located recharging points, which limits their operating radius.

<http://www.physorg.com/news/2011-05-rainbows-pigments-defense-fraud.html>

Rainbows without pigments offer new defense against fraud

Scientists from the University of Sheffield have developed pigment-free, intensely coloured polymer materials, which could provide new, anti-counterfeit devices on passports or banknotes due to their difficulty to copy.

The polymers do not use pigments but instead exhibit intense colour due to their structure, similar to the way nature creates colour for beetle shells and butterfly wings.

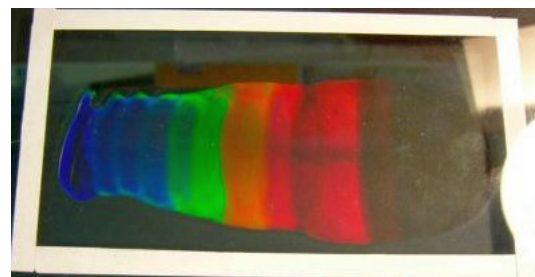
These colours were created by highly ordered polymer layers, which the researchers produced using block copolymers (an alloy of two different polymers). By mixing block copolymers together, the researchers were able to create any colour in the rainbow from two non-coloured solutions.



This type of polymer then automatically organises itself into a layered structure, causing optical effects similar to opals. The colour also changes depending on the viewing angle. This system has huge advantage in terms of cost, processing and colour selection compared to existing systems.

The complexity of the chemistry involved in making the polymer means they are very difficult for fraudsters to copy, making them ideally suited for use on passports or banknotes.

The academics used Diamond Light Source, the UK's national synchrotron science facility in Oxfordshire, to probe the ordered, layered structures using high power X-rays. This helped them understand how the colours were formed, and how to improve the appearance.



This multicolored image shows the range of colors that can be made by mixing the two block copolymers in varying proportions. Credit: University of Sheffield

Dr Andrew Parnell, from the University of Sheffield's Department of Physics and Astronomy, said: "Our aim was to mimic the wonderful and funky coloured patterns found in nature, such as Peacock feathers. We now have a painter's palette of colours that we can choose from using just two polymers to do this. We think that these materials have huge potential to be used commercially."

Professor Nick Terrill, Principal Beamline Scientist for I22, the Diamond laboratory used for the experiment, explained: "Small Angle X-ray Scattering is a simple technique that in this case has provided valuable confirmatory information. By using Diamond's X-rays to confirm the structure of the polymer, the group was able to identify the appropriate blends for the colours required, meaning they can now tailor the polymer composition accordingly."



The banknote picture demonstrates how these colored polymer materials can be made into robust layers that could be used as anti-counterfeit measures on banknotes. University of Sheffield

More information: To view the paper, 'Continuously tuneable optical filters from self-assembled block copolymer blends', published in Soft Matter, please see: [http://pubs.rsc.org ... m/c0sm01320j](http://pubs.rsc.org...m/c0sm01320j)

Abstract

We demonstrate that two symmetric high molecular weight diblock copolymers, of differing molecular weights, can be blended together and subsequently shear aligned to form one photonic structure without macrophase separation. The lamellar period depends on the composition of the blend and gives a photonic structure that is easily tuneable in the wavelength range ($\lambda_{\text{peak}} = 400\text{--}850\text{ nm}$). Provided by University of Sheffield

http://www.eurekalert.org/pub_releases/2011-05/uocp-auo051811.php

Archaeologists uncover oldest mine in the Americas

Archaeologists have discovered a 12,000-year-old iron oxide mine in Chile that marks the oldest evidence of organized mining ever found in the Americas, according to a report in the June issue of Current Anthropology.

A team of researchers led by Diego Salazar of the Universidad de Chile found the 40-meter trench near the coastal town of Taltal in northern Chile. It was dug by the Huentelauquen people - the first settlers in the region - who used iron oxide as pigment for painted stone and bone instruments, and probably also for clothing and body paint, the researchers say.

The remarkable duration and extent of the operation illustrate the surprising cultural complexity of these ancient people. "It shows that [mining] was a labor-intensive activity demanding specific technical skills and some level of social cooperation transmitted through generations," Salazar and his team write.

An estimated 700 cubic meters and 2,000 tons of rock were extracted from the mine. Carbon dates for charcoal and shells found in the mine suggest it was used continuously from around 12,000 years ago to 10,500 years ago, and then used again around 4,300 years ago. The researchers also found more than 500 hammerstones dating back to the earliest use of the mine.

"The regular exploitation of [the site] for more than a millennium ... indicates that knowledge about the location of the mine, the properties of its iron oxides, and the techniques required to exploit and process these minerals were transmitted over generations within the Huentelauquen Cultural Complex, thereby consolidating the first mining tradition yet known in America," the researchers write. The find extends "by several millennia the mining sites yet recorded in the Americas." Before this find, a North American copper mine dated to between 4,500 and 2,600 years ago was the oldest known in the Americas.

Diego Salazar, D. Jackson, J. L. Guendon, H. Salinas, D. Morata, V. Figueroa, G. Manriquez, and V. Castro, "Early Evidence (ca. 12,000 BP) for Iron Oxide Mining on the Pacific Coast of South America." *Current Anthropology* 52:3 (June 2011). The issue is scheduled to publish online later this week.

http://www.eurekalert.org/pub_releases/2011-05/uol-pms051811.php

**Paraplegic man stands, steps with assistance and moves his legs voluntarily
Regimen of epidural spinal cord stimulation plus extensive locomotor training 'a significant
breakthrough;' results published today in the Lancet**

A team of scientists at the University of Louisville, UCLA and the California Institute of Technology has achieved a significant breakthrough in its initial work with a paralyzed male volunteer at Louisville's Frazier Rehab Institute. It is the result of 30 years of research to find potential clinical therapies for paralysis.

The man, Rob Summers, age 25, was completely paralyzed below the chest after being struck by a vehicle in a hit and run accident in July 2006. Today, he is able to reach a standing position, supplying the muscular push himself. He can remain standing, and bearing weight, for up to four minutes at a time (up to an hour with periodic assistance when he weakens). Aided by a harness support and some therapist assistance, he can make repeated stepping motions on a treadmill. He can also voluntarily move his toes, ankles, knees and hips on command.

These unprecedented results were achieved through continual direct epidural electrical stimulation of the subject's lower spinal cord, mimicking signals the brain normally transmits to initiate movement. Once that signal is given, the research shows, the spinal cord's own neural network combined with the sensory input derived from the legs to the spinal cord is able to direct the muscle and joint movements required to stand and step with assistance on a treadmill.

The other crucial component of the research was an extensive regime of Locomotor Training while the spinal cord was being stimulated and the subject suspended over the treadmill. Assisted by rehabilitation specialists, the individual's spinal cord neural networks were retrained to produce the muscle movements necessary to stand and to take assisted steps.

The study is published today in the British medical journal *The Lancet*. Leading researchers on the 11-member team are two prominent neuroscientists: Susan Harkema, Ph.D., of the University of Louisville's Department of Neurosurgery, Kentucky Spinal Cord Research Center and Frazier Rehab Institute, a service of Jewish Hospital & St. Mary's HealthCare in Louisville; and V. Reggie Edgerton, Ph.D., of the Division of Life Sciences and David Geffen School of Medicine at UCLA. Joel W. Burdick, Ph.D., Professor of Mechanical Engineering and Bioengineering at Caltech, developed new electromechanical technologies and computer algorithms to aid in locomotion recovery in spinal cord injury patients.

The research was funded by the Christopher & Dana Reeve Foundation and the National Institutes of Health. Dr. Harkema is Director of the Reeve Foundation's NeuroRecovery Network, which translates scientific advances into activity-based rehabilitation treatments. Dr. Edgerton is a member of the Reeve Foundation's Science Advisory Council and its International Research Consortium on Spinal Cord Injury.

Drs. Harkema, Edgerton and their colleagues envision a day when at least some individuals with complete spinal cord injuries will be able to use a portable stimulation unit and, with the assistance of a walker, stand independently, maintain balance and execute some effective stepping.

Relief from secondary complications of complete spinal cord injury – including impairment or loss of bladder control, sphincter control and sexual response – could prove to be even more significant.

"The spinal cord is smart," notes Dr. Edgerton, distinguished professor of integrative biology and physiology, and neurobiology at UCLA. "The neural networks in the lumbosacral spinal cord are capable of initiating full weight bearing and relatively coordinated stepping without any input from the brain. This is possible, in part, due to information that is sent back from the legs directly to the spinal cord." This sensory feedback from the feet and legs to the spinal cord facilitates the individual's potential to balance and step over a range of speeds, directions and level of weight bearing. The spinal cord can independently interpret these data and send movement instructions back to the legs – all without cortical involvement.

Dr. Harkema, Professor of Neurological Surgery at the University of Louisville, oversees the human research program there. She began her career as a postgraduate student in Dr. Edgerton's UCLA laboratory, where he pioneered the field of locomotion with extensive animal studies. The two have been close collaborators ever since. "This is a breakthrough. It opens up a huge opportunity to improve the daily functioning of these individuals," concludes Dr. Harkema, lead author of today's *Lancet* article. "But we have a long road ahead."

"While these results are obviously encouraging," concurs Dr. Edgerton, "we need to be cautious. There is much work to be done." To begin with, only one subject has been studied, and he was an athlete in

extraordinary physical condition before his injury. (Five human subjects have been authorized by the Food and Drug Administration to be enrolled in the study.)

Additionally, the first subject, while completely paralyzed below the chest (C7/T1 vertebra spinal section), was rated "B" on the American Spinal Injury Association's classification system, since he did retain some feeling below the level of injury. It is not known how these interventions will work with "A"-level patients (no cognition of sensation below the injury). Yet another issue is the stimulation equipment itself. To date, researchers have only had access to standard off-the-shelf stimulation units designed for pain relief.

Finally, in earlier published animal studies, drug interventions further heightened the sensitivity and functioning of the spinal cord's neural network. The compounds used in animals, however, are not approved for human use; it is likely that a large investment in further pharmacological research will be required to bring such compounds to market.

More than five million Americans live with some form of paralysis, defined as a central nervous system disorder resulting in difficulty or inability to move the upper or lower extremities. More than 1.275 million are spinal cord injured, and of those many are completely paralyzed in the lower extremities.

Epidural stimulation, in the context of paralysis of the lower extremities, is the application of continuous electrical current, at varying frequencies and intensities to specific locations on the lumbosacral spinal cord corresponding to the dense neural bundles that largely control movement of the hips, knees, ankles and toes. The electrodes required for this stimulation were implanted at University of Louisville Hospital by Dr. Jonathan Hodes, chairman of the Department of Neurosurgery at the University of Louisville.

"Today's announcement clearly demonstrates proof of concept," said Susan Howley, Executive Vice President for Research at the Christopher & Dana Reeve Foundation (which, in addition to supporting this particular work, has underwritten basic research in the field for more nearly three decades). "It's an exciting development. Where it leads to from here is fundamentally a matter of time and money."

Adds research volunteer Rob Summers, "This procedure has completely changed my life. For someone who for four years was unable to even move a toe, to have the freedom and ability to stand on my own is the most amazing feeling. To be able to pick up my foot and step down again was unbelievable, but beyond all of that my sense of well-being has changed. My physique and muscle tone has improved greatly, so much that most people don't even believe I am paralyzed. I believe that epidural stimulation will get me out of this chair."

http://www.eurekalert.org/pub_releases/2011-05/bc-hro051811.php

Herbal remedies offer hope as the new antibiotics

Cancer treatments often have the side effect of impairing the patient's immune system.

This can result in life-threatening secondary infections from bacteria and fungi, especially since bacteria, like *Staphylococcus aureus*, are becoming multi-drug resistant (MRSA). New research published by BioMed Central's open access journal *Annals of Clinical Microbiology and Antimicrobials* investigates the potency of Indian wild plants against bacterial and fungal infections in the mouths of oral cancer patients.

Researchers from Rohtak, India, tested extracts from several plants used in traditional or folk medicine against microbes found in the mouths of oral cancer patients. Of the 40 patients involved in the study, 35 had compromised immune systems with severely reduced neutrophil counts. Eight of the plants tested were able to significantly affect the growth of organisms collected by oral swab, and pure cultures of bacteria and fungi grown in the lab. This included wild asparagus, desert date, false daisy, curry tree, castor oil plant and fenugreek.

Dr. Jaya Parkash Yadav said, "Natural medicines are increasingly important in treating disease and traditional knowledge provides a starting point in the search for plant-based medicines. Importantly we found that the extraction process had a huge effect on both the specificity and efficacy of the plant extracts against microbes. Nevertheless several of the plants tested were broad spectrum antibiotics able to combat bacteria including *E. coli*, *S. aureus* and the fungi *Candida* and *Aspergillus*. Both desert date and castor oil plant were especially able to target bacteria, such as *Pseudomonas aeruginosa*, which are known to be difficult to treat with conventional antibiotics."

Dr. Yadav continued, "Although the plants tested had a lower potency than conventional antibiotics they offer hope against resistant species. These results are a starting point for further testing in the lab and clinic."

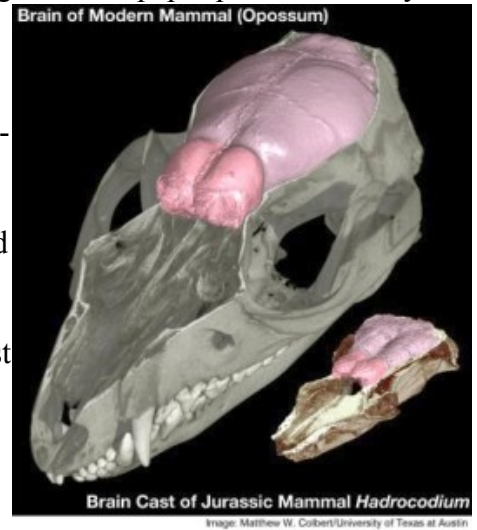
Notes to Editors 1. In vitro antimicrobial activity of ten medicinal plants against clinical isolates of oral cancer cases Manju Panghal, Vivek Kaushal and Jaya Parkash Yadav Annals of Clinical Microbiology and Antimicrobials (in press)

Large brains in mammals first evolved for better sense of smell

Ability to sense touch through fur also a factor

Pittsburgh, Pennsylvania... Paleontologists have often wondered why mammals - including humans - evolved to have larger brains than other animals. A team of paleontologists now believe that large brains may have developed in mammals to facilitate an acute sense of smell, according to a new paper published today in the prestigious journal *Science*. The team also noticed enlargement in the areas of the brain that correspond to the ability to sense touch through fur; this sense is acutely developed in mammals.

Scientists used high-resolution CT scans to study rare 190-million-year-old fossil skulls of *Morganucodon* and *Hadrocodium*, two of the earliest known mammal species. The research team of Timothy Rowe (University of Texas at Austin), Thomas Macrini (St. Mary's University of Texas), and Zhe-Xi Luo (Carnegie Museum of Natural History) discovered that these tiny mammals from the Jurassic fossil beds of China had much larger brains than expected for specimens of their period. Carnegie paleontologist Luo and his colleagues were the first to discover *Hadrocodium*, a tiny early Jurassic age mammal that weighed just two grams. Luo noticed that this animal had a very large cranium compared to its tiny body mass, and named it accordingly ("Hadro" being Latin for "fullness"; codium for "head").



The fossil of the Jurassic mammal *Hadrocodium wui* -- its skull is only 12 millimeters (less than 0.5 inch) long and estimated to weigh only 2 grams. The CT scan of its braincase reveals new information about the sense of smell in early mammals. Mark A. Klingler/Carnegie Museum of Natural History

"Our new study shows clearly that the olfactory part of the brain and the part of the brain linked to tactile sensation through fur were enlarged in these early mammals," says Luo. "A sophisticated sense of smell and touch would have been crucial for mammals to survive and even thrive in the earliest part of our evolutionary history."

Using computed tomography, also known as CT scanning, the team took a series of X-rays, inching along the specimens and then reassembling the images into a single, detailed image of the interior anatomy of the fossils. "I have spent years studying these fossils, but until they were CT scanned it was impossible to see the internal details unless you were willing to destroy the skulls to look inside," says Luo. "I was absolutely thrilled to see the shape of the brain of our 190-million-year-old relatives."

"This is a great example of technology allowing us to examine classic scientific questions in a new way," says University of Texas at Austin paleontologist Rowe. "We had studied the outside features of these fossils for years but knew that the inside held the answers. Until now, getting to those answers required destructive methods. With high-resolution CT scanning, we can take a good look into the braincase without damaging the precious fossils - we can have our cake and eat it too."



The brain cast of the Jurassic mammal *Hadrocodium*, reconstructed from CT scanning of its skull. Purple: brain; Pink: olfactory bulb for smell. Although the external features of *Hadrocodium* have been known, it is the latest CT study that has revealed characteristics of its brain. *Hadrocodium* has a large brain relative to its body weight. Its brain is very large for its ancient geological age (190 million years). The external features of its brain are already comparable to those of modern mammals, such as the opossum (above). The Jurassic mammals already have large olfactory bulb for a sophisticated sense of smell. Computed Tomography (CT) images from the CT laboratory of Jackson School of Geosciences, University of Texas. Images by Dr. Matthew Colbert/University of Texas.

Thomas Macrini of St. Mary's University (Texas), an expert in analyzing interior structures of fossils through CT scanning, was able to construct a virtual cast of the brains of these mammals. These were compared to the team's CT-scan data from more than a dozen other fossils and some 200 mammal species living today. The results were surprising: Even 190 million years ago, the brains of the earliest mammals were notably large (as relative to body mass), with brain-to-body sizes approaching the proportions seen in modern mammals.

From previously discovered fossil evidence, scientists knew that the nasal structure in some early mammals was quite advanced. From the CT scans of *Morganucodon* and *Hadrocodium* researchers were able to

determine that area of the brain that had grown the largest in these early mammals was the region responsible for the sense of smell. The CT scans of Morganucodon and Hadrocodium also revealed that the area of the brain mapped to tactile sensations from fur was enlarged. Mammals have a uniquely well developed ability to sense touch through their fur. Jurassic mammals such as Hadrocodium are considered by scientists to have had full coats of dense hair.

"Our mammal ancestors didn't develop that larger brain for contemplation, but for the sense of smell and touch. But thanks to these evolutionary advancements, which gave mammals a head start toward developing a large brain, humans some 190 million years later can ponder these very questions of natural history and evolution," said Luo.

http://www.eurekalert.org/pub_releases/2011-05/uoz-tpf051911.php

The peculiar feeding mechanism of the first vertebrates

Jaws made of bone are commonplace in the animal kingdom. However, how jaws developed in the course of evolution is still a mystery.

Under the direction of paleontologist Nicolas Goudemand, a team of researchers from the University of Zurich and the European Synchrotron Radiation Facility set about solving this puzzle. Living and extinct jawless animals can yield clues as to the development of the jaw. The researchers studied fossilized conodonts – extinct, eel-shaped animals whose precise relationship with the actual vertebrates is still a matter of debate. For their project, which was funded by the Swiss National Science Foundation and just published in the American journal PNAS, the researchers analyzed new conodont fossils that date from around the biggest mass extinction event at the boundary between the Permian and Triassic periods.



This is the feeding apparatus of a conodont. [VIDEO](#) University of Zurich, Nicolas Goudemand

Multitasking thanks to teeth on upper lips and tongue

In some of these new fossils discovered in China, the researchers noticed several conjoined tooth-like structures that occupied an unusual position in the mouth. Based on this discovery and the re-evaluation of other unusually constructed conodont feeding apparatus, the scientists developed a 3D animated model that shows how conodonts fed: most conodonts had to have two upper lips, upon each of which there was a long, fang-like structure. The conodonts also had a kind of tongue bearing a complex set of spiny or comb-like 'teeth'. The 'tongue' rested on pulley-like cartilage and could be moved backwards and forwards thanks to two opposing muscles. The conodonts used the 'tongue' and lips to grab food before two pairs of relatively robust, sometimes molar-like 'throat teeth' ground and cut it up.

Similarity with lampreys

The conodonts' unique feeding mechanism is fairly similar to that of the extant lamprey, which is widely regarded as the extinct conodonts' nearest relative. The new findings confirm that conodonts are to be considered primitive vertebrates from an evolutionary point of view. Moreover, due to the comparative feeding mechanism and other similarities, lampreys and conodonts must have a common ancestor which was one of the first vertebrates. This common ancestor must also have had a tongue mounted on pulley-like cartilage and therefore eaten in the same manner as the conodonts.

http://www.eurekalert.org/pub_releases/2011-05/bc-ttr051811.php

The traditional remedy bitter cumin is a great source antioxidant plant phenols

Bitter cumin is used extensively in traditional medicine to treat a range of diseases from vitiligo to hyperglycemia.

It is considered to be antiparasitic and antimicrobial and science has backed up claims of its use to reduce fever or as a painkiller. New research published in BioMedCentral's open access journal BMC Complementary and Alternative Medicine shows that this humble spice also contains high levels of antioxidants.

Reactive oxygen species (ROS), also known as free radicals, are produced as part of the metabolic processes necessary for life. Oxidative stress, however, is caused by overproduction or under-removal of these free radicals. Oxidative stress is itself involved in a number of disorders, including atherosclerosis, neural degenerative disease, inflammation, cancer and ageing. Antioxidants are thought to mop up these free radicals, reduce oxidative stress, and prevent disease.

Phenolic compounds from plants, especially polyphenolic compounds, are often considered to be antioxidants. Researchers from Mysore, India, have used biochemical and biological techniques to show that seeds from bitter cumin (*Centratherum anthelminticum* (L.) Kuntze), a member of the daisy family, are a rich source of phenolic antioxidants.

Researchers from the Central Food Technological Research Institute said that, "Bitter cumin extracts were strong antioxidants in the free radical scavenging systems tested. The extracts were also strong electron donors and hence reducing agents, another marker of antioxidation. In biological tests bitter cumin inhibited the oxidation of liposomes (used as a model for cell membrane oxidation) and offered complete protection against DNA damage."

Dr Naidu said, "The amount of plant phenols we were able to extract and the antioxidant activity of bitter cumin depended on the method used. Nevertheless the antioxidant activity of bitter cumin correlated with total phenol content so it may well be that an array of phenolic compounds within bitter cumin seeds are responsible for the antioxidant activity seen."

Notes to Editors 1. Antioxidant potential of bitter cumin (Centratherum anthelminticum (L.) Kuntze) seeds in in vitro models V Ani and Kamatham A Naidu BMC Complementary and Alternative Medicine (in press)

<http://medicalxpress.com/news/2011-05-implant-jab-misery-pain.html>

Implant jab could solve the misery of back pain

(PhysOrg.com) -- University of Manchester scientists have developed a biomaterial implant which could finally bring treatment, in the form of a jab, for chronic back pain.

Chronic lower back pain is a major problem for society – behind only headaches as the most common neurological ailment – and is frequently caused by degeneration of the intervertebral disc. Researchers have worked for many years to find a way of repairing the wear and tear on the lower back. Now, in results published in the journal *Soft Matter*, they have discovered how to permanently replace the workings of the intervertebral disc. It is estimated that back pain affects 80% of people at some point in their lives. In the United States it is the most common cause of job-related disability, a leading contributor to people missing work.

The University of Manchester cross-faculty team have been working with microgel particles, which are swellable nanoscopic polymer particles, for a number of years. Previously, they have demonstrated that an injectable fluid of these particles could transform into a gel that restored the mechanical properties of damaged model intervertebral discs. Lead researcher Dr Brian Saunders, of the School of Materials, and his team have now succeeded in linking the microgel particles together to form injectable durable, elastic gels capable of sustaining large permanent changes in shape without breaking. These improved injectable gels have much better mechanical properties than the first generation and should now display the necessary long-term durability required for an implanted device.

In this study the researchers – who include PhD student Amir Milani and Dr Ruixue Liu – have achieved an important milestone for producing injectable gels for minimally-invasive repair of IVD degeneration.

Dr Saunders said: "Our team has made a breakthrough through innovative materials design that brings the prospect of an injectable gel for treating degeneration of the intervertebral disc a step closer.

Professor Tony Freemont, Head of Research in the School of Biomedicine, and co-author on the paper, added: "Degeneration of the intervertebral disc results in chronic back pain which costs the country billions of pounds per annum and causes untold misery for sufferers and their families. "We have been working for 25 years to identify methods for treating degeneration of the intervertebral disc."

More information: Doubly crosslinked pH-responsive microgels prepared by particle inter-penetration: swelling and mechanical properties, by Ruixue Liu, Amir H. Milani, Tony J. Freemont and Brian R. Saunders, Soft Matter. Provided by University of Manchester

<http://www.scientificamerican.com/article.cfm?id=cells-may-stray-from-central-dogma>

RNA Editing to Create 'Acquired Characteristics' Appears Common

The ability to edit RNA to produce 'new' protein-coding sequences could be widespread in human cells.

By Erika Check Hayden of Nature magazine

All science students learn the 'central dogma' of molecular biology: that the sequence of bases encoded in DNA determines the sequence of amino acids that makes up the corresponding proteins. But now researchers suggest that human cells may complicate this tidy picture by making many proteins that do not match their underlying DNA sequences. In work published today in *Science*, Vivian Cheung at the University of Pennsylvania in Philadelphia and her team report that they have found more than 10,000 places where the base (A, C, G or U) in a cell's RNA messages is not the one expected from the DNA sequences used to make the RNA read-out. When some of these 'mismatched' RNAs were subsequently translated into proteins, the latter reflected the 'incorrect' RNA sequences rather than that of the underlying DNA.

It was already known that some cells 'edit' RNA after it has been produced to give a new coding sequence, but the new work suggests that such editing occurs much more often in human cells than anyone had realized, and that hitherto unknown editing mechanisms must be involved to produce some of the changes observed. If

the finding is confirmed by other investigators -- and some scientists already say they see the same phenomenon in their own data -- it could change biologists' understanding of the cell and alter the way researchers study genetic contribution to disease.

Editing the central dogma

"The central dogma says that there is faithful transcription of DNA into RNA. This challenges that idea on a much larger scale than was known," says Chris Gunter, director of research affairs at the HudsonAlpha Institute for Biotechnology in Huntsville, Alabama. The work suggests that RNA editing is providing a previously unappreciated source of human genetic diversity that could affect, for instance, how vulnerable different people are to disease.

Cheung does not know whether there are heritable changes, passed down from parent to child, that affect how much RNA editing occurs in different people. But scientists already know of a handful of RNA editing proteins that play a role in human health, such as the APOBEC enzymes, some of which have antiviral activity. Researchers investigating the connection between genetics and disease have been stymied by their inability to find strong connections between genetic variation and risk for most common diseases, leading researchers to wonder where the 'missing heritability' is hiding. The new study at least provides one place to look.

"These events could explain some of the 'missing heritability' because they are not present in everyone and therefore introduce a source of genetic variation which was previously unaccounted for," says Gunter.

Living with error

But because they do not know what mechanism might be responsible, most scientists contacted by Nature remained cautious about the significance of the finding and its possible impact on biology. Some say it is possible that technical errors could have caused the results. For instance, high-throughput sequencing machines can make systematic errors in DNA and RNA sequencing experiments. And even if the findings hold up, it is still too early to know whether 'mismatching' plays an important role in human biology or not.

"The devil is in the details -- to determine if the results are caused by some unintended technical or computational flaw or are correctly describing a biological phenomenon," says Thomas Gingeras at the Cold Spring Harbor Laboratory in New York. "Assuming the latter, I would be encouraged to look at our own large data sets to see if we see similar phenomena."

Other researchers, such as Manolis Dermitzakis at the University of Geneva in Switzerland, say they are seeing the phenomenon in their data. Indeed, Cheung's team drew in part on data generated by the 1000 Genomes project, of which Dermitzakis is a member. However, Dermitzakis says it is still unclear how important the phenomenon is for disease susceptibility.

Cheung's group attempts to address many of these concerns, some of which were raised when the preliminary work was presented last November (see 'DNA sequence may be lost in translation') at the annual meeting of the American Society for Human Genetics, in Washington DC. Since then, the team has been looking for possible errors that could have caused the results.

For example, the researchers first observed DNA-RNA 'mismatches' in data generated by next-generation sequencing technologies in the International HapMap Project and the 1000 Genomes project. They have now confirmed some of the putative DNA-to-RNA changes using traditional Sanger sequencing, and have found the same changes in different people, across different cell types, and reflected in proteins.

Cheung says that at first "we truly did not believe it". But after performing the additional experiments "we cannot explain this by any obvious technical errors, so we are pretty convinced that this is real," she says.

Researchers who study RNA editing, which up to now was known mostly from plants and some unicellular human parasites, are intrigued by the new finding.

Kazuko Nishikura of the Wistar institute in Philadelphia says she was sceptical at first, because some of the base changes could not be explained by previously identified mechanisms. But she was convinced once she saw Cheung's data. "It's really exciting, because this study reports a different variety of RNA editing that is much more widespread than existing mechanisms," Nishikura says.

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<http://www.bbc.co.uk/news/health-13452457>

Crossing your arms 'relieves hand pain'

Crossing your hand in front of you 'could reduce pain'

Crossing your arms across your body after injury to the hand could relieve pain, researchers suggest.

The University College London team, who undertook a proof-of-concept study of 20 people, say the brain gets confused over where pain has occurred. In the journal *Pain*, they suggest this is because putting hands on the "wrong" sides disrupts sensory perception. Pain experts say finding ways of confusing the brain is the focus of many studies.

The team used a laser to generate a four millisecond pin-prick of pain to participants' hands, without touching them. Each person ranked the intensity of the pain they felt, and their electrical brain responses were also measured using electroencephalography (EEG).

The results from both participants' reports and the EEG showed that the perception of pain was weaker when the arms were crossed over the "midline" - an imaginary line running vertically down the centre of the body.

Activation

Dr Giandomenico Iannetti, from the UCL department of physiology, pharmacology and neuroscience, who led the research, said: "In everyday life you mostly use your left hand to touch things on the left side of the world, and your right hand for the right side of the world. "This means that the areas of the brain that contain the map of the right body and the map of right external space are usually activated together, leading to highly effective processing of sensory stimuli. "When you cross your arms these maps are not activated together anymore, leading to less effective brain processing of sensory stimuli, including pain, being perceived as weaker."

He said the discovery could potentially lead to new ways of treating pain that exploit this confusion. Dr Iannetti he added: "Perhaps when we get hurt, we should not only 'rub it better' but also cross our arms." His team, alongside Australian researchers, are now testing the theory on patients who have chronic pain conditions.

A spokesman for the Pain Relief Foundation said a lot of research into relieving chronic pain was looking into ways of confusing the brain and disrupting pain messages.

http://www.eurekalert.org/pub_releases/2011-05/uoc-rpi052011.php

Research provides insight into quality of stored blood used for transfusions

Old red blood cells shown to have undergone 'significant changes and damage'; techniques could help rapidly monitoring quality of blood supply

New research provides evidence for significant differences between new and old red blood cells used for transfusions and could provide a cheap, rapid and effective way to monitor the quality of blood supplies.

Even with preservatives, blood stored in banks continues to age, resulting in biomaterials leaking from the red blood cells and subsequent changes to cell properties and function. There have been concerns raised worldwide about using older stored blood because of questions about various changes believed to affect the quality of the red blood cells. Currently, blood stored in a special medium can be used for clinical transfusion for up to 42 days, but monitoring of the blood varies.

Dr Jay Mehrishi, PhD, FRCPath (a Fellow of the Royal College of Pathologists), formerly of the Department of Radiotherapeutics and Medicine (now called the Department of Haematology) at the University of Cambridge and one of the lead authors of the study, said: "Recent trials on cardiac surgery patients involving over 40,000 patients showed that transfused blood which was older than 14 days produced serious side effects.

"The side effects of transfusing old blood are thought to result in acute lung injury and possible adverse effects of the immune system. In severe trauma patients, transfusion of blood stored for more than 28 days doubled the incidence of deep vein thrombosis and increased death secondary to multiple organ failure. Our research will hopefully highlight the significant differences between old and new blood used in transfusions as well as the possibility of using our technique to quickly and cheaply monitor blood supply quality."

The electrical properties of red blood cells have previously been used to distinguish between foetal and adult haemoglobin as well as the mutated form of haemoglobin found in sickle cells from normal haemoglobin. Now, using the unique electrical properties of red blood cells, Dr Mehrishi, working with Professor Yao-Xiong Huang from the Ji Nan University in China, used fluorescence from the positively charged quantum dots, which had been bound to electrical charges on the negatively charged cells to discriminate between old cells (which had diminished in quality) and young cells.

On young red blood cells (left of the figure) the fluorescence was intense bright, indicating that the surface architecture was intact. Whereas on the older red blood cells (right of the figure), the fluorescence was almost zero and the cells shown significantly darker, indicating that there had been a substantial loss of the electrical charges, indicating the cell membrane integrity had been compromised. It is recognised that such damaged cells are not useful for transfusions because the body eliminates them from circulation quite quickly.

Dr Mehrishi continued: "This study is the culmination of decades of research into blood cells, and a collaboration with the skilful Professor Huang - persevering with his expertise and team - and I am thrilled that for the first time visual imaging has provided evidence for the quality of the red blood cells.

"We need simple, routine quality control monitoring of blood in storage to avoid the serious adverse effects caused by biomaterials released from damaged cells accumulating."

In addition to its use as a monitoring technique for the quality of blood stored in blood banks, Dr Mehrishi believes that it could also be used to ensure a high quality of 'cleaned up' blood (older blood which has had the leaked biomaterials removed), which is of immense practical clinical importance worldwide.

Dr Mehrishi said: "These results are not only of theoretical interest but are also of immense practical clinical value, with vast commercial potential for new, rapid automated monitoring tests in clinics and in blood banks worldwide. "Our novel approach is also likely to be of practical value in clinics before, during and after therapy, for such problems as circulatory disorders, abnormal red cells, macrophages - e.g. in Gaucher disease -, respiratory physiology, hypoxia, high-altitude mountaineers, residents at high altitudes, etc."

The findings have been published in the Journal of Cellular and Molecular Medicine.

Notes to editors: The paper 'Human Red Blood Cell Aging: Correlative changes in surface charge and cell properties' was published in the Journal of Cellular and Molecular Medicine. 2011, 15: ePUB

http://www.eurekalert.org/pub_releases/2011-05/cmc-2ra052011.php

2-year results: Artificial disc a viable alternative to fusion for 2-level disc disease Article in Journal of Bone and Joint Surgery will be subject of educational video

LOS ANGELES – When two adjacent discs in the low back wear out, become compressed and cause unmanageable pain, numbness or other symptoms, replacement with artificial discs can be a viable alternative to standard fusion surgery, based on two-year post-surgery data from a randomized, multicenter trial recently published in the Journal of Bone and Joint Surgery.

Previous studies have compared single-disc replacement with fusion but this is believed the first to evaluate the two forms of treatment for two contiguous discs, said Rick B. Delamarter, MD, vice chair for Spine Services in the Department of Surgery and co-medical director of the Spine Center at Cedars-Sinai Medical Center. He is the article's first author.

As part of the approval process for a specific artificial disc (the ProDisc-L), the study was designed to meet Food and Drug Administration criteria comparing overall results from a disc replacement patient group with those of a fusion group. Those comparisons found the two therapies comparable in terms of outcomes deemed favorable, but Delamarter said individual patient outcomes suggest the disc replacement operation may have advantages.

"Overall, 24 months after surgery, patients in both groups had less pain and were able to reduce their use of medication, but the percentages were higher in the disc replacement group. Seventy-three percent of disc replacement patients met the study's pain improvement criteria, compared with less than 60 percent of the fusion patients. Of these, only 19 percent in the disc replacement group continued to need narcotics for pain, compared with 40 percent in the fusion group. Also, more disc replacement patients said they were satisfied with their outcomes and would choose to have the surgery again," Delamarter said.

The article reported that disc replacement operations were quicker and resulted in less blood loss, hospital stays were shorter and patients experienced more rapid improvement.

Discs act as cushions between the bones (vertebrae) of the spine. When healthy, they have enough "give" to allow the back to be flexible but they are firm enough to provide stability. With age or injury, they can lose their pliability and density. Nerves may become pinched between the bones, causing pain not just in the spine but in other parts of the body.

Fusion surgery is intended to relieve symptoms of degenerative disc disease by removing the damaged disc and replacing it with bone. Rods and screws are attached to the spine to hold the bones in place while the vertebrae grow together (fuse). Studies show these procedures often can be effective in certain situations but there can be drawbacks: fused sections of the spine can lose their flexibility, potentially impeding normal movement and putting greater stress on the surrounding discs. The adjacent discs then can be prone to injury, often requiring more fusion surgery. Artificial discs are designed to maintain natural spine movement. They may reduce the need for follow-up surgery.

"Although our data extend two years out from surgery, fully evaluating the benefits or disadvantages of either procedure will require longer follow-up to detect adjacent-level disc degeneration and possible device wear," said Delamarter, who joined Cedars-Sinai in 2009.

In a commentary on the article in the same journal, Andrew J. Schoenfeld, MD, of the William Beaumont Army Medical Center in El Paso, Texas, said the authors "are to be commended for an important work that contributes substantially to the growing literature regarding total disc replacement. While it has limitations, the work of Delamarter et al. should be recognized as the first prospective, randomized study on two-level total disc replacement and one that highlights short-term clinical advantages for the procedure, such as accelerated rehabilitation and enhanced pain relief."

The Journal of Bone and Joint Surgery chose Delamarter's article for video presentation and it will be used for surgeon education.

The study included 237 patients treated from January 2002 to June 2004 by 38 spine surgeons at 16 sites across the United States. It was funded by Synthes USA, the device manufacturer. Delamarter is a consultant for Synthes and receives royalties on the ProDisc devices, but he does not receive royalties on any patient he sees or treats.

Citation: *The Journal of Bone and Joint Surgery*, April 20, 2011: "Prospective, Randomized, Multicenter Food and Drug Administration Investigational Device Exemption Study of the ProDisc-L Total Disc Replacement Compared with Circumferential Arthrodesis for the Treatment of Two-Level Lumbar Degenerative Disc Disease."

http://www.eurekalert.org/pub_releases/2011-05/uotm-hic052011.php

High iron, copper levels block brain-cell DNA repair

Discovery could shed light on Alzheimer's, Parkinson's and other neurodegenerative disorders

GALVESTON, Texas - No one knows the cause of most cases of Alzheimer's, Parkinson's and other neurodegenerative disorders. But researchers have found that certain factors are consistently associated with these debilitating conditions. One is DNA damage by reactive oxygen species, highly destructive molecules usually formed as a byproduct of cellular respiration. Another is the presence of excessive levels of copper and iron in regions of the brain associated with the particular disorder.

University of Texas Medical Branch at Galveston researchers have discovered how these two pieces of the neurodegenerative disease puzzle fit together, a connection they describe in a review article in the current *Journal of Alzheimer's Disease*. A high level of copper or iron, they say, can function as a "double whammy" in the brain by both helping generate large numbers of the DNA-attacking reactive oxygen species and interfering with the machinery of DNA repair that prevents the deleterious consequences of genome damage.

"It's been suggested that an imbalance of DNA damage and repair produces a buildup of unrepaired genetic damage that can initiate neurodegenerative pathology," said postdoctoral fellow Muralidhar Hegde, lead author of the paper. "We don't yet know enough about all the biochemical mechanisms involved, but we have found multiple toxic mechanisms linking elevated iron and copper levels in the brain and extensive DNA damage - pathological features associated with most neurodegenerative disorders."

Humans ordinarily have small amounts of iron and copper in their bodies - in fact, the elements are essential to health. But some people's tissues contain much larger quantities of iron or copper, which overwhelm the proteins that normally bind the metals and sequester them for safe storage. The result: so-called "free" iron or copper ions, circulating in the blood and able to initiate chemical reactions that produce reactive oxygen species.

"Reactive oxygen species cause the majority of the brain cell DNA damage that we see in Alzheimer's and Parkinson's disease, as well as most other neurodegenerative disorders," Hegde said. "It's bad enough if this damage occurs on one strand of the DNA double helix, but if both strands are damaged at locations close to each other you could have a double-strand break, which would be fatal to the cell."

Normally, special DNA repair enzymes would quickly mend the injury, restoring the genome's integrity. But experiments conducted by Hegde and his colleagues showed that iron and copper significantly interfere with the activity of two DNA repair enzymes, known as NEIL1 and NEIL2.

"Our results show that by inhibiting NEIL1 and NEIL2, iron and copper play an important role in the accumulation of DNA damage in neurodegenerative diseases," Hegde said.

The researchers got a surprise when they tested substances that bond to iron and copper and could protect NEIL1 from the metals. One of the strongest protective agents was the common South Asian spice curcumin, which also has been shown to have other beneficial health effects.

"The results from curcumin were quite beautiful, actually," Hegde said. "It was very effective in maintaining NEIL activity in cells exposed to both copper and iron."

Other authors of the Journal of Alzheimer's Disease paper include research associate Pavana Hegde; K.S. Rao, director of the Institute for Scientific Research and High Technology Services in Panama; and UTMB Professor Sankar Mitra. The United States Public Health Service and the American Parkinson's Disease Association supported this research.

<http://www.scientificamerican.com/article.cfm?id=how-brains-bounce-back>

How Brains Bounce Back from Physical Damage

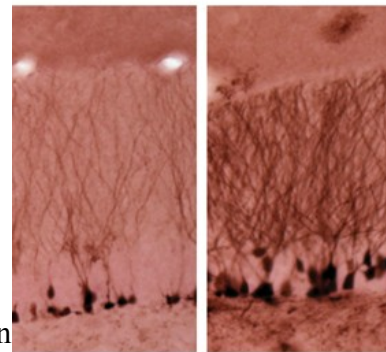
After a traumatic injury, neurons that govern memory can regenerate

By Tim Requarth and Meehan Crist

For most of the past century the scientific consensus held that the adult human brain did not produce any new neurons. Researchers overturned that theory in the 1990s, but what role new neurons played in the adult human brain remained a mystery. Recent work now suggests that one role may be to help the brain recover from traumatic brain injury.

Cory Blaiss, then at the University of Texas Southwestern Medical Center, and her colleagues genetically engineered mice such that the researchers could selectively turn neurogenesis on or off in a brain region called the hippocampus, a ribbon of tissue located under the neocortex that is important for learning and memory. They then administered blunt-force trauma to the brain and compared the performance of brain-injured mice that could produce new neurons to brain-injured mice that could not. They sent each mouse through a water maze that required it to find a platform obscured beneath the surface of murky water. The researchers found that after injury only mice with intact neurogenesis could develop an efficient strategy to find the hidden platform, a skill that is known to rely on spatial learning and memory. They concluded that without neurogenesis in the hippocampus, the recovery of cognitive functions after brain injury was significantly impaired.

The finding may lead to much needed therapeutic techniques. Deficits in learning and memory are nearly universal after a traumatic brain injury. The ability to stimulate more robust neurogenesis could lead to faster healing times or perhaps even more complete recovery of cognitive functions, a potentially life-changing prospect for the millions of people who suffer from traumatic brain injury every year.



GROWTH SPURT: *A brain injury can spur the development of new neurons (right). At the left is an uninjured brain.*

Image: Courtesy of University of Texas Southwestern Medical Center

<http://www.physorg.com/news/2011-05-gorillas-right-handedness-clues-human-language.html>

Gorillas' right-handedness gives new clues to human language development

(PhysOrg.com) -- A new study that has identified a right-handed dominance in gorillas may also reveal how tool use led to language development in humans.

Psychologist Dr Gillian Forrester, a visiting fellow at the University of Sussex, has been studying a family of gorillas at Port Lympne Wild Animal Park in Kent. Using a specially developed coding system for analysis, she and her team identified which hand gorillas used when doing activities such as: using objects and eating or preparing food (described as 'inanimate targets'), and which hand they used for social interactions, such as: scratching their head, patting their friend on the back or mothering ('animate targets').

They found the gorillas were more likely to use their right hands for inanimate targets and either hand with equal frequency - for social interaction. In the human population, 90 per cent are right-handed - and 95 per cent of these right-handers have language centres in the left hemisphere of the brain.

Dr Forrester's study suggests a direct link between the area of the brain used for manipulating inanimate objects and its specialisation for language skills. She says: 'It is thought that humans exhibit extreme population right-handedness as a sign of our left hemisphere language centers. While a causal relationship is yet to be discovered, this argument for human right-handedness has been bolstered in the past by great ape studies that reveal no consistent population bias for using either hand.'

'These new findings represent a breakthrough in the attempt to define a causal relationship between language and right-handedness,' she adds. 'While apes do not demonstrate language abilities, MRI scans of great apes show that they do share with humans areas designated for language skills in the left hemisphere of the brain. In apes, these areas are active during tool use.'

Dr Forrester says the relationship between right-handedness and language may be due to the repurposing of a brain area once used for structured sequences of events, such as tool use and manufacture, in a common human-ape ancestor. 'The basic hierarchy of steps required to make and use tools could be akin to providing us with the scaffolding to build a syntax for language.'

The study, 'Target animacy influences gorilla handedness', is published this month in Animal Cognition.

Provided by University of Sussex

<http://www.scientificamerican.com/blog/post.cfm?id=curing-paralysis--again-2011-05-20>

Curing Paralysis--Again

By R. Douglas Fields

An article by Rob Stein on the front page of today's Washington Post (May 20, 2011) announces a stunning breakthrough treatment for paralysis that has transformed the life of a man who was paralyzed in a car accident.

The successful experimental treatment involves electrical stimulation of his damaged spinal cord through implanted electrodes. Scientists are still not exactly sure how it works, but it does. For one individual reading this article, this breakthrough was very old news - more than 27 years old.

In the early 1980's a researcher had performed similar experiments on rats. He had designed and hand-built implantable microstimulators, using a simple electrical circuit powered by a watch battery. Then he implanted the device into rats in which he had severed their nerves under anesthesia. Immediately after the surgery was complete, he flipped a coin to determine whether to snip the wires to the electrodes rendering the device useless, or to leave them intact to stimulate the growing nerve fibers.

Several weeks later when he examined the nerves carefully with an electron microscope, the results were striking. There was little if any nerve regeneration in the rats in which the stimulator had been disabled, but the nerves in rats that had been stimulated with the device showed remarkable healing. Not only had the nerve fibers regenerated, new blood vessels had formed, infusing the tissue with nutrients, and the coating of electrical insulation (myelin) had re-formed around the nerve fibers. This coating is critical for transmission of electrical impulses. None of the control animals showed any myelin formation; only withered bare axon stubs and feeble naked sprouts. But no one ever heard about it.

This story gives some insight into the question people often ask about why it takes so long to bring new discoveries in basic research to development of a practical medical treatment, and it exposes a perplexing dilemma.

All of this research over a quarter of a century ago was unfunded. It was financed by the researcher's personal cash, which was quite modest, because he was not a scientist with his own research lab. He was a graduate student living on a modest stipend. He wrote a draft of a scientific paper to announce the results of his independent experiments and hired a patent attorney to begin the process of developing a practical medical device. A photo of the date-stamped envelope containing the patent application, experimental data, and the draft of the research paper, which he mailed to himself, is attached.

The young student may have demonstrated keen scientific insight into a problem that costs society enormously and brings much suffering to families and individuals, but when he shared his results with his professor, the student's extraordinary naivety was revealed. None of the research had been authorized. The research had nothing to do with the funded research being conducted in the laboratory. The university had not sanctioned the experiments. The proper animal study protocols had not been submitted. The student had committed an outrageous blunder. He had violated several legal and ethical requirements for conducting scientific research through his ignorance and enthusiasm. His major professor, legally responsible for assuring compliance with all regulations involving research in his lab felt betrayed and worried as he contemplated the serious consequences. The professor could now face charges for having failed to adequately supervise his student to the extent that unauthorized experiments were being conducted in his lab. The student's academic career was over.

Seeing the error of his ways, the student stopped the patent application. He turned over his experimental results and notes to his professor and wrote a sincere letter of apology to him and to the university and vowed not to pursue the research. The transgression was forgiven and an important lesson was learned. Everyone makes mistakes - especially when one is young and inexperienced. Today he is all the wiser for the experience.

Now a successful scientist with his own laboratory, the researcher kept his vow not to pursue research on electrical stimulation for nerve regeneration. His research over the ensuing decades on how electrical activity arising naturally in the brain guides the formation of connections between neurons and stimulates the formation of myelin on axons during development began to reveal specific molecular mechanisms that could explain in part how artificial electrical stimulation could promote healing of injured nerves. He noted with interest over the years other researchers beginning to experiment with electrical stimulation for treating nerve injury, and that several of his more recent scientific papers were cited in patent applications by others.

There are no villains in this story, but the ending is unsatisfying. 27 years is a long time, especially for people suffering paralysis or other debilitating illnesses. It was not the quality of the science or the motives of anyone that were faulty. Rather, the abrupt halt to this promising research was the consequence of a well-intentioned system that assures proper conduct of research. Therein lies the dilemma. Scientific research must be carried out responsibly. But the system in place to assure this outcome necessarily means that only research that is sanctioned, supervised, and funded, can be conducted.

History shows that it is often the young mind naively approaching a problem from a fresh perspective that results in the unlikely breakthrough. But young people are the least equipped of any to exercise their novel ideas in scientific research. Research that must be sanctioned by established leaders in the field may not be approved if it is unconventional. Would the Pope have endorsed Galileo's experiments? Galileo could nevertheless perform his experiments with simple tools, but today science has grown so complex, the sophisticated and expensive tools and facilities necessary to perform scientific research are well beyond the capabilities of an individual.

Last night (before this story broke) a colleague of mine from France was a guest in my home for dinner. He spoke with pride of the multi-million dollar new research center on brain and spinal cord research that he had spent the last three years working to establish in Paris. He was justifiably proud of the accomplishment, but then he shared his impossible dream. His wish was that he could equip a research institute with modern scientific equipment for the exclusive use of students. "Why should people who are just learning their craft be further hampered by having no equipment or being forced to struggle with the poorest quality instruments?" He lamented the educational system in France, which he likened to attending mass in which the students sat observantly "staring like cows" at the lecturer for enlightenment. My wife has, for the last 23 years, taught a neuroscience research class that dispenses with books and lectures, and replaces them with original scientific research conducted by students. This involves interactions with working scientists, presentations at scientific meetings, and even publication in scientific journals. The results of empowering students in this way have been impressive. Many are now research scientists in the most prestigious universities in the country. But the class will not be taught next year because of funding cuts, and instead students will take AP Biology classes where they will be indoctrinated with information required to pass the AP Biology exam.

When the former graduate student read the article in the Washington Post this morning he smiled. He had been on the right track. The promise of relieving the suffering of many people struggling from traumatic spinal cord and brain injury is on the horizon. How do I know so much about this him? He is the author of this article.

http://www.eurekalert.org/pub_releases/2011-05/uow-hbm051711.php

Human brain's most ubiquitous cell cultivated in lab dish

MADISON – Pity the lowly astrocyte, the most common cell in the human nervous system.

Long considered to be little more than putty in the brain and spinal cord, the star-shaped astrocyte has found new respect among neuroscientists who have begun to recognize its many functions in the brain, not to mention its role in a range of disorders of the central nervous system. Now, writing in the current (May 22) issue of the journal *Nature Biotechnology*, a group led by University of Wisconsin-Madison stem cell researcher Su-Chun Zhang reports it has been able to direct embryonic and induced human stem cells to become astrocytes in the lab dish.

The ability to make large, uniform batches of astrocytes, explains Zhang, opens a new avenue to more fully understanding the functional roles of the brain's most commonplace cell, as well as its involvement in a host of central nervous system disorders ranging from headaches to dementia. What's more, the ability to culture the cells gives researchers a powerful tool to devise new therapies and drugs for neurological disorders.

"Not a lot of attention has been paid to these cells because human astrocytes have been hard to get," says Zhang, a researcher at UW-Madison's Waisman Center and a professor of neuroscience in the UW-Madison School of Medicine and Public Health. "But we can make billions or trillions of them from a single stem cell."

Although astrocytes have gotten short shrift from science compared to neurons, the large filamentous cells that process and transmit information, scientists are turning their attention to the more common cells as their roles in the brain become better understood. There are a variety of astrocyte cell types and they perform such basic housekeeping tasks as helping to regulate blood flow, soaking up excess chemicals produced by interacting neurons and controlling the blood-brain barrier, a protective filter that keeps dangerous molecules from entering the brain.

Astrocytes, some studies suggest, may even play a role in human intelligence given that their volume is much greater in the human brain than any other species of animal.

"Without the astrocyte, neurons can't function," Zhang notes. "Astrocytes wrap around nerve cells to protect them and keep them healthy. They participate in virtually every function or disorder of the brain."

The ability to forge astrocytes in the lab has several potential practical outcomes, according to Zhang. They could be used as screens to identify new drugs for treating diseases of the brain, they can be used to model disease in the lab dish and, in the more distant future, it may be possible to transplant the cells to treat a variety of neurological conditions, including brain trauma, Parkinson's disease and spinal cord injury. It is possible that astrocytes prepared for clinical use could be among the first cells transplanted to intervene in a neurological condition as the motor neurons affected by the fatal amyotrophic lateral sclerosis, also known as Lou Gehrig's disease, are swathed in astrocytes.

"With an injury or neurological condition, neurons in the brain have to work harder, and doing so they make more neurotransmitters," chemicals that in excess can be toxic to other cells in the brain, Zhang says.

"One idea is that it may be possible to rescue motor neurons by putting normal, healthy astrocytes in the brain," according to Zhang. "These cells are really useful as a therapeutic target."

The technology developed by the Wisconsin group lays a foundation to make all the different species of astrocytes. What's more, it is possible to genetically engineer them to mimic disease so that previously inaccessible neurological conditions can be studied in the lab.

In addition to Zhang, co-authors of the new Nature Biotechnology paper include Robert Krencik, Jason Weick and Zhijian Zhang, all of UW-Madison, and Yan Liu of Fudan University Shanghai Medical School. The work was supported by the ALS Foundation, the National Institute of Neurological Disorders and Stroke, the National Multiple Sclerosis Society, the Bleser Family Foundation and the Busta Family Foundation.