http://www.eurekalert.org/pub_releases/2012-06/tes-tvd062412.php

Treating vitamin D deficiency may improve depression

Women with moderate to severe depression had substantial improvement in their symptoms of depression after they received treatment for their vitamin D deficiency, a new study finds.

The case report series will be presented Saturday at The Endocrine Society's 94th Annual Meeting in Houston. Because the women did not change their antidepressant medications or other environmental factors that relate to depression, the authors concluded that correction of the patients' underlying shortage of vitamin D might be responsible for the beneficial effect on depression.

"Vitamin D may have an as-yet-unproven effect on mood, and its deficiency may exacerbate depression," said Sonal Pathak, MD, an endocrinologist at Bayhealth Medical Center in Dover, Del. "If this association is confirmed, it may improve how we treat depression."

Pathak presented the research findings in three women, who ranged in age from 42 to 66. All had previously diagnosed major depressive disorder, also called clinical depression, and were receiving antidepressant therapy. The patients also were being treated for either Type 2 diabetes or an underactive thyroid (hypothyroidism).

Because the women had risk factors for vitamin D deficiency, such as low vitamin D intake and poor sun exposure, they each underwent a 25-hydroxyvitamin D blood test. For all three women, the test found low levels of vitamin D, ranging from 8.9 to 14.5 nanograms per milliliter (ng/mL), Pathak reported. Levels below 21 ng/mL are considered vitamin D deficiency, and normal vitamin D levels are above 30 ng/mL, according to The Endocrine Society.

Over eight to 12 weeks, oral vitamin D replacement therapy restored the women's vitamin D status to normal. Their levels after treatment ranged from 32 to 38 ng/mL according to the study abstract.

After treatment, all three women reported significant improvement in their depression, as found using the Beck Depression Inventory. This 21-item questionnaire scores the severity of sadness and other symptoms of depression. A score of 0 to 9 indicates minimal depression; 10 to 18, mild depression; 19 to 29, moderate depression; and 30 to 63, severe depression.

One woman's depression score improved from 32 before vitamin D therapy to 12, a change from severe to mild depression. Another woman's score fell from 26 to 8, indicating she now had minimal symptoms of depression. The third patient's score of 21 improved after vitamin D treatment to 16, also in the mild range.

Other studies have suggested that vitamin D has an effect on mood and depression, but there is a need for large, good-quality, randomized controlled clinical trials to prove whether there is a real causal relationship, Dr Pathak said.

"Screening at-risk depressed patients for vitamin D deficiency and treating it appropriately may be an easy and cost-effective adjunct to mainstream therapies for depression," she said.

http://www.eurekalert.org/pub_releases/2012-06/tes-omc062412.php

Overweight men can boost low testosterone levels by losing weight

Weight loss can reduce the prevalence of low testosterone levels in overweight, middle-aged men with prediabetes by almost 50 percent, a new study finds.

"Doctors should first encourage overweight men with low testosterone levels to try to lose weight through diet and exercise before resorting to testosterone therapy to raise their hormone levels," said study co-author Frances Hayes, MD, professor at St. Vincent's University Hospital, Dublin. Results will be presented Monday at The Endocrine Society's 94th Annual Meeting in Houston.

The new study involved nearly 900 men with prediabetes (also called impaired glucose tolerance) who had participated in the Diabetes Prevention Program. That now-completed U.S. study showed that people at high risk of Type 2 diabetes could delay or avoid developing the disease through weight loss. Because overweight men are more likely to have low testosterone levels, Hayes and her colleagues studied the effect of weight loss on men's testosterone levels.

The investigators excluded men from the study who had a known diagnosis of hypogonadism or were taking medications that could interfere with testosterone levels. Hypogonadism is a condition characterized by low testosterone levels with symptoms of male hormone deficiency. Symptoms can include reduced sex drive, poor erections, enlarged breasts and low sperm counts.

The study population had 891 middle-aged men, with an average age of 54 years. The men were randomly assigned to receive one of three treatments: 293 men to lifestyle modification, 305 to the diabetes drug metformin and 293 to inactive placebo pills. Lifestyle modifications consisted of exercising for 150 minutes a week and eating less fat and fewer calories.

The results showed that low testosterone levels are common in overweight men with prediabetes, Hayes said. At the beginning of the study, nearly one in four men had low testosterone levels, considered to be below 300 nanograms per deciliter.

With lifestyle modification, the prevalence of low testosterone levels decreased from about 20 percent to 11 percent after one year, a 46 percent decrease, the authors reported. The prevalence of low testosterone was unchanged in the metformin group (24.8 versus 23.8 percent) and the placebo group (25.6 versus 24.6 percent).

Men in the lifestyle modification group lost an average of about 17 pounds (7.8 kilograms) over the one-year study, according to the abstract. The increase in testosterone levels in that group correlated with decreasing body weight and waist size.

"Losing weight not only reduces the risk of prediabetic men progressing to diabetes but also appears to increase their body's production of testosterone," Hayes said.

Researchers from Massachusetts General Hospital in Boston and from Centre Hospitalier Universitaire Vaudois in Lausanne, Switzerland, contributed to this study, which received funding from the National Institutes of Health and the American Diabetes Association.

http://www.eurekalert.org/pub_releases/2012-06/pcc-pac062512.php

Prions and cancer: A story unfolding

New evidence that p53, may show a typical prion-like behavior when mutated

Prions, the causal agents of Mad Cow and other diseases, are very unique infectious particles. They are proteins in which the complex molecular three-dimensional folding process just went astray. For reasons not yet understood, the misfolding nature of prions is associated to their ability to sequester their normal counterparts and induce them to also adopt a misfolding conformation. The ever-growing crowd of misfolded proteins form the aggregates seen in diseases such as Parkinson's and Alzheimer's. Once misfolded, a protein can no longer exert its normal functions in the cell.

Now, a group led by Dr Jerson Lima Silva at the Federal University of Rio de Janeiro, Brazil, presents some new evidence that p53, a protein with the daunting task of suppressing tumor formation in the body, may show a typical prion-like behavior when mutated.

It has been known for some time that the buildup of p53 in the cell impairs the protein in preventing tumor growth. This has been observed in neuroblastoma, retinoblastoma, breast, and colon cancers. In a paper entitled "Mutant p53 aggregates into prion-like amyloid oligomers and fibrils: Implications for cancer" and published in the Journal of Biological Chemistry, the group shows that in breast cancer cell lines carrying the most common p53 mutation, the formation of amyloid-like aggregates of p53 proteins may explain the protein's lack of function.

Whether this prionoid behavior in fact represents a relevant cancer-related mechanism remains to be shown. Development of novel and ingenious strategies to prevent p53 misfolding and aggregation may be just one way to find out.

"We are planning pre-clinical tests with synthesized nucleic acids in an attempt to prevent the changing in conformation of normal p53, and avoid aggregates of misfolded protein," says Dr. Silva.

If successful, the strategy may help unveil unforeseen molecular mechanisms leading to tumor development. Considering that more than half of the cancers lose p53 function, this prionoid behavior may serve as a potential novel target for cancer therapy, dramatically transforming our way of thinking of cancer and treating cancer patients.

The study was funded by the National Council for Scientific and Technological Development (CNPq), the Rio de Janeiro State Foundation for Research (FAPERJ), the Ministry of Health (MS/Decit) and the National Institute of Science and Technology for Structural Biology and Bioimaging (INBEB). A PDF of the paper can be found at http://www.jbc.org/content/early/2012/06/19/jbc.M112.340638.abstract

http://www.sciencedaily.com/releases/2012/06/120625064620.htm

Complex Thinking Behind the Bow and Arrow

University of Tübingen and South African researchers have revealed sophisticated design and technology developed by early humans.

ScienceDaily - The bow and arrow have long been regarded as a possible indicator of culture in prehistoric times. Bows and arrows appear to have been in use for some 64,000 years, given evidence from South Africa. Until recently, their significance in human cognitive ability was unclear. Now two researchers have been able to decode the conceptual foundations of the bow and arrow. The results of the study, by Miriam Haidle of the Heidelberg Academy's ROCEEH project (sponsored by the Senckenberg Research Institute) and the University of Tübingen and Marlize Lombard of the University of Johannesburg, appear in the latest edition of the Cambridge Archaeological Journal.

Using archaeological finds and ethnological parallels, the two researchers reconstructed the steps needed to make a bow and arrows. These are complimentary tools -- separate, but developed interdependently. The bow is the controlling element, while the arrows can be used more flexibly and are interchangeable. About 2.5 million years ago, humans first used tools to make other tools then to make tools assembled from different parts to make a unit with particular qualities, such as wooden spears with stone spearheads (ca. 200,000-300,000 years ago.) The bow and arrow and other complementary tool sets made it possible for prehistoric humans to greatly increase the flexibility of their reactions.

There are many basic complementary tool sets: needle and thread, fishing rod and line, hammer and chisel. The bow and arrow are a particularly complex example. The reconstruction of the technique shows that no less than ten different tools are needed to manufacture a simple bow and arrows with foreshafts. It takes 22 raw materials and three semi-finished goods (binding materials, multi-component glue) and five production phases to make a bow, and further steps to make the arrows to go with it. The study was able to show a high level of complexity in the use of tools at an early stage in the history of homo sapiens.

It may look simple, but it is a highly complex tool: a Bushman's bow from Botswana. **Image courtesy of Universitaet Tübingen**

The Heidelberg Academy of Sciences and Humanities project "The Role of Culture in Early Expansions of Humans" (ROCEEH) incorporates archaeologists, paleoanthropologists, palaeobiologists and geographers, working together to find out where the first humans arose, where they moved to in Africa and Eurasia, and why. The project covers the time between three million years ago and the last glacial maximum 20,000 years ago. The focus is on when, where, and in what form a changing climate, evolution and cultural development of early humans enabled them to expand the behavioral niche of a large primate within Africa and to find new roles outside of Africa. The University of Tübingen and the Senckenberg Research Institute in Frankfurt have been cooperating on this 20-year Heidelberg Academy project since 2008.

*Lombard, Marlize & Miriam Noël Haidle. Thinking a bow-and-arrow: cognitive implica-tions of Middle Stone Age bow and stone-tipped arrow technology. Cambridge Archaeological Journal, 2012; 22/2, 237-264; in press [**link**]*

http://phys.org/news/2012-06-immigration-growth-spain-crime.html

Immigration growth in Spain has not caused more crime

Society tends to perceive an increase in the immigrant population with an increase in crime.

But, according to a new study, it is not possible to infer this cause-effect relationship in the case of Spain. "Crime in Spain is low compared to the rest of Europe. Crime rates have increased slightly in recent years, unlike the immigrant population which has grown at a much greater pace. This suggests a positive yet low correlation between immigration and crime," as explained to SINC by César Alonso-Borrego, lecturer in economics at the Carlos III University in Madrid, Spain.

The researcher is a coauthor of the study published in the American Law and Economics Review Journal. It evaluates whether "this correlation consists of a causal relationship between immigration and crime." The conclusion is that it does not.

The researchers constructed an empirical model to measure the probability of committing crime depending on environmental and individual characteristics, such as educational attainment. They used data from the Spanish Home Office on the crimes committed each year for each 10,000 inhabitants in every Spanish province from 1999 to 2009. Information on the immigrant population was extracted from the Electoral Register and the Labour Force Survey. Furthermore, environmental characteristics were taken into account using measures like the GDP per capita and the unemployment rate in each province.

As the expert points out, "we studied the number of crimes per inhabitant for each place and each year. Amongst the relevant variables was the proportion of immigrants according to their origin and characteristics (age, gender, education and language)."

The use of information for each province causes a potential endogenous problem. In other words, this means the unseen differences between provinces that affect crime levels (like access to opportunities) and the proportion of immigrants.

The researcher stresses that "there tends to be more crime in places that offer more economic opportunities. These places are precisely where there are higher levels of immigrants. This suggests a positive correlation between immigration and crime, which could wrongly lead to attributing this to a causal link between both

phenomena." However, thanks to the availability of longitudinal data (values for each variable over a period of various years), the researchers have been able to consistently calculate the veracity of this causal effect. Estimates confirm the importance of language and education. "In particular, there is less crime amongst the Spanish-speaking immigrant population and, to a lesser extent, those immigrants from the European Union. Furthermore, the immigrant's educational attainment, which is relatively high in relation to native Spaniards, explains how the effect of immigration on delinquency is moderate," according to the experts.

Young men commit more crime

Likewise, as is the case in other countries, the immigration proportion of young men is associated with a higher crime rate since this population group is responsible for most of crimes committed. The expert emphasises that "the proportion of young men is higher amongst the immigrant population than the native population."

Unlike in the USA, this massive influx of immigrants is relatively recent throughout the European Union. This is particularly the case in Spain where the weight of the immigrant population has increased since the year 2000. "Our results fall in line with well-known 'Latino Paradox' in the USA, where the immigrant Mexican population saw a decrease in crime. This is because the immigrants from Mexico consisted of a 'virtuous selection' of individuals whose tendency to commit crime was lower than that of the native population. Immigration is not a homogenous phenomenon but is rather a range of very different groups that each require different policies depending on the problems associated with their specific characteristics," conclude the researchers.

American Law and Economics Review 14 (1): 165-191, primavera 2012. doi: 10.1093/aler/ahr019 Provided by Spanish Foundation for Science and Technology (FECYT)

http://www.sciencedaily.com/releases/2012/06/120625125138.htm

New Hormonal Gel Combination Shows Promise as Reversible Birth Control for Men

Male hormonal contraceptives applied daily to the skin reduce sperm production

ScienceDaily - Male hormonal contraceptives applied daily to the skin reduce sperm production, finds a new study presented June 25 at The Endocrine Society's 94th Annual Meeting in Houston.

Very low sperm counts resulted for about 89 percent of men using a new combination of hormones, the authors reported. They combined a transdermal (skin) gel containing the male hormone testosterone and a gel containing a new synthetic progestin called Nestorone.

"This is the first time that testosterone and Nestorone have been applied to the skin together to deliver adequate amounts of hormones that suppress sperm production," said principal investigator Christine Wang, MD, professor, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center (LA BioMed). "Men can use transdermal gels at home -- unlike the usual injections and implants, which must be given in a health care provider's office."

Prior studies of male contraceptives that combined testosterone and progestin used progestin pills, implants or shots, according to Wang. In men, progestin increases the contraceptive effectiveness of testosterone. Both testosterone and progestin work together to turn off production of reproductive hormones controlling the production of sperm, she said. Furthermore, Wang said, unlike other progestins studied as male contraceptives, Nestorone has no androgenic (male hormone) activity. Androgenic activity may cause side effects such as acne and changes in good and bad cholesterol.

In this preliminary study, the investigators randomly assigned 99 healthy men to use one of three unidentified transdermal treatments every day for six months. The assigned treatment was either a gel containing 10 grams of testosterone plus a placebo ("dummy") gel, or the same testosterone gel plus a gel containing either 8 or 12 milligrams (mg) of Nestorone.

Fifty-six men completed at least 20 weeks of treatment and adhered to the study protocol, according to the abstract. Only 23 percent of men who received testosterone alone obtained a sperm concentration less than 1 million sperm per milliliter, "a level that is compatible with very low pregnancy rates," Wang said. For the testosterone-progestin combinations, sperm counts reached that level in 88 to 89 percent of men, depending on the progestin dose.

In addition, complete absence of sperm occurred in significantly more men receiving combined testosterone and progestin than testosterone alone: 78 and 69 percent (8 and 12 mg of progestin, respectively) versus 23 percent for testosterone only."The combination of testosterone with Nestorone had few adverse effects," Wang said. "It warrants further study as a male contraceptive."

Nestorone is an investigational new drug being developed by the Population Council, a nonprofit organization in New York City, which supplied this drug for the study. Besins Pharma provided the testosterone gel. Grant funding came from the National Institute of Child Health and Human Development through the Contraceptive Clinical Trials Network. The University of Washington, Seattle, also participated in this study.

http://phys.org/news/2012-06-choice-diminishes-wealth-inequality.html

Thinking about choice diminishes concern for wealth inequality

Against the backdrop of a worldwide recession, wealth inequality has become a prominent theme in discussions about politics and the economy.

In some ways, Americans seem to advocate a more equal distribution of wealth. In surveys and public opinion polls, for example, the majority of Americans supports having a strong middle class. But, when it comes to specific policies, they often vote against measures that would narrow the gap between those with the highest and lowest incomes.

In a new study published in Psychological Science, a journal of the Association for Psychological Science, researchers Krishna Savani of Columbia Business School and Aneeta Rattan of Stanford University investigate the underlying factors that explain Americans' contradictory opinions on wealth.

They surmised that one factor – the concept of choice – might be particularly influential in discussions about wealth. "Choice is a pervasive and highly valued concept in the U.S.," say the authors. If we assume that people make free choices, they theorized, while at the same time we acknowledge that some people are rich and others are poor, we may be more likely to believe that inequality in life outcomes is justified and reasonable because it must be the result of individual choice.

In a series of six experiments, they put their theory about the effects of a choice mindset to the test.

In the first experiment, participants were randomly assigned to a control or a choice condition. The participants in the control condition were asked to list five things they did in each of four time periods the previous day; in the choice condition, the participants listed five choices instead. All of the participants then rated how disturbed they were by statistics about existing wealth inequalities in the United States.

The results of the experiment confirmed the researchers' hypothesis. After controlling for certain characteristics like political orientation, socioeconomic status, and gender, Savani and Rattan found that participants in the choice condition were less disturbed about wealth inequalities in the U.S. than participants in the control condition. And these findings were supported in a second experiment, in which the researchers used a priming technique to incidentally highlight the concept of choice.

In a third experiment, the researchers found that when the concept of choice is activated, people under-emphasize the role of societal structures in allowing individuals to create and accumulate wealth.

Evidence from the first three experiments convinced Savani and Rattan that choice is indeed an important factor underlying Americans' attitudes toward wealth inequality. "When people think in terms of choice, they become focused on the idea that people gain wealth through their own choices and not because of social protections. This additional emphasis on individual agency leads them to be less disturbed the wealth inequalities that exist," the authors explain.

With these results in hand, they decided to look at how a choice-oriented mindset affects attitudes toward specific policies.

In a fourth experiment, they investigated how thinking about choice might influence support for policies that aim to equalize the distribution of resources in the context of education. In line with their hypotheses, participants in the choice condition were less supportive of redistributive policies than participants in the control condition. The relationship was explained by participants' beliefs about individuals' entitlement to keep their wealth.

In a fifth experiment, the researchers confirmed that the effects of choice are specific to redistributive policies and not to some more general reluctance to support government spending on public goods.

In July 2011, Savani and Rattan were in the midst of conducting their research when current events intervened. The federal government was faced with a decision: raise the debt ceiling or default on the national debt. The researchers decided to seize the moment: "We wanted to see if the concept of choice could shift people's attitudes even with the nation's economic future hanging in the balance."

In the week prior to the resolution of the debt crisis, they surveyed participants, asking them how supportive they would be of different policies that might help to resolve the federal debt crisis, all of which involved increasing taxes on the wealthy. As in the previous studies, participants who were not thinking about choice were relatively supportive of increasing taxes given the stakes at hand. By comparison, the participants who were made to think about choice were significantly less supportive of such policies, even when faced directly with the consequences of maintaining the status quo.

Overall, Savani and Rattan believe their research offers critical insights into how people think about wealth inequality. "When the U.S. faces hard economic challenges, people often talk about needing to make difficult

choices. But our findings suggest that when Americans are prompted to think about making choices, they might act in ways that are inconsistent with their own attitudes."
Given how important the issue of wealth inequality is in American society, Savani and Rattan hope to continue research in this area. "Issues of income inequality affect so many aspects of people's lives – how happy they are, what they strive for, what opportunities their kids have – and also influence governmental decisions – what public services to provide, how to tax individuals, and how to allocate benefits," they say. "Investigating additional factors that influence people's attitudes toward income and wealth inequality will be a fascinating and important question for future research to explore." *Provided by Association for Psychological Science*

http://phys.org/news/2012-06-economist-mom-dad.html

Economist shows the value of moving back with mom and dad

Though many may dread the idea, young adults who move back home with mom and dad after a job loss may benefit from it more than they realize.

Research published in the Journal of Political Economy finds that returning to the nest can be valuable insurance in a tough labor market, serving as a short-term safety net while also keeping long-term earnings from being stunted by a job loss.
"Intuitively, it makes sense that people move home after an employment shock," said Greg Kaplan, an economics professor at the University of Pennsylvania and the study's author. "We've seen a lot of anecdotal evidence of this during the latest recession, but there hadn't been much hard data on how common it is or what the effects might be. This study demonstrates that the option to move home is potentially very important."
Kaplan used data on nearly 1,500 men born between 1980 and 1984. Surveys tracked the men through their 20s, capturing employment status and living arrangements for each month.
By the age of 23, nearly 40 percent of the men in the sample had returned home for at least a month after initially moving away from home. Those who stopped working were 63 percent more likely to back move home in the following three months, compared to those who continued to work.
Constraints of the survey data forced Kaplan to limit his sample to men who did not go to college, but an additional dataset suggests that the phenomenon applies to the broader population. "When we look at aggregate state-level data we see a similar pattern," Kaplan said. "As a state's unemployment level increases, so do co-residency rates."
The data show an important long-term advantage to moving home after a job loss. Take for example an average person in Kaplan's sample who loses his job at the age of 20. People in that situation had earnings at age 26 that were 25 percent lower than someone who did not lose a job. However, this long-term effect was concentrated almost entirely among youths who did not live with their parents and did not return home after their job loss. Those who lost a job and did move back home had essentially the same earnings in later years as people who had never lost a job.
Why does living with mom and dad serve as a buffer from the negative earnings effect? Kaplan believes it's because those living at home can be choosier when looking for a new job. They have the option to wait for a job that offers higher future earning potential. "Jobs with higher growth potential may be harder to find," Kaplan said. "And they often involve low earnings in the short run but higher earnings in the future—an internship for example. If you're living at home, you might be able to wait for these better opportunities."
But if you're on your own and need to pay rent, you need a decent-paying job quickly. Easier-to-find jobs—like food service or simple labor—have lower long-term growth potential. As a result people who are pushed into those jobs will have lower earnings down the line compared to those who can live at home and wait it out.
To test this idea, Kaplan used his real-world data to construct a theoretical model that simulates labor market choices. "In the model, I can do counterfactual experiments," he said. "I can take away the option to move home and see how important it is in different circumstances."
Using his data, Kaplan modeled how a 23-year-old might evaluate job offers in a world where the option to move home was turned on or off. He created two types of hypothetical jobs. "Safe" jobs come around often, but have lower potential for future earnings. "Risky" jobs are rarer, but have higher future earnings.
According to the model, there would be as many as 15 percent fewer youths working in risky, high-growth jobs if the option to move home is removed entirely, resulting in lower earnings over the long term.
The model results echo the long-term income loss found in the real-world data and provide good evidence that the pattern is linked to constrained job choices for those who may be unable to move home.
"Moving Back Home: Insurance against Labor Market Risk." Journal of Political Economy 120:3 (June 2012).

http://bit.ly/LBuxyh

Anticlotting Compounds Shown to Protect Mice from Radiation Poisoning

Two compounds already approved for use in humans increased the survival of lab mice even after they were exposed to radiation

By Brendan Borrell and Nature magazine | June 25, 2012 | 3

Two anti-clotting compounds already approved for use in humans may have a surprising role in treating radiation sickness. The findings, reported online today in Nature Medicine, also reveal another avenue for understanding and treating the effects of radiation exposure. Last year's nuclear accident in Fukushima, Japan, renewed anxiety over the lack of treatments for radiation poisoning. It was long thought that the effects of exposure to high doses of radiation were instantaneous and irreversible, leading to destruction of the gut and loss of bone marrow cells, which damages blood-cell production and the immune system.

As a precaution against mass radiation poisoning, many governments stock a treatment called granulocyte colony-stimulating factor. This boosts bone marrow function, but it must be kept refrigerated, has occasional side effects, and must be taken as soon as possible after a disaster has occured.

Hartmut Geiger, a stem-cell biologist at the Cincinnati Children's Hospital Medical Center in Ohio, and his colleagues have uncovered a therapeutic strategy that can be deployed up to 24 hours after radiation exposure. "Most people think the game is over after you have the damage," says Geiger. "Now, we know you can modify that."

The two compounds are thrombomodulin (Solulin/Recomodulin), currently approved in Japan to prevent thrombosis, and activated protein C (Xigris). Xigris, made by pharmaceutical firm Eli Lilly in Indianapolis, Indiana, was a leading drug for treating inflammation from blood poisoning until it was pulled from the US market last October because of a lack of efficacy. In experiments by Geiger and his colleagues, treating mice with either drug led to an eightfold increase in key bone marrow cells needed for the production of white blood cells, and improved the survival rates of mice receiving lethal radiation doses by 40–80%.

Surprise synergy

The radiation study came about when two independent lines of research were united by a chance phone call. Geiger and his colleagues were screening for mutant mice that showed radiation resistance. They noticed that one mutant mouse was particularly resistant, with a mutation that meant it was producing an excess of thrombomodulin.

Meanwhile, a separate team, including physiologist Hartmut Weiler of the Blood Center of Wisconsin in Milwaukee, had been investigating how naturally occurring protein C in the gut would respond to radiation. A mutual colleague connected the two teams after recognizing the seeds of a potentially fruitful collaboration. Thrombomodulin, it turns out, activates protein C. "We talked on the phone, and there was stunned silence after we listened to each other's data," says Weiler.

In one key experiment, the researchers exposed 48 mice to 9.5 grays of radiation (a measure of absorbed radiation dose). After 24 hours and 48 hours, 30 mice were injected with activated protein C. After 30 days, only 30% of the uninjected mice had survived, whereas 70% of the injected mice were still alive. Thrombomodulin also increases survival, but must be administered within 30 minutes of radiation exposure to be effective, the researchers found.

"It's great that the reagents they are using have already been used in humans," says Mark Whitnall, a radiation biologist at the Armed Forces Radiobiology Research Institute in Bethesda, Maryland. He cautions that the researchers have not conducted the study at the full range of radiation doses as is standard in the field, but he says that it is a great "first stab" and opens up new possibilities for potential drug targets.

The compounds add to a growing arsenal of anti-radiation drugs that are currently being investigated. Last year, researchers at Harvard Medical School in Boston, Massachusetts, identified a potent combination of an antibiotic and a protein that could stave off radiation-induced infections. Whitnall says that two other compounds for treating radiation sickness are due to move forwards into human clinical trials, and that several others have shown promise in animal studies. "It's been an under-appreciated area," he says.

http://bit.ly/LONtGl

Swine flu pandemic killed 15 times more than thought

The swine flu pandemic of 2009 has been derided as a "wimp" pandemic.

Updated 17:32 26 June 2012 by Debora MacKenzie

Well, how's this for wimp: it probably killed 284,400 people – 15 times the number officially reported – within its first 12 months of touring the world. Because few cases are tested, we know the official numbers were an underestimate. But Fatimah Dawood of the US Centers for Disease Control and Prevention in Atlanta, Georgia,

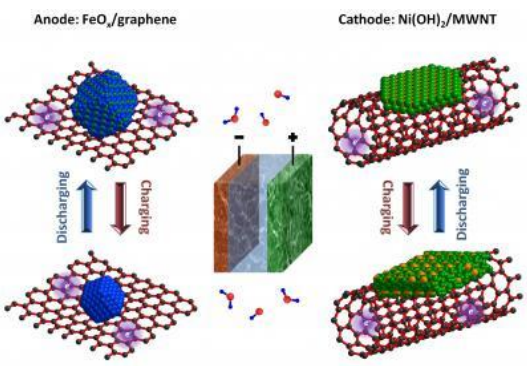
and a host of colleagues around the world sought to derive the global toll by putting together confirmed measurements of rates of infection at 17 places in 13 countries, poor and rich, together with known variations in death rates in rich and poor countries.
In fact, uncertainties in the data mean deaths might have been much higher than 284,400 – they might have reached some 575,400. A normal seasonal flu takes 250,000 to 500,000 lives a year globally but, crucially, 87 per cent of the pandemic dead were people younger than 65. In ordinary winters, 90 per cent of flu deaths are in people aged 65 or over. That means the years of life lost to the pandemic were a staggering 9.7 million globally – 3.4 times as many as during a regular flu season.
Five million of those lost years were in Africa and Southeast Asia, due to higher death rates from respiratory infections. Dawood's team says this shows how much more flu vaccine and antiviral drugs are needed in those regions. Supplies for both are currently low to non-existent in both places.
"This is a good analysis" and is probably a good rough estimate of the deaths from the pandemic, says Lone Simonsen of George Washington University in Washington DC, who wrote an accompanying commentary. But the analysis is based on generalising the measured rates of infection and death from a few countries to other countries, which inevitably involves uncertainty. In particular, says Simonsen, the relative likelihood of someone dying once they are infected is hard to get right, and may have been underestimated for "middle income" countries such as Mexico.
Simonsen is involved in another study, also involving the CDC, which will look at real data for pandemic deaths in more than a dozen countries that have such measurements. The problem, says Simonsen, is that many countries do not have such measurements, and those that do can take time to collect the numbers – even US figures became available only a few months ago.
Journal reference: The Lancet Infectious Diseases, Dawood's paper: DOI: 10.1016/S1473-3099(12)70121-4; Simonsen's commentary: DOI: 10.1016/S1473-3099(12)70152-4
Update: It was previously reported that the flu pandemic killed 284,400 people – eight times the number officially reported – within its first 12 months. The figure is actually 15 times the officially reported number.

http://www.eurekalert.org/pub_releases/2012-06/su-sss062112.php

Stanford scientists spark new interest in the century-old Edison battery

Stanford University scientists have breathed new life into the nickel-iron battery, a rechargeable technology developed by Thomas Edison more than a century ago.

Designed in the early 1900s to power electric vehicles, the Edison battery largely went out of favor in the mid-1970s. Today only a handful of companies manufacture nickel-iron batteries, primarily to store surplus electricity from solar panels and wind turbines.
"The Edison battery is very durable, but it has a number of drawbacks," said Hongjie Dai, a professor of chemistry at Stanford. "A typical battery can take hours to charge, and the rate of discharge is also very slow."
Now, Dai and his Stanford colleagues have dramatically improved the performance of this century-old technology. The Stanford team has created an ultrafast nickel-iron battery that can be fully charged in about 2 minutes and discharged in less than 30 seconds. The results are published in the June 26 issue of the journal Nature Communications.
"We have increased the charging and discharging rate by nearly 1,000 times," said Stanford graduate student Hailiang Wang, lead author of the study. "We've made it really fast."
The high-performance, low-cost battery could some day be used to help power electric vehicles, much as Edison originally intended, Dai said. "Hopefully we can give the nickel-iron battery a new life," he added.



Stanford scientists have developed an ultrafast Edison battery by growing iron oxide crystals on graphene sheets and nickel hydroxide crystals on multi-walled carbon nanotubes. Credit: Hialiang Wang, Stanford University

Electric vehicles
Edison, an early advocate of all-electric vehicles, began marketing the nickel-iron battery around 1900. It was used in electric cars until about 1920. The battery's long life and reliability made it a popular backup power source for railroads, mines and other industries until the mid-20th century.
Edison created the nickel-iron battery as an inexpensive alternative to corrosive lead-acid batteries. Its basic design consists of two electrodes – a cathode made of nickel and an anode made of iron – bathed in an alkaline solution. "Importantly, both nickel and iron are abundant elements on Earth and relatively nontoxic," Dai noted.

Carbon has long been used to enhance electrical conductivity in electrodes. To improve the Edison battery's performance, the Stanford team used graphene – nanosized sheets of carbon that are only one-atom thick – and multi-walled carbon nanotubes, each consisting of about 10 concentric graphene sheets rolled together.
"In conventional electrodes, people randomly mix iron and nickel materials with conductive carbon," Wang explained. "Instead, we grew nanocrystals of iron oxide onto graphene, and nanocrystals of nickel hydroxide onto carbon nanotubes."
This technique produced strong chemical bonding between the metal particles and the carbon nanomaterials, which had a dramatic effect on performance. "Coupling the nickel and iron particles to the carbon substrate allows electrical charges to move quickly between the electrodes and the outside circuit," Dai said. "The result is an ultrafast version of the nickel-iron battery that's capable of charging and discharging in seconds."
Future applications
The 1-volt prototype battery developed in Dai's lab has just enough power to operate a flashlight. The researchers' goal is to make a bigger battery that could be used for the electrical grid or transportation.
Most electric cars, such as the Nissan Leaf and the Chevy Volt, run on lithium-ion batteries, which can store a lot of energy but typically take hours to charge. "Our battery probably won't be able to power an electric car by itself, because the energy density is not ideal," Wang said. "But it could assist lithium-ion batteries by giving them a real power boost for faster acceleration and regenerative braking."
The enhanced Edison battery might be especially useful in emergency situations, Dai added. "There may be applications for the military, for example, where you have to charge something very quickly," he said.
"It's definitely scalable," Wang said. "Nickel, iron and carbon are relatively inexpensive. And the electrolyte is just water with potassium hydroxide, which is also very cheap and safe. It won't blow up in a car."
The prototype battery has one key drawback – the ability to hold a charge over time. "It doesn't have the charge-discharge cycling stability that we would like," Dai said. "Right now it decays by about 20 percent over 800 cycles. That's about the same as a lithium-ion battery. But our battery is really fast, so we'd be using it more often. Ideally, we don't want it to decay at all.
"The use of strongly coupled nanomaterials represents a very exciting approach to making electrodes," he said. "It's different from traditional methods, where you simply mix materials together. I think Thomas Edison would be happy to see this progress."
Other co-authors of the study are postdoctoral scholars Yongye Liang and Yanguang Li, graduate student Ming Gong, and undergraduates Wesley Chang and Tyler Mefford of Stanford; Jigang Zhou, Jian Wang and Tom Regier of Canadian Light Source, Inc.; and Fei Wei of Tsinghua University.
This work was supported by Intel; a Stinehart/Reed Award from the Precourt Institute for Energy at Stanford; and a Stanford graduate fellowship.
This article was written by Mark Shwartz, the Precourt Institute for Energy at Stanford University.
Dai Lab http://dailab.stanford.edu/

http://www.eurekalert.org/pub_releases/2012-06/uoc--sch062512.php

Spinal cord, heal thyself

UCLA study shows omega-3 fatty acid and curry spice repair tissue damage, preserve walking in rats with spinal-cord injury

UCLA researchers discovered that a diet enriched with a popular omega-3 fatty acid and an ingredient of curry spice preserved walking ability in rats with spinal-cord injury. Published June 26 in the Journal of Neurosurgery: Spine, the findings suggest that these dietary supplements help repair nerve cells and maintain neurological function after degenerative damage to the neck.
"Normal aging often narrows the spinal canal, putting pressure on the spinal cord and injuring tissue," explained principal investigator Dr. Langston Holly, associate professor of neurosurgery at the David Geffen School of Medicine at UCLA. "While surgery can relieve the pressure and prevent further injury, it can't repair damage to the cells and nerve fibers. We wanted to explore whether dietary supplementation could help the spinal cord heal itself."
The UCLA team studied two groups of rats with a condition that simulated cervical myelopathy – a progressive disorder that often occurs in people with spine-weakening conditions like rheumatoid arthritis and osteoporosis. Cervical myelopathy can lead to disabling neurological symptoms, such as difficulty walking, neck and arm pain, hand numbness and weakness of the limbs. It's the most common cause of spine-related walking problems in people over 55.
The first group of animals was fed rat chow that replicated a Western diet high in saturated fats and sugar. The second group consumed a standard diet supplemented with docosahexaenoic acid, or DHA, and curcumin, a

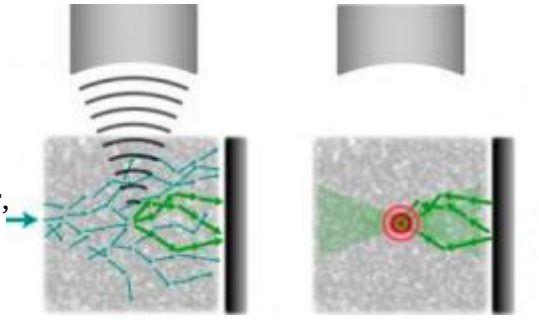
compound in turmeric, an Indian curry spice. A third set of rats received a standard rat diet and served as a control group.
Why these supplements? DHA is an omega-3 fatty acid shown to repair damage to cell membranes. Curcumin is a strong antioxidant that previous studies have linked to tissue repair. Both reduce inflammation.
"The brain and spinal cord work together, and years of research demonstrate that supplements like DHA and curcumin can positively influence the brain," said coauthor Fernando Gomez-Pinilla, professor of neurosurgery. "We suspected that what works in the brain may also work in the spinal cord. When we were unable to find good data to support our hypothesis, we decided to study it ourselves."
The researchers recorded a baseline of the rats walking and re-examined the animals' gait on a weekly basis. As early as three weeks, the rats eating the Western diet demonstrated measurable walking problems that worsened as the study progressed. Rats fed a diet enriched with DHA and curcumin walked significantly better than the first group even six weeks after the study's start.
Next, the scientists examined the rats' spinal cords to evaluate how diet affected their injury on a molecular level. The researchers measured levels of three markers respectively linked to cell-membrane damage, neural repair and cellular communication.
The rats that ate the Western diet showed higher levels of the marker linked to cell-membrane damage. In contrast, the DHA and curcumin appeared to offset the injury's effect in the second group, which displayed equivalent marker levels to the control group.
Levels of the markers linked to neural repair and cellular communication were significantly lower in the rats raised on the Western diet. Again, levels in the animals fed the supplemented diet appeared similar to those of the control group.
"DHA and curcumin appear to invoke several molecular mechanisms that preserved neurological function in the rats," said Gomez-Pinilla. "This is an exciting first step toward understanding the role that diet plays in protecting the body from degenerative disease."
"Our findings suggest that diet can help minimize disease-related changes and repair damage to the spinal cord," said Holly. "We next want to look at other mechanisms involved in the cascade of events leading up to chronic spinal-cord injury. Our goal is to identify which stages will respond best to medical intervention and identify effective steps for slowing the disease process."
Holly's and Gomez-Pinilla's coauthors included Dr. Donald Blaskiewicz, Aiguo Wu, Cameron Feng and Zhe Ying, all of UCLA. Their research was supported by grants from the National Institutes of Health (RO1 NS056413) and the Craig H. Neilsen Foundation.

http://www.sciencedaily.com/releases/2012/06/120626114322.htm

Seeing Inside Tissue for No-Cut Surgeries: Researchers Develop Technique to Focus Light Inside Biological Tissue

Imagine if doctors could perform surgery without ever having to cut through your skin.

ScienceDaily - Or if they could diagnose cancer by seeing tumors inside the body with a procedure that is as simple as an ultrasound. Thanks to a technique developed by engineers at the California Institute of Technology (Caltech), all of that may be possible in the not-so-distant future.
Ying Min Wang, a graduate student in electrical engineering, and Benjamin Judkewitz, a postdoctoral scholar, are the lead authors on the paper, which was published in the June 26 issue of the journal Nature Communications.
The new method enables researchers to focus light efficiently inside biological tissue. While the previous limit for how deep light could be focused was only about one millimeter, the Caltech team is now able to reach two and a half millimeters. And, in principle, their technique could focus light as much as a few inches into tissue. The technique is used much like a flashlight shining on the body's interior, and may eventually provide researchers and doctors with a host of possible biomedical applications, such as a less invasive way of diagnosing and treating diseases.



Left: Light enters the tissue sample and is scattered (blue arrows). From above, ultrasound is focused into a small area inside the tissue. The ultrasound shifts the frequency of any light that passed through that area ever so slightly, changing its color. The color-shifted light (green) is then recorded. Right: The recorded light is sent back to retrace its steps to the small region where the ultrasound was focused -- which means the light itself is focused on that area.
Caltech/Ying Min Wang and Benjamin Judkewitz

If you crank up the power of light, you might even be able to do away with a traditional scalpel. "It enables the possibilities of doing incision-less surgery," says Changhuei Yang, a professor of electrical engineering and bioengineering at Caltech and a senior author on the new study. "By generating a tight laser-focus spot deep in tissue, we can potentially use that as a laser scalpel that leaves the skin unharmed."

The new work builds on a previous technique that Yang and his colleagues developed to see through a layer of biological tissue, which is opaque because it scatters light. In the previous work, the researchers shined light through the tissue and then recorded the resulting scattered light on a holographic plate. The recording contained all the information about how the light beam scattered, zigzagging through the tissue. By playing the recording in reverse, the researchers were able to essentially send the light back through to the other side of the tissue, retracing its path to the original source. In this way, they could send light through a layer of tissue without the blurring effect of scattering.

But to make images of what is inside tissue -- to get a picture of cells or molecules that are embedded inside, say, a muscle -- the researchers would have to be able to focus a light beam into the tissue. "For biologists, it's most important to know what's happening inside the tissue," Wang says.

To focus light into tissue, the researchers expanded on the recent work of Lihong Wang's group at Washington University in St. Louis (WUSTL); they had developed a method to focus light using the high-frequency vibrations of ultrasound. The WUSTL group took advantage of two properties of ultrasound.

First, the high-frequency sound waves are not scattered by tissue, which is why it is great for taking images of fetuses in utero. Second, ultrasonic vibrations interact with light in such a way that they shift the light's frequency ever so slightly. As a result of this so-called acousto-optic effect, any light that has interacted with ultrasound changes into a slightly different color.

In both the WUSTL and Caltech experiments, the teams focused ultrasound waves into a small region inside a tissue sample. They then shined light into the sample, which, in turn, scattered the light. Because of the acousto-optic effect, any of the scattered light that passes through the region with the focused ultrasound will change to a slightly different color.

The researchers can pick out this color-shifted light and record it. By employing the same playback technique as in the earlier Caltech work, they then send the light back, having only the color-shifted bits retrace their path to the small region where the ultrasound was focused -- which means that the light itself is focused on that area, allowing an image to be created. The researchers can control where they want to focus the light simply by moving the ultrasound focus.

The WUSTL experiment was limited, however, because only a very small amount of light could be focused. The Caltech engineers' new method, on the other hand, allows them to fire a beam of light with as much power as they want -- which is essential for potential applications.

The team demonstrated how the new method could be used with fluorescence imaging -- a powerful technique used in a wide range of biological and biomedical research. The researchers embedded a patch of gel with a fluorescent pattern that spelled out "CIT" inside a tissue sample. Then, they scanned the sample with focused light beams.

The focused light hit and excited the fluorescent pattern, resulting in the glowing letters "CIT" emanating from inside the tissue. The team also demonstrated their technique by taking images of tumors tagged with fluorescent dyes.

"This demonstration that we can focus significant optical power deep within tissues opens up significant possibilities in optical imaging," Yang says. By tagging cells or molecules that are markers for disease with fluorescent dyes, doctors can use this technique to make diagnoses noninvasively, much as if they were doing an ultrasound procedure.

Doctors might also use this process to treat cancer with photodynamic therapy. In this procedure, a drug that contains light-sensitive, cancer-killing compounds is injected into a patient. Cancer cells absorb those compounds preferentially, so that the compounds kill the cells when light shines on them. Photodynamic therapy is now only used at tissue surfaces, because of the way light is easily scattered. The new technique should allow doctors to reach cancer cells deeper inside tissue.

The team has been able to more than double the current limit for how far light can be focused into tissue. With future improvements on the optoelectronic hardware used to record and play back light, the engineers say, they may be able to reach 10 centimeters (almost 4 inches) -- the depth limit of ultrasound -- within a few years. Still, the researchers say, their demonstration shows they have overcome the main conceptual hurdle for effectively focusing light deep inside tissue. "This is a big breakthrough, and we're excited about the potential,"

Judkewitz says. Adds Caltech's Wang, "It's a very new way to image into tissue, which could lead to a lot of promising applications."
The Nature Communications paper is titled "Deep-tissue focal fluorescence imaging with digitally time-reversed ultrasound-encoded light." In addition to Wang, Judkewitz, and Yang, the other author on the paper is Charles DiMarzio of Northeastern University. This work was supported by the National Institutes of Health, the Defense Advanced Research Projects Agency, the Sir Henry Wellcome Postdoctoral Fellowship from the Wellcome Trust, and the National Science Scholarship from the Agency for Science, Technology, and Research in Singapore.

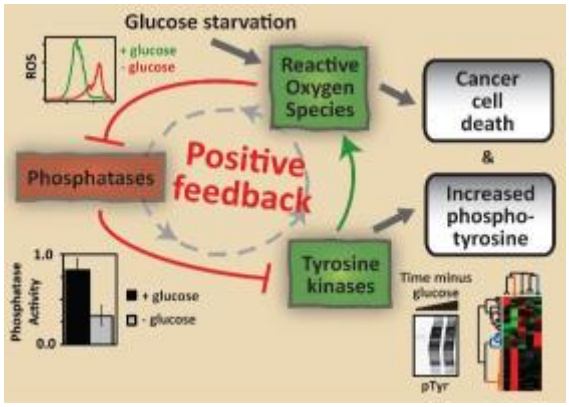
Ying Min Wang, Benjamin Judkewitz, Charles A. DiMarzio, Changhuei Yang. Deep-tissue focal fluorescence imaging with digitally time-reversed ultrasound-encoded light. Nature Communications, 2012; 3: 928 DOI: 10.1038/ncomms1925

http://www.sciencedaily.com/releases/2012/06/120626131854.htm

Glucose Deprivation Activates Feedback Loop That Kills Cancer Cells, Study Shows

Glucose starvation activates a metabolic and signaling amplification loop that leads to cancer cell death

ScienceDaily - Compared to normal cells, cancer cells have a prodigious appetite for glucose, the result of a shift in cell metabolism known as aerobic glycolysis or the "Warburg effect." Researchers focusing on this effect as a possible target for cancer therapies have examined how biochemical signals present in cancer cells regulate the altered metabolic state.
Now, in a unique study, a UCLA research team led by Thomas Graeber, a professor of molecular and medical pharmacology, has investigated the reverse aspect: how the metabolism of glucose affects the biochemical signals present in cancer cells. In research published June 26 in the journal Molecular Systems Biology, Graeber and his colleagues demonstrate that glucose starvation - that is, depriving cancer cells of glucose - activates a metabolic and signaling amplification loop that leads to cancer cell death as a result of the toxic accumulation of reactive oxygen species, the cell-damaging molecules and ions targeted by antioxidants like vitamin C.



In cancer cells, glucose starvation activates a metabolic and signaling feedback loop leading to cell death. Glucose starvation induces generation of reactive oxygen species generation (ROS), thereby inhibiting phosphatases and activating tyrosine kinases, which in turn generate additional ROS. This glucose starvation-induced positive feedback loop amplifies ROS levels until cells undergo ROS-mediated cell death. **(Credit: CNSI)**

The research, which involved UCLA scientists from the Crump Institute for Molecular Imaging, the Institute for Molecular Medicine, the California NanoSystems Institute, the Jonsson Comprehensive Cancer Center, the Eli and Edythe Broad Center of Regenerative Medicine and Stem Cell Research, and the Department of Pathology and Laboratory Medicine, demonstrates the power of systems biology in uncovering relationships between metabolism and signaling at the network level.
"Most strikingly, our discovery that glucose withdrawal causes both cell death and increased tyrosine phosphorylation is intriguing because increased tyrosine kinase signaling is normally associated with cell growth," said Nicholas A. Graham, a senior postdoctoral scholar in Graeber's lab who helped design the project.
To explain the seemingly contradictory result that glucose deprivation reduced viability and at the same time increased signaling, the authors used an unbiased systems-biology approach that included phospho-tyrosine mass spectrometry and other biochemical profiling techniques.
Assessing the "crosstalk" between metabolism and signaling, they discovered that the glucose deprivation activates a positive feedback loop whereby the withdrawal of glucose induces increased levels of reactive oxygen species, which in turn inhibit negative regulators of tyrosine signaling.
The resulting supra-physiological levels of tyrosine phosphorylation then generate additional reactive oxygen species.
"Because cancer cells live on the edge of what is metabolically feasible, this amplifying cycle of oxidative stress ultimately overwhelms and kills the cancer cell," Graeber explained. "These findings illustrate the delicate balance that exists between metabolism and signaling in the maintenance of cancer cell homeostasis."
In addition, the authors showed the possibility of exploiting this positive feedback loop for therapeutic intervention.

Combining short-term glucose deprivation with an inhibitor of tyrosine phosphatases, they demonstrated synergistic cell death in a cancer cell line.
"Understanding the links between metabolism and signaling will empower new therapeutic approaches toward inducing this metabolic catastrophe," Graham said. "This study provides a framework for rational design of combinatorial therapeutics targeting both metabolism and signaling in cancer."
The findings by Graeber and his colleagues add to the emerging concept of systems integration between oncogenic signaling networks and the metabolism of malignant tumors. The work lays a foundation for future studies delineating how signaling and metabolism are linked, with the ultimate goal of refining therapeutic strategies targeting cancer metabolism.
The research team also included collaborators from the department of neurology and the human oncology and pathogenesis program at Memorial Sloan-Kettering Cancer Center and the department of pharmacology at Weill-Cornell Medical College.
The research was funded by the National Institutes of Health, UCLA's Jonsson Comprehensive Cancer Center, and the California Institute of Technology-University of California, Los Angeles, Joint Center for Translational Medicine.
Nicholas A Graham, Martik Tahmasian, Bitika Kohli, Evangelia Komisopoulou, Maggie Zhu, Igor Vivanco, Michael A Teitell, Hong Wu, Antoni Ribas, Roger S Lo, Ingo K Mellinghoff, Paul S Mischel, Thomas G Graeber. Glucose deprivation activates a metabolic and signaling amplification loop leading to cell death. Molecular Systems Biology, 2012; 8 DOI: 10.1038/msb.2012.20

http://phys.org/news/2012-06-evidence-oceanic-green-rust-future.html

Evidence of oceanic 'green rust' offers hope for the future

A rare kind of mineral which scientists hope could be used to remove toxic metals and radioactive species from the environment played a similar, crucial role early in Earth's history.

Research carried out by an international team of leading biogeochemists suggests for the first time that 'green rust' was likely widespread in ancient oceans and may have played a vital role in the creation of our early atmosphere.
Led by Newcastle University, UK, the study shows that during the Precambrian period, green rust 'scavenged' heavy metals such as nickel out of the water. Nickel availability is linked to the production of methane by anaerobic organisms, which is a major sink for oxygen produced during photosynthesis, and thus green rust played a crucial role in the oxygenation of the Earth's atmosphere.
Only discovered in the last decade, green rust is a highly reactive iron mineral which experts hope could be used to clean up metal pollution and even radioactive waste.
Newcastle University's Professor Simon Poulton said this latest discovery – published this month in the academic journal Geology – proved the effectiveness of green rust as an environmental cleaner.
"Because it is so reactive, green rust has hardly ever been found before in nature and never in a water system like this," explains Professor Poulton, who led the research team involving experts from the Universities of Newcastle, Nancy, Southern Denmark, Leeds, Brussels and Kansas, and the Canadian Light Source and Indonesian Institute of Sciences.
"The discovery of green rust in Lake Matano, Indonesia, where we carried out our experiments shows for the first time what a key role it played in our ancient oceans – scavenging dissolved nickel, a key micronutrient for methanogenesis."
Dr Sean Crowe of the University of Southern Denmark explains: "We still know relatively little about green rust but our research shows that it is likely to be much more prevalent in the environment than has previously been recognised and the role it plays in cycling elements such as nickel and other metals is significant.
"Understanding the important role it played in our past and its effectiveness at removing metals from the environment will help us to understand how we might be able to use it to clean up polluted land and water in the future."
The high reactivity of green rust is the reason it could be so much help in cleaning up polluted sites. The rust reduces elements like chromium, uranium and selenium, significantly reducing their solubility and mobility in the environment, and in some cases absorbing them into the rust's molecular structure.
Professor Poulton adds: "Green rust has received a lot of attention recently due to its possible role as a pollutant mediator, but it is particularly exciting to think that this may have been a natural process throughout huge periods of ancient Earth history."
More information: "Green rust formation controls nutrient availability in a ferruginous water column." Asfaw Zegeye, Steve Bonneville, Liane Benning, Arne Sturm, David Fowle, CarriAyne Jones, Donald Canfield, Christian Ruby, Lachlan MacLean, Sulung Nomosatryo, Sean Crowe and Simon Poulton. Geology, July 2012.

http://www.eurekalert.org/pub_releases/2012-06/uobc-pdg062612.php

Parkinson's disease gene identified with help of Mennonite family: UBC-VCH research International team has identified the latest gene associated with typical late-onset Lewy body Parkinson's disease

An international team led by human genetic researchers at the University of British Columbia and Vancouver Coastal Health has identified the latest gene associated with typical late-onset Lewy body Parkinson's disease (PD), with the help of a Canadian Mennonite family of Dutch-German-Russian ancestry. Twelve of the 57 members of the Saskatchewan family who participated in the study had previously been diagnosed with PD.

UBC Medical Genetics Prof. Matthew Farrer, who led the research, notes that unequivocal confirmation of the gene's linkage with PD required DNA samples from thousands of patients with PD and healthy individuals. He refers to the new discovery as the "missing link," as it helps to unify past genetic discoveries in PD.

"A breakthrough like this would not be possible without the involvement and support of the Saskatchewan Mennonite family who gave up considerable time, contributed clinical information, donated blood samples, participated in PET imaging studies and, on more than one occasion following the death of an individual, donated brain samples," says Farrer, Canada Excellence Research Chair in Neurogenetics and Translational Neuroscience and the Dr. Donald Rix BC Leadership Chair in Genetic Medicine.

"We are forever indebted to their generosity and contribution to better understanding – and ultimately finding a cure – for this debilitating disease." The mutation, in a gene called DNAJC13, was discovered using massively parallel DNA sequencing. Conclusive evidence came from the identification of the gene mutation in several other families across many Canadian provinces, including British Columbia.

"This discovery is not only significant for researchers, but also for those families carrying this genetic mutation and afflicted with this disease in that it offers hope that something good might yet result from their suffering," says Bruce Guenther, President of the Mennonite Brethren Biblical Seminary Canada, a community leader and spokesperson for the family that participated in the study.

"The family involved is very grateful for the research team's respectful, collaborative and sensitive approach, and we hope that this enables the discovery of more effective treatments, and hopefully eventually a cure."

The discovery resulted from a longstanding collaboration with neurology colleagues, Ali and Alex Rajput at the University of Saskatchewan and Silke Cresswell and Jon Stoessl at UBC. The research team also includes scientists from McGill University, the Mayo Clinic in Florida, and St. Olav's Hospital in Norway.

Farrer shared the discovery last week with the medical community as part of his keynote speech in Dublin today at the 16th International Congress of Parkinson's Disease and Movement Disorders (Plenary Session V: Is it time to change how we define Parkinson's disease?) Details of the study was presented at the conference and is being submitted for publication.

"The identification of DNAJC13 will certainly be of interest to people around the world who trace their family history to the nineteenth-century Mennonite colonies in Russia, and who have family members suffering from Parkinson's disease," Guenther adds.

BACKGROUND | New Parkinson's gene identified

Parkinson's disease (PD) is the second most common chronic neurodegenerative disorder after Alzheimer's. According to the U.S. National Institutes of Health, Parkinson's disease affects more than one million people in North America and more than four million people worldwide. The late-onset form is the most common type of PD. The risk of developing late-onset PD increases with age but most patients begin showing symptoms in their late 60s and early 70s.

Once considered a sporadic disease, latest studies have shown genetic components of PD that provide the foundation for neuroscience research and potential treatment targets. Approximately 15 per cent of people with PD have a family history of the disorder. There is a higher rate of PD in families where two or more members are affected, possibly due to a shared genetic susceptibility among blood relatives.

UBC Prof. Matthew Farrer is an internationally renowned expert in the genetic aspects of PD and related dementia. He and his team have helped identified many genes involved in PD by analyzing DNA from families throughout the world.

Farrer and his research team are based at the Department of Medical Genetics at UBC's Faculty of Medicine, and at the Brain Research Centre at UBC and Vancouver Coastal Health Research Institute. He has had an adjunct Faculty in Medicine (Neurology) at the University of Saskatchewan since 2003.

For more information on the genetic aspects of PD, visit http://www.can.ubc.ca/parkinson-disease/genetics/.
Answers to frequently asked questions about genetic testing are available at http://www.can.ubc.ca/parkinson-disease/genetics/genetic-testing-faq/.

http://phys.org/news/2012-06-planet-probe-harvard-scientist-view.html

Planet probe: Harvard scientist offers new view of Earth's makeup

A Harvard scientist is challenging long-held scientific views about the geochemical makeup of the Earth's mantle, and whether the massive collision that formed the moon affected the chemical composition of the planet close to its core.

In a paper published this month in Nature, Associate Professor of Geochemistry Sujoy Mukhopadhyay presents evidence that the Earth's deep mantle incorporated gas found in the solar nebula in the first few millions of years of the solar system's formation. The upper mantle — the layer closest to the crust — was formed later, from material found farther away from the sun. As a result of that separate formation, the two mantle layers — the upper and deep mantle — have fundamentally different chemical makeups.

"The fact that we see gas from the solar nebula in the deep mantle suggests that it was captured by a growing Earth and dissolved into a magma ocean when the planet was largely molten," Mukhopadhyay said. "Our evidence suggests that chemical layering in the mantle was never subsequently destroyed, an idea which runs counter to views of mixing in the mantle over the intervening 4.45 billion years."

Though researchers have long understood that the mantle consists of two separate layers, studying the geochemical differences between them has remained challenging, because rocks that move from the deep mantle to the surface are contaminated as they move through the upper mantle and by gases in the atmosphere. To get around that problem, Mukhopadhyay turned to an unusual technique.

Just as climate scientists study the ancient atmosphere by examining air bubbles trapped in ice, Mukhopadhyay studied bubbles of gas trapped in volcanic rock that originated from the deep mantle. Importantly, he said, the rock samples were collected from a site in Iceland where the rock erupted beneath a glacier, which helped to trap more gas in the rocks and protected the samples from air contamination.

Mukhopadhyay crushed the samples in a vacuum chamber to release the gas bubbles trapped inside the rock, then used the latest generation of mass spectrometer to analyze trace amount of gases released.

Isotopes of neon found in the rock suggest that the deep mantle consists of material collected from the solar nebula in the region where the Earth grew, while gases in the upper mantle, by contrast, come from meteorites that formed farther away. Since the inner part of the solar nebula was dry, the initial stages of Earth's formation were drier than the later stages.

Mukhopadhyay's research also challenges earlier notions about the massive impact that formed the moon. For decades, researchers have maintained that the moon was likely the result of a collision between the young Earth and a Mars-size protoplanet. The impact also produced a "mixing" effect that eliminated chemistry differences between mantle layers, scientists believed. Mukhopadhyay's findings, however, turned up trace amounts of a xenon isotope produced by the radioactive decay of an element found only in the first 100 million years of the solar system's life span. That such a chemical signature was detected, he said, shows that the deep mantle's chemical makeup survived over billions of years.

"Since the chemical differences that the Earth inherited as it grew are still preserved in the present day mantle, the moon-forming impact did not mix the earth well, and the chemical signature of the ancient deep mantle survived the giant impact," Mukhopadhyay said. "While this does not invalidate the impact hypothesis, it suggests some aspects of the giant impact hypothesis will have to be re-evaluated." Ultimately, Mukhopadhyay said, his research offers a new view on geologic processes, without which, life would likely not exist.

"Plate tectonics is what makes the Earth unique and different from the inhospitable worlds of Mars and Venus," Mukhopadhyay said. "Many details about plate tectonic processes, however, remain obscure. This is where the importance of the new measurements from Iceland comes in. This research tells us about mixing rates in the mantle and the exchange of heat, which determines how rapidly the Earth is cooling. It also sheds light on how much mass is exchanged between the shallow and deep mantle and the rates at which the mantle has been losing gases since the Earth formed. In essence, we are learning more about how plate tectonics actually operated through deep time."

http://www.eurekalert.org/pub_releases/2012-06/icl-hs062712.php

'Broken heart syndrome' protects the heart from adrenaline overload

A condition that temporarily causes heart failure in people who experience severe stress might actually protect the heart from very high levels of adrenaline, according to a new study published in the journal Circulation.

The research provides the first physiological explanation for Takotsubo cardiomyopathy, also called "broken heart syndrome" because it affects people who suffer severe emotional stress after bereavement, and suggests guidance for treatment.

Around 1-2% of people who are initially suspected of having a heart attack are finally discovered to have this increasingly recognised syndrome.
The Imperial College London study, which simulated the condition in an animal model, suggests that the body changes its response to adrenaline by switching from its usual role in stimulating the heart to reducing its pumping power. Although this results in acute heart failure, most patients make a full recovery within days or weeks.
The researchers propose that the switch in the heart's response to adrenaline might have evolved to protect the heart from being overstimulated by the particularly high doses of adrenaline that the body releases during stress.
Patients with Takotsubo cardiomyopathy, most often older women, experience symptoms that resemble a heart attack, but heart tests reveal no blockage in the coronary arteries; instead the heart has a balloon-like appearance caused by the bottom of the heart not contracting properly. The same condition is sometimes seen in people who are injected with adrenaline to treat severe allergic reactions.
In this new research, the authors simulated the condition by injecting high doses of adrenaline in anaesthetised rats. In these rats, as in Takotsubo patients, heart muscle contraction was suppressed towards the bottom of the heart. The researchers found that these rats were protected from an otherwise fatal overstimulation of the heart, indicating that adrenaline acts through a different pathway from usual, and that this switch protects the heart from toxic levels of adrenaline. The study also examined drugs that might be useful for treating Takotsubo cardiomyopathy. Some beta blockers, used to treat high blood pressure, angina and heart failure, reproduced or enhanced the features of Takotsubo, giving new insights into the protective effects of these drugs.
Levosimendan, a different type of drug given in heart failure to stimulate the heart without going through the adrenaline receptor pathways, had a beneficial effect.
"Adrenaline's stimulatory effect on the heart is important for helping us get more oxygen around the body in stressful situations, but it can be damaging if it goes on for too long," said Professor Sian Harding, from the National Heart and Lung Institute (NHLI) at Imperial College London, who led the study. "In patients with Takotsubo cardiomyopathy, adrenaline works in a different way and shuts down the heart instead. This seems to protect the heart from being overstimulated."
Study co-author Dr Alexander Lyon, also from the NHLI at Imperial, and consultant cardiologist at Royal Brompton Hospital, set up one of the first specialist services in the UK to look after people who have experienced Takotsubo cardiomyopathy. "Currently it is not fully known how to treat these patients," he said. "Insights from this work show that the illness may be protecting them from more serious harm. We've identified a drug treatment that might be helpful, but the most important thing is to recognise the condition, and not to make it worse by giving patients with Takotsubo cardiomyopathy more adrenaline or adrenaline-like medications."
"At the Royal Brompton Hospital and Imperial College London we are leading a European initiative to bring together experts to understand this recently recognised cardiac syndrome, and we hope the findings from this work will lead to new treatment strategies for these patients during the acute phase of their illness, and to prevent recurrence". The study was funded by the British Heart Foundation (BHF), the Wellcome Trust, the Biotechnology and Biological Sciences Research Council (BBSRC) and the Academy of Medical Sciences. Dr Shannon Amoils, Research Advisor at the BHF, said:
"This is a fascinating study which presents a possible explanation for the signs of Takotsubo cardiomyopathy, a rare condition that's usually preceded by intense emotional or physical stress. Patients usually have symptoms that resemble those of a heart attack but nearly all fully recover after a short time.
"The study also provides new insights into how the heart may protect itself from stress, which opens up exciting avenues of exploration for research. We must remember though that this is a study in rats, and the findings need to be confirmed in people before we can be sure of their relevance to patients."
1. Reference: H Paur et al. 'High levels of circulating epinephrine trigger apical cardiodepression in a β2-1 adrenoceptor/Gi-dependent manner: a new model of Takotsubo Cardiomyopathy' Circulation, published online 25 June 2012.

http://phys.org/news/2012-06-gas-cloud-collide-galaxy-black.html

Gas cloud will collide with our galaxy's black hole in 2013

A giant gas cloud is on a collision course with the black hole in the center of our galaxy, and will provide a unique opportunity to observe how a super massive black hole sucks in material

Scientists have determined a giant gas cloud is on a collision course with the black hole in the center of our galaxy, and the two will be close enough by mid-2013 to provide a unique opportunity to observe how a super massive black hole sucks in material, in real time. This will give astronomers more information on how matter behaves near a black hole.

"The next few years will be really fantastic and exciting because we are probing new territory," said Reinhard Genzel, leading a team from the ESO in observations with the Very Large Telescope. "Here this cloud comes in gets disrupted and now it will begin to interact with the hot gas right around the black hole. We have never seen this before." By June of 2012, the gas cloud is expected to be just 36 light-hours (equivalent to 40,000,000,000 km) away from our galaxy's black hole, which is extremely close in astronomical terms.

Astronomers have determined the speed of the gas cloud has increased, doubling over the past seven years, and is now reaching more than 8 million km per hour. The cloud is estimated to be three times the mass of Earth and the density of the cloud is much higher than that of the hot gas surrounding black hole. But the black hole has a tremendous gravitational force, and so the gas cloud will fall into the direction of the black hole, be elongated and stretched and look like spaghetti, said Stefan Gillessen, astrophysicist at the Max Planck Institute for Extraterrestrial Physics in Munich, Germany, who has been observing our galaxy's black hole, known as Sagittarius A* (or Sgr A*), for 20 years. "So far there were only two stars that came that close to Sagittarius A*," Gillessen said. "They passed unharmed, but this time will be different: the gas cloud will be completely ripped apart by the tidal forces of the black hole."

No one really knows how the collision will unfold, but the cloud's edges have already started to shred and it is expected to break up completely over the coming months. As the time of actual collision approaches, the cloud is expected to get much hotter and will probably start to emit X-rays as a result of the interaction with the black hole. Although direct observations of black holes are impossible, as they do not emit light or matter, astronomers can identify a black hole indirectly due to the gravitational forces observed in their vicinity.

A black hole is what remains after a super massive star dies. When the "fuel" of a star runs low, it will first swell and then collapse to a dense core. If this remnant core has more than three times the mass of our Sun, it will transform to a black hole. So-called super massive black holes are the largest type of black holes, as their mass equals hundreds of thousands to a billion times the mass of our Sun.

Black holes are thought to be at the center of all galaxies, but their origin is not fully understood and astrophysicists can only speculate as to what happens inside them. And so this upcoming collision just 27,000 light years away will likely provide new insights on the behavior of black holes. ***More information***

http://www.eurekalert.org/pub_releases/2012-06/chb-ilo_1062212.php

Injecting life-saving oxygen into a vein

Oxygen microparticles could deliver oxygen when breathing is impaired

Boston, Mass. - Patients unable to breathe because of acute lung failure or an obstructed airway need another way to get oxygen to their blood - and fast - to avoid cardiac arrest and brain injury. A team led by researchers at Boston Children's Hospital has designed tiny, gas-filled microparticles that can be injected directly into the bloodstream to quickly oxygenate the blood.

The microparticles consist of a single layer of lipids (fatty molecules) that surround a tiny pocket of oxygen gas, and are delivered in a liquid solution. In a cover article in the June 27 issue of Science Translational Medicine, John Kheir, MD, of the Department of Cardiology at Boston Children's Hospital, and colleagues report that an infusion of these microparticles into animals with low blood oxygen levels restored blood oxygen saturation to near-normal levels, within seconds. When the trachea was completely blocked - a more dangerous "real world" scenario - the infusion kept the animals alive for 15 minutes without a single breath, and reduced the incidence of cardiac arrest and organ injury.

The microparticle solutions are portable and could stabilize patients in emergency situations, buying time for paramedics, emergency clinicians or intensive care clinicians to more safely place a breathing tube or perform other life-saving therapies, says Kheir.

"This is a short-term oxygen substitute - a way to safely inject oxygen gas to support patients during a critical few minutes," he says. "Eventually, this could be stored in syringes on every code cart in a hospital, ambulance or transport helicopter to help stabilize patients who are having difficulty breathing."

The microparticles would likely only be administered for a short time, between 15 and 30 minutes, because they are carried in fluid that would overload the blood if used for longer periods, Kheir says.

Kheir also notes that the particles are different from blood substitutes, which carry oxygen but are not useful when the lungs are unable to oxygenate them. Instead, the microparticles are designed for situations in which the lungs are completely incapacitated.

Kheir began investigating the idea of injectable oxygen in 2006, after caring for a little girl who sustained a severe brain injury resulting from a severe pneumonia that caused bleeding into her lungs and severely low oxygen levels. Despite the team's best efforts, she died before they could place her on a heart-lung machine. Frustrated by this, Kheir formed a team to search for another way to deliver oxygen.

"Some of the most convincing experiments were the early ones," he says. "We drew each other's blood, mixed it in a test tube with the microparticles, and watched blue blood turn immediately red, right before our eyes."
Over the years, Kheir and his team have tested various concentrations and sizes of the microparticles to optimize their effectiveness and to make them safe for injection. "The effort was truly multidisciplinary," says Kheir. "It took chemical engineers, particle scientists and medical doctors to get the mix just right."
In the studies reported in the paper, they used a device called a sonicator, which uses high-intensity sound waves to mix the oxygen and lipids together. The process traps oxygen gas inside particles averaging 2 to 4 micrometers in size (not visible without a microscope). The resulting solution, with oxygen gas making up 70 percent of the volume, mixed efficiently with human blood.
"One of the keys to the success of the project was the ability to administer a concentrated amount of oxygen gas in a small amount of liquid," Kheir says. "The suspension carries three to four times the oxygen content of our own red blood cells."
Intravenous administration of oxygen gas was tried in the early 1900s, but these attempts failed to oxygenate the blood and often caused dangerous gas embolisms. "We have engineered around this problem by packaging the gas into small, deformable particles," Kheir explains. "They dramatically increase the surface area for gas exchange and are able to squeeze through capillaries where free gas would get stuck."
The study was funded by three awards from the Technology Development Fund at Boston Children's Hospital Boston and a U.S. Department of Defense Basic Research Award to Kheir.

http://www.eurekalert.org/pub_releases/2012-06/uoca-aha062212.php

Ancient human ancestors had unique diet, according to study involving CU Boulder

Australopithecus sediba targeted trees, bushes and fruits

When it came to eating, an upright, 2-million-year-old African hominid had a diet unlike virtually all other known human ancestors, says a study led by the Max Planck Institute of Evolutionary Anthropology in Leipzig, Germany and involving the University of Colorado Boulder.
The study indicated that Australopithecus sediba -- a short, gangly hominid that lived in South Africa -- ate harder foods than other early hominids, targeting trees, bushes and fruits. In contrast, virtually all other ancient human ancestors tested from Africa -- including Paranthropus boisei, dubbed "Nutcracker Man" because of its massive jaws and teeth -- focused more on grasses and sedges, said CU-Boulder doctoral student Paul Sandberg, a co-author on the new study. The A. sediba diet was analyzed using a technique that involved zapping fossilized teeth with a laser, said Sandberg. The laser frees telltale carbon from the enamel of teeth, allowing scientists to pinpoint the types of plants that were consumed and the environments in which the hominids lived. The carbon signals from the teeth are split into two groups: C3 plants like trees, shrubs and bushes preferred by A. sediba, and C4 plants like grasses and sedges consumed by many other early hominids.

The teeth from the two A. sediba individuals analyzed in the study had carbon isotope values outside the range of all 81 previously tested hominids. "The lack of any C4 evidence, and the evidence for the consumption of hard objects, are what make the inferred diet of these individuals compelling," said Sandberg.
"It is an important finding because diet is one of the fundamental aspects of an animal, one that drives its behavior and ecological niche. As environments change over time because of shifting climates, animals are generally forced to either move or to adapt to their new surroundings," said Sandberg of CU-Boulder's anthropology department.

A high-tech dental analysis of a 2-million-year-old hominid from South Africa involving CU-Boulder researchers indicates it had a unique diet that included trees, bushes and fruits. **Paul Sandberg, University of Colorado**

The researchers concluded from their scientific tests that bark and other fracture-resistant foods were at least a seasonal part of the A. sediba diet. While bark and woody tissues had not been previously documented as a dietary component of any other ancient African hominids, such foods are consumed by many contemporary primates and contain both protein and soluble sugars. The diet of A. sediba may have been similar to that of today's African savanna chimpanzees, Sandberg said.
One unique aspect of the project was the analysis of microscopic, fossilized particles of plant tissue known as phytoliths trapped in ancient tooth tarter, a hardened form of dental plaque, said corresponding study author Amanda Henry of the Max Planck Institute for Evolutionary Anthropology.

"The fact that these phytoliths are preserved in the teeth of 2-million-year-old hominids is remarkable and speaks to the amazing preservation at the site," said Sandberg. "The phytolith data suggest the A. sediba individuals were avoiding the grasses growing in open grasslands that were abundant in the region at the time." A third, independent line of study -- analyzing microscopic pits and scratches on A. sediba teeth, which reveal what they were eating at the time just prior to death -- also confirmed that at least one of the hominids was eating harder foods, said Sandberg.

A paper on the subject was published online by Nature on June 27. Other paper authors included Professor Matt Sponheimer of CU-Boulder, Peter Ungar of the University of Arkansas, Benjamin Passey of Johns Hopkins University, Lloyd Rossouw of the Bloemfontein National Museum in Bloemfontein, South Africa, Lee Berger and Marion Bamford of the University of Witwatersrand in Johannesburg, South Africa and Darryl de Ruiter of Texas A&M University.

A. sediba is particularly intriguing to anthropologists. The first two individuals discovered -- a juvenile male and an adult female from the Malapa Cave site roughly 30 miles north of Johannesburg in 2008 --apparently had fallen into a hidden pit in the cave and died. With an upright posture and long arms, the curious creature appears to have characteristics of both primitive and modern hominids, including a human-like ankle, short fingers and a long thumb for possible precision gripping and a relatively complex brain compared to earlier hominids, according to researchers.

The jury is still out on exactly where these hominids land on the family tree. A. sediba may have been a descendant of A. africanus, which was spawned by A. afarensis, a hominid represented by "Lucy" who lived about 3 million years ago and is considered by many to be the matriarch of the human family.

The A. sediba remains at Malapa were dated to 2 million years by scientists, a precise number obtained by measuring the decay of isotopes of uranium into lead that occurred in a type of mineral deposit known as flowstone that capped the fossil-bearing layer.

Paleontological evidence, including pollen and phytoliths, shows that the region around Malapa likely was a mix of abundant grassland and woody vegetation about 2 million years ago, said Sandberg. The team's carbon isotope research on the ancient teeth of rodents and hooved mammals that inhabited the region at the time indicated they had a strong affinity for C4 grasses and sedges.

"What fascinates me is that these individuals are oddballs," said CU-Boulder's Sponheimer. "I had pretty much convinced myself that after 4 million years ago most of our hominid kin had diets that were different from living apes, but now I am not so sure. And while our sample is too small to be conclusive, the rate at which Malapa is spewing hominid fossils makes me reasonably certain we won't have to wait another 2 million years to augment our data set. "

The study was funded in part by the National Science Foundation, the Smithsonian Institution, the Malapa Project at the Institute for Human Evolution at the University of Witwatersrand and the Max Planck Society.

http://www.sciencedaily.com/releases/2012/06/120627091617.htm

Post-Anesthesia Dementia, Like Alzheimer's, Looks Micro-'Tubular'

Mentally, some patients "just aren't the same" for months or longer after surgery

ScienceDaily - Modern anesthesia is extremely safe. But as risks to heart, lungs and other organs have waned, another problem has emerged in the elderly: post-operative cognitive dysfunction. Mentally, some patients "just aren't the same" for months or longer after surgery. Other factors play a role, but a small number of patients deteriorate mentally due to anesthesia per se. Those with Alzheimer's disease suffer exacerbations, and those without the diagnosis may have it unmasked by anesthesia, suggesting some relationship.

Alzheimer's disease has two types of brain lesions. Beta-amyloid deposits accumulate outside neurons but don't cause cognitive problems. Neurofibrillary tangles inside neurons, composed of hyper-phosphorylated 'tau', a protein normally attached to microtubules, do correlate with dementia. These same tau tangles are found in post-anesthesia dementia.

Microtubules (MTs) polymerize from 'tubulin' proteins to grow, shape and regulate neurons. Synaptic components are transported by motor proteins which move like railroad trains along MT tracks. In branching dendrites, motors change MTs repeatedly to reach their destination. Tau is a traffic signal, telling motors where to get on and off, the route encoded in MT binding sites for tau. That MTs process information stems from Charles Sherrington in the 1950s, with recent controversial suggestions of MT computing, and even quantum computing mediating consciousness and memory. But whether MTs play a primary, or mere supportive role, their stability and function are essential to cognition and consciousness.

Excessive phosphorylation had been thought the culprit in detaching tau and causing tangles. But destabilized MTs now appear to be the primary problem in both Alzheimer's and post-anesthesia dementia, releasing tau

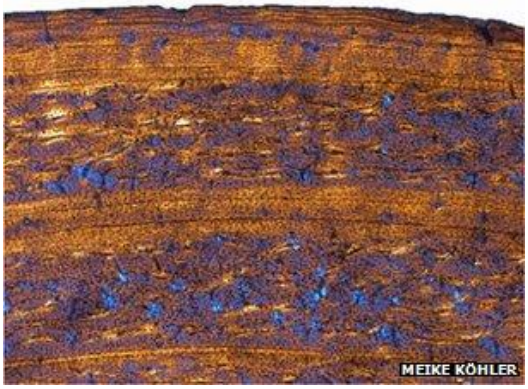
which then becomes hyperphosphorylated. Anesthetics are known to bind to tubulin, in some cases for days after exposure, and in high doses to cause MT disassembly.
Now, in a study in PLoS ONE, a team from Canada, Portugal and the USA report molecular modeling showing 32 anesthetic binding sites per tubulin, with at least 1 percent (10 million) of the billion tubulins per brain neuron binding an anesthetic molecule at clinical concentration (1 'MAC'). Two particular anesthetic binding regions may destabilize MTs, one inactivating tubulin C-termini tails (which otherwise knit together neighboring tubulins). The other weakens side-to-side tubulin couplings, the critical link in MT lattices, but only at high anesthetic concentrations, or perhaps with other MT destabilizing factors (low temperature, low zinc, high calcium, acidosis).
Travis Craddock PhD, lead author on the study said: "The good news is that therapies aimed at microtubule stabilization may help in both Alzheimer's and post-anesthetic dementias. Clinical trials are underway, or planned, for microtubule stabilizers Epothilone D, NAPVSIPQ, and the zinc ionophore PBT2, as well as brain ultrasound, shown in vitro to excite MT resonances and promote polymerization. However it's done, 'tightening the tubules' may best treat dementia."

http://www.bbc.co.uk/news/science-environment-18602965

Dinosaur cold-blood theory in doubt

One of the strongest lines of evidence that dinosaurs were cold-blooded, like modern reptiles, has been knocked down.

By Jason Palmer Science and technology reporter, BBC News



Prior studies of dinosaur bones uncovered what are known as "lines of arrested growth". The creatures were presumed to be cold-blooded because modern cold-blooded animals show these same lines. But scientists reporting in Nature have studied the bones of 41 modern mammal species from around the world, finding every one had these lines as well.
The idea that dinosaurs are cold-blooded, or ectothermic, goes back to the 19th Century. But a number of discoveries 1960s have been challenging that notion. Because soft tissues such as organs and skin are not preserved (with a few notable exceptions), much of what is known about dinosaurs must be inferred from their bones, and comparisons made with modern animals that can be studied in greater detail.

Lagging behind

Lines of arrested growth, or Lags, occur because organisms tend to suspend their growth and rally their resources during seasonal periods of environmental stress such as cold or dry conditions. This forms a boundary from one season to the next as growth resumes when conditions are more favourable. They are familiar in creatures such as molluscs, whose slow annual accumulations can be seen as ridges in their shells.
Lags have also been found in the bones of reptiles and amphibians and have until now been assumed to be limited to ectotherms - cold-blooded animals - that are more subject to the whims of harsh environments.
Meike Koehler of the Catalan Institute of Palaeontology in Barcelona and her colleagues were therefore surprised by what they found.
"Originally this was not a paper that we aimed to do," Dr Koehler told BBC News. "We were very curious to know how environmental conditions and changes affect bone growth in fossil and extant mammals, to get a good idea about... how they may have coped with these changes in the past."
As the team studied the thigh bones of animals from all over the world - ranging from the Svalbard reindeer in the Arctic to muntjac deer species from South Asia - Lags showed up in every one.
"These lines of arrested growth have been used a lot in dinosaurs, but nobody has ever had a really deep look at mammals," Dr Koehler explained.
David Weishampel, a palaeontologist at the Center for Functional Anatomy and Evolution at Johns Hopkins University School of Medicine in Maryland called the new work "a wonderful paper" and said it was a welcome addition to the debate. "I think most (palaeontologists) regard dinosaurs as being [warm-blooded] but there's a lot of waffling in the data that appeared before that wasn't conclusive," he told BBC News. "It's about time we have a connection between the modern bone histology and fossil bone histology, through a very nice ecological and metabolic comparison."
While Prof Weishampel considers it a closed case, Dr Koehler herself is more reserved about the result.
"I don't think that this debate is really settled," she said. "But this is the first time that you can say that Lags do not say anything about warm- or cold-bloodedness." She and her team will go on and put the Lags to use in

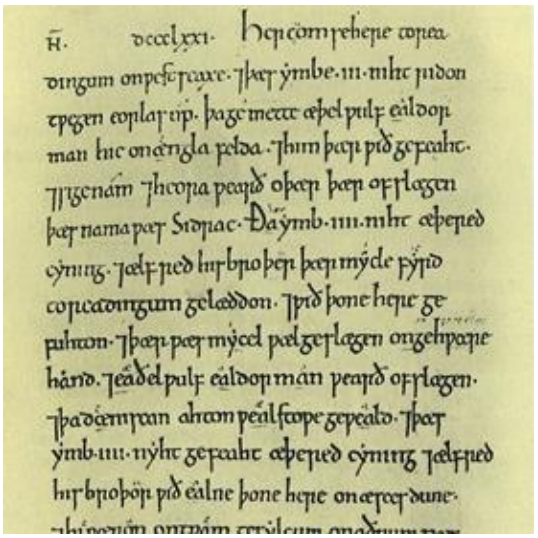
studies of modern animals instead. "It's like dendrochronology - the rings in trees. You can do skeletal chronology in bones and infer things like longevity, age at maturity, juvenile states - traits which are very, very important to get an idea about the health of a population and whether it is vulnerable.
"It is very good to know now that mammals do show these Lags and we can use them in the same way that we do in amphibians and reptiles to understand the situation of a population."

http://www.scientificamerican.com/article.cfm?id=supernova-red-crucifix-sky-774ad

Supernova Could Have Caused Mysterious "Red Crucifix" in the Sky in A.D. 774

An ancient text suggests that an eighth-century jump in carbon 14 levels in trees could be explained by a previously unrecognized supernova explosion

By Richard A. Lovett and Nature magazine



An eerie "red crucifix" seen in Britain's evening sky in ad 774 may be a previously unrecognized supernova explosion — and could explain a mysterious spike in carbon-14 levels in that year's growth rings in Japanese cedar trees. The link is suggested today in a Nature Correspondence by a US undergraduate student with a broad interdisciplinary background and a curious mind.
A few weeks ago, Jonathon Allen, a biochemistry major at the University of California, Santa Cruz, was listening to the Nature podcast when he heard about a team of researchers in Japan who had found an odd spike in carbon-14 levels in tree rings. The spike probably came from a burst of high-energy radiation striking the upper atmosphere, increasing the rate at which carbon-14 is formed (see 'Mysterious radiation burst recorded in tree rings').
But there was a problem: the only known causes of such radiation are supernova explosions or gigantic solar flares, and the researchers knew of no such events in ad 774 or 775, the dates indicated by the tree rings.
Intrigued, Allen hit the Internet. "I just did a quick Google search," he says.
His long-standing interest in history was helpful, he notes. "I knew that going that far back, there's very limited written history," he says. "The only things I'd ever seen or heard of were religious texts and 'chronicles' that listed kings and queens, wars and things of that nature."
His search found the eighth-century entries in the Anglo-Saxon Chronicle at the Avalon Project, an online library of historical and legal documents hosted by Yale University in New Haven, Connecticut. Scrolling down to the year ad 774, Allen found a reference to a "red crucifix" that appeared in the heavens "after sunset".

Hidden in the heavens

"It made me think it's some sort of stellar event," Allen says. Furthermore, he notes, the redness might indicate that the source was hidden behind a dust cloud dense enough to scatter all but a small amount of red light. Such a cloud might also prevent any remnants of the proposed supernova being seen by modern astronomers.
Scientists in the field are impressed. Geza Gyuk, an astronomer at Chicago's Adler Planetarium in Illinois, who has used the Anglo-Saxon Chronicle to investigate past astronomical events, says that Allen might be on to something. "The wording suggests that the object was seen in the western skies shortly after sunset," he says. "That would mean that it would have moved behind the Sun [where it could not be seen] as Earth orbited the Sun. That, along with the dimness of the 'new star' due to dust would go a long way to explaining why no one else would have seen or recorded the event."
Nevertheless, says Donald Olson, a physicist with an interest in historical astronomy at Texas State University in San Marcos, "Early chronicles can be difficult to interpret in an unambiguous way."
As far back as 1870, he says, John Jeremiah published an article in Nature that referred to the same wording from the Anglo-Saxon Chronicle. Jeremiah proposed then that it might have been an early description of the Northern Lights. "Another possible explanation could be an ice-crystal display," adds Olson, noting that the red "crucifix" could have been formed by sunset light illuminating high-altitude ice particles in both vertical and horizontal bands of light.
But, it could also have been a previously unrecognized supernova. Plenty of supernovae now known to astronomers "are simply missing" in the historical record, says Gyuk. "The sky is a large place and the historical record is not very good." ***NATURE PODCAST:*** *Cosmic Crucifix*

http://www.eurekalert.org/pub_releases/2012-06/mc-mcu062712.php

Mayo Clinic uses new approach to reverse multiple sclerosis in mice models

Mayo Clinic researchers have successfully used smaller, folded DNA molecules to stimulate regeneration and repair of nerve coatings in mice that mimic multiple sclerosis (MS

ROCHESTER, Minn. - They say the finding, published today in the journal PLoS ONE, suggests new possible therapies for MS patients. "The problem has been to find a way to encourage the nervous system to regenerate its own myelin (the coating on the nerves) so nerve cells can recover from an MS attack," says L. James Maher III, Ph.D., Mayo Clinic biochemist and senior author on the paper. "We show here that these small molecules, called aptamers, can stimulate repair in the mice we are studying."

More than 200,000 people have multiple sclerosis. There is no cure and no effective therapy to stop progression or repair damage to the myelin sheath that surrounds and protects the nerves. Without that protection, nerve fibers will be damaged, leading to declining mobility and cognitive function, and other debilitating complications.

MS researchers, including Mayo neurologist Moses Rodriguez, M.D., a co-author on this paper, have focused on monoclonal antibodies in mice to stimulate myelin repair. The Rodriguez and Maher teams, working together, have determined that the aptamers are not only effective, but they are easy and cheap to synthesize -- an important point for drug developers. They also are stable and not likely to cause an immune response. This new approach must be validated in other mouse models to see if it might be a candidate for human clinical trials.

The monoclonal antibodies used in earlier research are large and complex, but were shown to promote both cell signaling and remyelination of central nervous system lesions in mice. The aptamers used in this study are less than one-tenth the size of antibodies and are single-strands of DNA containing only 40 nucleotide units.

The research was supported by Mayo Clinic and the National Multiple Sclerosis Society.

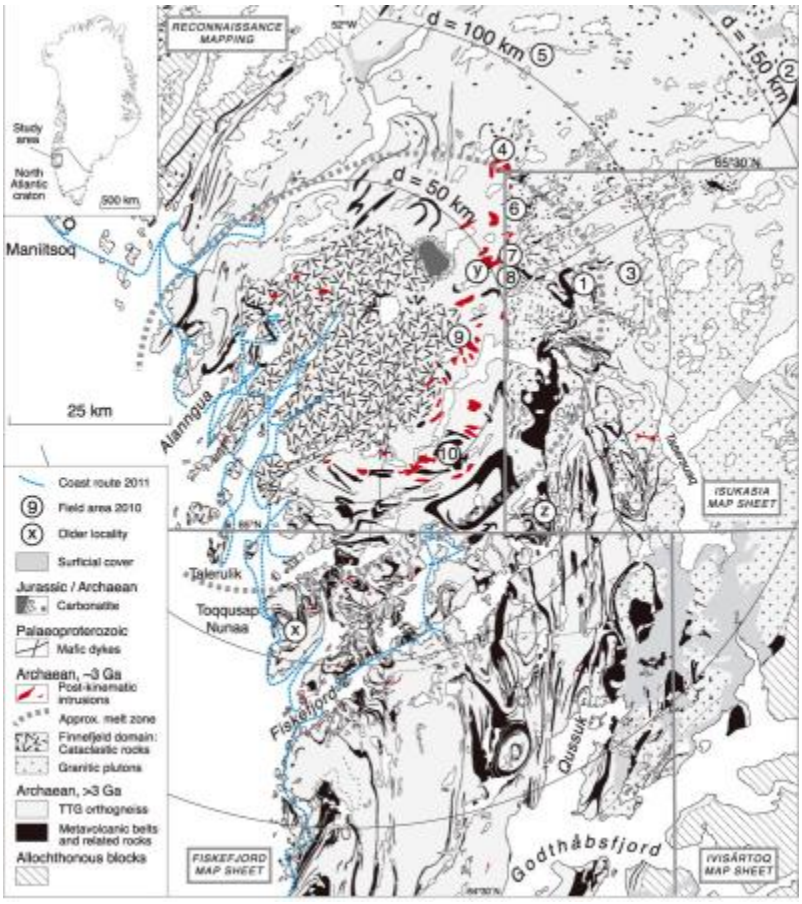
Co-authors include Branislav Nastasijevic, Brent Wright, Ph.D., John Smestad, and Arthur Warrington, Ph.D., all of Mayo Clinic.

http://www.eurekalert.org/pub_releases/2012-06/cu-eok062812.php

Earth's oldest known impact crater found in Greenland

A 100 kilometre-wide crater has been found in Greenland, the result of a massive asteroid or comet impact a billion years before any other known collision on Earth.

The spectacular craters on the Moon formed from impacts with asteroids and comets between 3 and 4 billion years ago. The early Earth, with its far greater gravitational mass, must have experienced even more collisions at this time – but the evidence has been eroded away or covered by younger rocks. The previously oldest known crater on Earth formed 2 billion years ago and the chances of finding an even older impact were thought to be, literally, astronomically low. Now, a team of scientists from the Geological Survey of Denmark and Greenland (GEUS) in Copenhagen, Cardiff University in Wales, Lund University in Sweden and the Institute of Planetary Science in Moscow has upset these odds. Following a detailed programme of fieldwork, funded by GEUS and the Danish 'Carlsbergfondet' (Carlsberg Foundation), the team have discovered the remains of a giant 3 billion year old impact near the Maniitsoq region of West Greenland. "This single discovery means that we can study the effects of cratering on the Earth nearly a billion years further back in time than was possible before," according to Dr Iain McDonald of Cardiff University's School of Earth and Ocean Sciences, who was part of the team.



Finding the evidence was made all the harder because there is no obvious bowl-shaped crater left to find. Over the 3 billion years since the impact, the land has been eroded down to expose deeper crust 25 km below the original surface. All external parts of the impact structure have been removed, but the effects of the intense impact shock wave penetrated deep into the crust - far deeper than at any other known crater - and these remain visible.

However, because the effects of impact at these depths have never been observed before it has taken nearly three years of painstaking work to assemble all the key evidence. "The process was rather like a Sherlock Holmes story," said Dr McDonald. "We eliminated the impossible in terms of any conventional terrestrial processes, and were left with a giant impact as the only explanation for all of the facts."

Only around 180 impact craters have ever been discovered on Earth and around 30% of them contain important natural resources of minerals or oil and gas. The largest and oldest known crater prior to this study, the 300 kilometre wide Vredefort crater in South Africa, is 2 billion years in age and heavily eroded.

Dr McDonald added that "It has taken us nearly three years to convince our peers in the scientific community of this but the mining industry was far more receptive. A Canadian exploration company has been using the impact model to explore for deposits of nickel and platinum metals at Maniitsoq since the autumn of 2011."

The international team was led by Adam A. Garde, senior research scientist at GEUS. The first scientific paper documenting the discovery has just been published in the journal Earth and Planetary Science Letters.

http://www.eurekalert.org/pub_releases/2012-06/sfeb-cbp062712.php

Caffeine boosts power for elderly muscles

A new study has shown that caffeine boosts power in older muscles, suggesting the stimulant could aid elderly people to maintain their strength

A new study to be presented at the Society for Experimental Biology meeting on 30th June has shown that caffeine boosts power in older muscles, suggesting the stimulant could aid elderly people to maintain their strength, reducing the incidence of falls and injuries. For adults in their prime, caffeine helps muscles to produce more force. But as we age, our muscles naturally change and become weaker.

Sports scientists at Coventry University looked for the first time at whether these age-related changes in muscle would alter the effect of caffeine. They found that caffeine continued to enhance muscle performance in two different muscles from mice, although it was less effective in older muscles.

Jason Tallis, the study's primary author, said: "Despite a reduced effect in the elderly, caffeine may still provide performance-enhancing benefits."

For adults in their prime, caffeine helps muscles to produce more force. But as we age, our muscles naturally change and become weaker. So, sports scientists at Coventry University looked for the first time at whether these age-related changes in muscle would alter the effect of caffeine. Caffeine's effect was smallest for juvenile muscles, suggesting caffeine may not have an enhancing effect in developing muscles.

The decline in muscle strength that occurs as we age contributes to injuries and reduces quality of life. The process is not well understood, but it is clear that preserving muscle tone is key.

Tallis said: "With the importance of maintaining a physically active lifestyle to preserve health and functional capacity, the performance-enhancing benefit of caffeine could prove beneficial in the aging population."

The researchers isolated muscles from mice ranging in age from juvenile to elderly, then tested their performance before and after caffeine treatment. They looked at two different skeletal muscles, which are the muscles we can control voluntarily. The first was the diaphragm, a core muscle used for respiration; the second was a leg muscle called the extensor digitorum longus (EDL), used for locomotion.

http://www.eurekalert.org/pub_releases/2012-06/cp-wms062212.php

With mind-reading speller, free-for-all conversations that are silent and still

Researchers have come up with a device that may enable people who are completely unable to speak or move at all to nevertheless manage unscripted back-and-forth conversation.

The key to such silent and still communication is the first real-time, brain-scanning speller, according to the report published online on June 28 in Current Biology, a Cell Press publication.

The new technology builds on groundbreaking earlier uses of fMRI brain scans to assess consciousness in people described as being in an unconscious, vegetative state and to enable them to answer yes and no questions. fMRI (or functional magnetic resonance imaging) is typically used for clinical and research purposes to track brain activity by measuring blood flow.

"The work of Adrian Owen and colleagues led me to wonder whether it might even become possible to use fMRI, mental tasks, and appropriate experimental designs to freely encode thoughts, letter-by-letter, and

therewith enable back-and-forth communication in the absence of motor behavior," said Bettina Sorger of Maastricht University in The Netherlands.
The new evidence shows that the answer to that thought question is yes. Sorger's team came up with a letter-encoding technique that requires almost no pre-training. Participants in their study voluntarily selected letters on a screen, which guided the letter encoding; for each specific character, participants were asked to perform a particular mental task for a set period of time. That produced 27 distinct brain patterns corresponding to each letter of the alphabet and the equivalent of a space bar, which could be automatically decoded in real-time using newly developed data analysis methods.
In each communication experiment, participants held a mini-conversation consisting of two open questions and answers. Everyone the researchers tested was able to successfully produce answers within a single one-hour session.
The results substantially extend earlier uses of fMRI, which allowed individuals to answer the equivalent of multiple-choice questions having four or fewer possible answers, by enabling free-letter spelling. That could make all the difference for people who are completely paralyzed and unable to benefit from other means of alternative communication, Sorger says.
Ultimately, she says their goal is to transfer the fMRI technology they've developed to a more portable and affordable method for measuring blood flow, such as functional near-infrared spectroscopy (fNIRS).
Sorger et al.:"A Real-time fMRI-based Spelling Device Immediately Enabling Robust Motor-independent Communication."

http://www.eurekalert.org/pub_releases/2012-06/nsf-sof062012.php

Study on fungi helps explain coal formation and may advance future biofuels production

Study reveals potentially large influences of fungi, one of the most biologically diverse classes of organisms, on our energy supplies

A new study--which includes the first large-scale comparison of fungi that cause rot decay--suggests that the evolution of a type of fungi known as white rot may have brought an end to a 60-million-year-long period of coal deposition known as the Carboniferous period. Coal deposits that accumulated during the Carboniferous, which ended about 300 million years ago, have historically fueled about 50 percent of U.S. electric power generation.
In addition, the study provides insights about diverse fungal enzymes that might be used in the future to help generate biofuels, which are currently among the most promising and attractive alternatives to fossil fuels for powering vehicles.
The study, which was conducted by a team of 71 researchers from 12 countries, appears in the June 29, 2012 issue of Science and was partially funded by the National Science Foundation (NSF).
There are almost 1.5 million fungi species on Earth. They perform essential ecological roles that include decomposing organisms and serving as food for many insect species and larger organisms.
However, only about five percent of fungi species have, thus far, been classified. The new study is part of an effort--supported by NSF's Assembling the Tree of Life and Partnerships for Enhancing Expertise in Taxonomy programs--to resolve evolutionary relationships between fungi species, define the diversity of fungi, and explain the early evolutionary history of fungi. Information produced by this effort is integral to the story of life on Earth and the evolution of its varied ecosystems.

The End Of A Geologic Era

Coal is composed of the fossilized remains of plants--mostly lignin, which is a complex polymer that is an important component of the cell walls of plants and helps give wood its strength and rigidity.
The study indicates that white rot fungi, which are the only types of microorganisms that can break down lignin, evolved at the end of the Carboniferous green period, and that the synchrony between the rise of white rot fungi and the close of the Carboniferous was no coincidence.
According to the study, once white rot, which breaks down lignin via enzymatic activity, became an ecological force, it destroyed huge accumulations of woody debris that would have otherwise escaped decay to ultimately be fossilized as coal.
So if not for the advent of white rot, large coal deposits may have continued to form long after the end of the Carboniferous period. This study supports a paper published in 1990 by Jennifer M. Robinson that pegged the evolution of white rot as a potential contributing factor to the end of the Carboniferous period.

The Matrix

Lignin exists in cell walls as part of a tough matrix with cellulose, which is a carbohydrate composed of sugar subunits. But once white rot attacks and destroys lignin, the matrix collapses, and the cellulose is freed--to be devoured by the white rot as food.

The ability of white rot fungi to decay lignin may ultimately be used to help conquer what is among the world's most longstanding and vexing problems associated with the large-scale production of biofuels: that is, obtaining plant carbohydrates that could be converted into biofuels via fermentation processes.
It may ultimately be feasible to use white rot to break down lignin to release cellulose from cell walls, which could then be broken down into sugars. Next, the sugars would be fed to yeast that would be fermented into alcohols that would provide the bases for new biofuels.
In addition, because enzymes from white rot fungi are able to break down complex organic molecules, they have been investigated for use in bioremediation operations that involve breaking down contaminants to remove them from the environment.

Genomic Comparisons

"Our study was designed to reconstruct the evolution of lignin decay mechanisms in fungi, analyze the distribution of enzymes that enable fungi to break down lignin, and better define the evolution of the gene families that encode those enzymes," said David Hibbett of Clark University, who led the study.
Hibbett and his team focused on a large group of fungi known as Agaricomycetes, which include white rot fungi as well as mushroom species that have the familiar cap-and-stem shape.
The Agaricomycetes group also includes brown rot fungi that can destroy wood by breaking down cellulose and hemicellulose, which is another component of cell walls--all the while without breaking down lignin.
The researchers compared 31 fungal genomes--26 of which were sequenced at the Department of Energy's Joint Genome Institute, including 12 that were sequenced at the DOE JGI specifically for the study, and were then annotated and analyzed by NSF-funded researchers in collaboration with JGI and other partners.
"The 12 new genome sequences could serve as potential resources for industrial microbiologists aiming to develop new tools for producing biofuels, bioremediation or other products, perhaps by using recombinant DNA methods or by selecting new organisms for fermentation," said Hibbett.
"This study exemplifies the tremendous gains we can make in understanding complicated biologic processes such as lignin decomposition when we learn about the genealogical relationships of organisms," said Charles Lydeard, an NSF program director.

The Evolution Of White Rot

The study also involved tracking the evolution of lignin-decomposing enzymes back through time. This was done via so-called "molecular clock analyses." Such analyses are based on the assumption that genes accumulate mutations through evolution at fairly predictable rates--similar to the way that the hands of a clock advance around a clock at predictable rates. The ability to estimate these mutation rates enables researchers to trace mutations back in time and estimate how recently fungal lineages shared a common ancestor but then diverged from one another.
Results of molecular clock analyses suggest that the oldest ancestor of the Agaricomcyetes was a white rot species that possessed multiple lignin-degrading enzymes and lived roughly 300 million years ago. Many surviving lineages of Agaricomycetes-including fungi species known as wood-decaying polypores and bracket fungi-produce lignin-degrading enzymes. "Our results suggest that the ability of fungi to break down lignin evolved only once," said Hibbett.
In addition, Hibbett said, "This study underscores the adaptability of fungi." This adapatability is underscored by the fact that some Agaricomycete lineages have maintained their lignin-degrading enzymes. By contrast, other Agaricomycete lineages, including brown rot and mycorrhizal species, which survive via symbiotic relationships with the roots of certain trees without decaying them, ultimately lost their lignin-degrading enzymes as they developed alternative methods of obtaining nutrition, said Hibbett.

Potential Payback

The economic value of fungi is already almost incalculable: fungi currently impact diverse applied disciplines, including agriculture, medicine and drug discovery.
The more scientists learn about these important organisms, the more likely they will be to identify additional uses for them that will benefit the economy, the environment, and human welfare, as well as to develop new ways to fight wood rot that, at great costs, kills trees and destroys wood structures, including homes and ships.
Joseph Spatafora of Oregon State University who is a co-author on the study said, "It's a really exciting time in fungal biology, and part of that is due to the technology today that allows us to address the really longstanding questions."

http://www.eurekalert.org/pub_releases/2012-06/uoa-ua062412.php

U Alberta resets date of earliest animal life by 30 million years

University of Alberta researchers have uncovered physical proof that animals existed 585 million years ago, 30 million years earlier than all previous established records show.

The discovery was made U of A geologists Ernesto Pecoits and Natalie Aubet in Uruguay. They found fossilized tracks of a centimetre long, slug-like animal left behind 585 million years ago in a silty sediment.

Along with other U of A researchers, the team determined that the tracks were made by a primitive animal called a bilaterian, which is distinguished from other non-animal, simple life forms by its symmetry-its topside is distinguishable from its bottom side-and a unique set of 'footprints'.

The researchers say the fossilized tracks indicate the soft-bodied animal's musculature enabled it to move through the sediment on the shallow ocean floor. The pattern of movement indicates an evolutionary adaptation to search for food, which would have been organic material in the sediment.

Evidence ... burrows left in sediment point to signs of life almost 30 million years older than any previous animals known to modern humans. **Photo: Richard Siemens**

The precise age of the tracks was calculated at the U of A by dating the age of an igneous rock that intruded into the siltstone in the area where the tracks were found. It took more than two years for U of A researchers to satisfy themselves and a panel of peer review scientists that the age of 585 million years is accurate. The dating process included a trip back to Uruguay to collect more samples of the fossilized rock and multiple sessions of mass spectrometry analysis.

U of A paleontologist Murray Gingras said when it comes to soft-bodied animals and their tracks it's not unusual for the animal's body to disappear but its tracks become fossilized.

Prior to the U of A find and age confirmation, the oldest sign of animal life was dated at 555 million years ago from a find made in Russia.

Kurt Konhauser, a U of A geomicrobiologist, says the team's discovery will prompt new questions not only about the timing of animal evolution, but also the environmental conditions under which they evolved. Konhauser explains that the challenge now is "to find out how these animals evolved to the point where they were able to move about and hunt for food."

The U of A's research team includes Ernesto Pecoits, Natalie Aubet, Kurt Konhauser, Larry Heaman, and Richard Stern and Murray Gingras. The research was published June 28, in the journal Science.

http://bit.ly/N3AHq9

'Death carrot' could hold the key to new cancer drugs

A pretty yellow flower could hold the key to the next generation of cancer drugs, and is about to head into human clinical trials.

10:03 28 June 2012 by Hannah Krakauer

The flowering Thapsia garganica plant looks innocent enough, but the common Mediterranean weed is highly toxic to sheep and cattle, earning it the moniker "death carrot" in ancient Greek literature.

But this lethal plant could find a new use: targeting and killing cancer cells. The challenge lies in harnessing the power of this toxic substance, goading it into killing just the cancer cells while leaving healthy cells alone.

The task has been taken on by Samuel Denmeade, an oncologist at Johns Hopkins University in Baltimore. He and his team spent 15 years engineering an analogue of thapsigargin, the active ingredient in the plant, to fight cancer cells exclusively.

Thapsigargin typically works by passing through cell membranes and shutting down calcium pumps – essential for cell survival – on the inside of cells. Denmeade's team modified the thapsigargin molecule by adding an extra peptide chain which prevents the toxin from entering cells. That is, until it encounters PSMA – an enzyme commonly found on the surface of many prostate cancer cells. PSMA cleaves the extra chain off the toxin, setting it free to do its devastating business.

Precision killer

While traditional chemotherapy drugs only target cells undergoing rapid growth, this new toxin is a generalist, destroying not just the cancer cells currently growing, but also those lying dormant as well as non-cancer cells recruited to help the tumour grow.

"You can envision it as a grenade," Denmeade says. "One guy pulls the pin, but it kills all the guys standing around." Fortunately for the mouse test subjects, though, the effects of the toxin stay local, causing minimal collateral damage to healthy tissues nearby.

PSMA is an oft-targeted site for prostate cancer researchers, but creating a drug that goes beyond seeking out the PSMA enzyme and actually takes advantage of its ability to cleave proteins is a major innovation, says David Nanus at Weill Cornell Medical College in New York City.

The results of extensive animal studies are promising enough for the drug to now be moving into phase 1 clinical trials, focusing first on prostate cancer. Recent studies have shown that PSMA is also found in tumours outside the prostate, so trials on other cancers may not be far away.

Journal reference: Science Translational Medicine, DOI: 10.1126/scitranslmed.3003886

http://www.sciencedaily.com/releases/2012/06/120628131041.htm

Treating Diabetes Early, Intensively Is Best Strategy, New Study Suggests

Intensive early treatment of type 2 diabetes slows down progression of the disease by preserving the body's insulin-producing capacity, a UT Southwestern study has shown.

ScienceDaily - "We can potentially change the course of this prevalent disease, which would represent a breakthrough," said Dr. Ildiko Lingvay, assistant professor of internal medicine and author of the study published online in Diabetes Care. "The intensive treatment regimen we propose is different from the stepwise approach recommended in standard guidelines." As one of the fastest-growing diseases in the U.S., diabetes afflicts an estimated 25.8 million children and adults, or 8.3 percent of the population, according to the American Diabetes Association. A study by Population Health Management projects the number of diabetes cases to nearly double by 2025.

The UT Southwestern study was selected for presentation at the recent American Diabetes Association's Diabetes Care Symposium and will be published in the July print issue of ADA's Diabetes Care.

While intensive treatment has been the standard at UT Southwestern for at least a decade, the industry norm has been to emphasize lifestyle changes first. The American College of Physicians, for example, suggests losing weight and dieting before drug treatment. The ADA recommends similar lifestyle changes, plus the use of metformin -- the standard drug used to treat type 2 diabetes - for those newly diagnosed.

"We believe that the stepwise approach exposes patients to long periods of high blood sugar, which leads to complications," Dr. Lingvay said. "Unless dietary changes are significant and sustained long-term, diabetes is a progressive disease in which the body's ability to produce insulin declines."

If a patient can maintain insulin production, she explained, the disease is easier to manage. The study showed intensive treatment with insulin, followed by one of two drug regimens, enabled diabetes patients to maintain steady insulin-producing beta-cell function for three and a half years after diagnosis. "This finding was true, regardless of the method used to attain intensive control," Dr. Lingvay said. "Intensive treatments led to excellent control of blood-sugar levels, they were well-tolerated, safe, and had good compliance."

In the UT Southwestern clinical trial, participants were randomly divided into two groups. Both groups first had three months of treatment with insulin and the anti-diabetes drug metformin. After that, one group took three types of diabetes medications daily, while the other continued the insulin and metformin treatment. Out of 63 initial trial recruits, 58 completed the study and are still being tracked for six-year results. Dr. Lingvay said the study did not show that any single regimen worked better than another; both intensive treatment regimens were just as effective. "The point is that whatever you choose, make sure it's intensive," she said. "We have shown that this preserves beta-cell function, and that's the key in changing the course of the disease."

Other UT Southwestern researchers involved in the study were Dr. Lindsay Harrison, an endocrinology fellow; Beverley Adams-Huet, assistant professor in clinical sciences and internal medicine; and Dr. Philip Raskin, professor of internal medicine.

The research was supported by grants from the National Institutes of Health and Novo Nordisk Inc., a supplier of insulin. Novo Nordisk played no role in the study design, conduct, analysis, preparation, or final approval.

L. B. Harrison, B. Adams-Huet, P. Raskin, I. Lingvay. Cell Function Preservation After 3.5 Years of Intensive Diabetes Therapy. Diabetes Care, 2012; 35 (7): 1406 DOI: 10.2337/dc11-2170

http://www.scientificamerican.com/article.cfm?id=cover-charge-new-spray-on-battery

Cover Charge: New Spray-On Battery Could Convert Any Object into an Electricity Storage Device

The lithium ion battery is applied in layers, each of which is an aerosol paint, leading to possible solar-energy applications

By Evelyn Lamb | Thursday, June 28, 2012 | 7

Perhaps someday you'll need to go to the store because you ran out of cathode paint. A team of researchers has just announced a new paint-on battery design. The technique could change the way batteries are produced and eliminate restrictions on the surfaces used for energy storage.

The paint-on battery, like all lithium ion batteries, consists of five layers: a positive current collector, a cathode that attracts positively charged ions, an ion-conducting separator, an anode to attract negative ions, and a negative current collector. For each layer, the challenge was to find a way to mix the electrically conductive material with various polymers to create a paint that could be sprayed onto surfaces.
Neelam Singh, a member of the team of materials scientists and chemists from Rice University in Houston and Catholic University of Louvain in Belgium and lead author of the paper, says, "It was really exciting to find out. Can we really paint a battery on various surfaces and convert any object into a storage device?"
Singh says her team's work is filling a need in the socially critical field of energy storage for new battery designs. "We find that the focus of research is now shifting towards integration of batteries," she says. That is, people are trying to design batteries that can be built into a variety of different objects. Several teams are working to make thin and flexible batteries as well as batteries that can be incorporated into textiles. Solar energy is one of the applications that researchers are particularly interested in. Solar panels can require large surface areas, and the Rice team's design is an efficient way to collect and store energy in this realm.
To test their design, they applied the battery paints onto ceramic bathroom tiles, glass, a flexible transparency film, stainless steel and the side of a beer stein. In each case, the battery worked. In one experiment, they hooked a solar cell to one of the batteries and powered an LED display.
Singh said the biggest challenge was to make a battery that was both stable and powerful: "It was not very easy to get all the layers on top of each other without interfering with their capacity or compromising the performance of the battery." There were safety concerns as well. Many lithium ion batteries use aluminum as a positive current collector, but aluminum microparticles can be lung irritants, so using them in aerosol paint would be hazardous. Instead, the researchers relied on carbon nanotubes.
Lithium cobalt oxide was used as the cathode, commercially available gel electrolytes as the separator, lithium titanium oxide as the anode, and copper as the negative current collector. The approach is detailed in the June 28 issue of Scientific Reports. (Scientific American is part of Nature Publishing Group.)
Singh thinks that the Rice team's battery is a game-changer because it is energy efficient for its volume and can be applied to objects of many different compositions and shapes.
Vilas Pol, a materials scientist at Argonne National Laboratory who was not affiliated with the study, agrees that the new design is exciting, describing it as "an exceptional and notable concept in the arena of battery design and integration."
But for now paint-on batteries are not quite ready to hit the shelves at your local hardware store. For one, the electrolyte separator layer is not yet oxygen stable. It would explode if it came into contact with air, so special conditions are necessary when creating the battery.
Singh says the team currently is working to make all the materials less reactive to air and moisture and more environmentally friendly. She adds that other groups are working on developing paint-on solar cells. Then, she envisions "paintable solar cells on top of paintable solar batteries." Houses could become solar-energy capture-and-storage devices.

http://bit.ly/NVcVdE

Oldest pottery hints at cooking's ice-age origins

Did a deep freeze spur our ancestors to get cooking?

19:00 28 June 2012 by Michael Marshall

The discovery that the oldest pots in the world were made in China around the time of the Last Glacial Maximum suggests that might be the case. Hundreds of fragments of pottery have been found since the 1960s in Xianrendong cave in south-east China. Ofer Bar-Yosef of Harvard University and colleagues excavated the cave again in 2009 and, for the first time, used radiocarbon dating to work out the age of the layers where the pottery shards were found. The oldest ones turned out to be between 19,000 and 20,000 years old.
That is thousands of years before people began farming some 12,000 years ago – suggesting that the pots were made by hunter-gatherers, which is contrary to previous thinking. "The making of pottery is not necessarily related to agriculture," says Bar-Yosef.

Is this a piece of 20,000-year-old cookware? **(Image: courtesy of Science/AAAS)**

World's first stew

Bar-Yosef thinks the shards are the remains of crude pots and bowls, probably about 20 centimetres across. "They were poorly fired and easily breakable," he says. Their outer surfaces carry scorch marks and small

amounts of soot, so Bar-Yosef thinks they were used for cooking. His dating data helps to locate the oldest potters, but humans had been manipulating clay into figurines for many years by then. The Venus of Dolní Věstonice, a small statuette of a naked woman found in what is now the Czech Republic is estimated to be about 30,000 years old.

What prompted Chinese hunter-gatherers to start cooking food 20,000 years ago? Bar-Yosef points out that, at the time, Earth was in the clutches of the Last Glacial Maximum, the height of the last ice age.

The extreme cold would have caused food shortages. Cooked food yields more energy than raw food, so throwing their meals on the fire could have helped people to survive. It takes some form of stress for species to undergo major changes, says Bar-Yosef.

A later cold period, the Younger Dryas starting about 12,800 years ago, could have forced people to start farming (Current Anthropology, DOI: 10.1086/659784). Because much of Eurasia was colonised by then, people couldn't escape food shortages by moving to a new area. The only option was to start growing crops.

Journal reference: Science, DOI: 10.1126/science.1218643

http://phys.org/news/2012-06-accidents-ancient-bakeries-years-brew.html

Accidents in ancient bakeries produced 8,000 years of brew

When next you reach for a cold one in the buzzing heat of a summer day, you will probably give no thought to the glorious history, complicated chemistry, and abundant myths associated with what you are drinking.

That's OK. Just know you are participating on one of humanities oldest and most popular activities. After water and tea, beer is the third most favored drink in the world. It is one of the first by-products of human agriculture. Beer may, in fact, be a reason for civilization.

The United States is a splendid place to drink beer, said British-born expert Charles Bamforth of the University of California, Davis. The market is huge and diverse, with an enormous variety of the stuff available from breweries large and small. Beer is made of fermented cereal grains. Usually, the grain is barley, but wheat beer is common, sometimes rye, rice, corn, or even sorghum.

The drink was discovered about 8,000 years ago, historians believe, likely the result of accidents in bakeries. "The story goes that in what is now Iraq they used to eat barley," said Bamforth. "Someone got some wet, and it started to sprout. It got softer and easier to digest and chew, and it tasted better." They made bread out of it and liked it. "That bread was somehow crumbled in jars and mixed with water. Wild yeast came along and converted it to a delicious drink and when they drank it, they fell over. They were kind of happy about that," Bamforth said.

That still required someone to look at the mess in the jar and think, "hey, what if I drank some?" The brave soul, like the first person to eat an oyster, is lost to history.

Historians think the discovery made people happy enough to consider ending life as hunter gatherers and settling down to agriculture and brewing, the beginnings of civilization. Beer even became a leading source of nutrition and was tied up with religious observances and feasts. Egyptian Pharaohs drank it. Sophocles urged Greeks to enjoy beer responsibly in the fifth century B.C.

The beer of ancient Mesopotamia and modern beer taste and look nothing alike. Ancient beer was unfiltered and included various herbs and spices, uncommon today. By around the ninth century, brewers -- mostly European monks -- began adding hops in their beers, Bamforth said. Hops, a flower, adds bitterness to the taste, a complexity to the aroma and acts as a preservative. It is the taste and smell we now most associate with beer.

That accidental brewing now is duplicated in modern breweries. The process begins with malted grain. Malting means the grain is soaked in water so it begins to germinate but then is heated before the process is completed. The malting produces enzymes that convert starch in the grain to sugar. Yeast then turns most of the sugar into alcohol.

Beers come with several urban legends. One common misconception is that European beers have a higher alcohol content than American beers. Not so, says Bamforth. "The reality is the beers tend to be stronger in America. If you compare Guinness, they have less alcohol in it than Budweiser. In the U.K., beer tends to be lower in alcohol because it is taxed according to its strength," Bamforth said.

American beers usually contain 4-6 percent alcohol. The difference is that Americans generally like a milder beer and European beer has a more intense flavor, but it has nothing to do with alcohol content. In the last 30 years, small craft brewers have sprung up making a more European-style beer that is now the fastest growing segment of the business.

Another myth is that beer in a bottle is better than beer in a can and that also is not true, Bamforth said.

The enemies of beer are light and air, he said. No matter how tight the bottle, air and light eventually get in and the longer the beer is in the bottle the more likely it is to get a "skunky" taste, the result of light altering the chemistry of the hops. That's why Heineken in New York is not the same as Heineken in Amsterdam. It has travelled across an ocean, which takes time.
Cans do not let in air or light. Brown bottles are better than green bottles, which are better than clear bottles, because they let in less light. Brewers who sell beer in clear bottles, like the makers of Mexico's Corona, use genetically-modified hops to counter the effects of light, Bamforth said.
Huge breweries, like Anheuser-Busch, produce gigantic quantities around the world, all exactly the same, a feat of industrial chemistry almost unmatched in the world.
But, the process fascinates many and there is a booming business in supplying home brewers who run mini-Coors in their basements, either because they love beer or are fascinated by the chemistry.
Rabbi Charles Arian of Norwalk, Conn., brews beer at home, just a couple of gallons at a time from kits. His equipment costs about $120. He does it because of the process.
"I'm an urban person," Arian said. "As a non-scientist and liberal arts guy, it's the interaction of nature and learning how something works. It really works. If you put the right combination of stuff together and the temperature is right, you get predictable results."
It doesn't matter to Bamforth what you drink. "I don't think anyone has the right to decree what is a good and bad beer," Bamforth said. Just enjoy.

http://phys.org/news/2012-06-japan-major-rare-earth-deposits.html

Japan finds major rare earth deposits: researcher

Japan has found a large deposit of rare earth minerals in its Pacific seabed, enough to supply its hi-tech industries for more than 200 years, a scientist said Friday.

Around 6.8 million tonnes of the valuable minerals, used in electric cars, iPods and lasers, are sitting under the seabed near a far eastern Japanese island, Tokyo University professor Yasuhiro Kato told AFP. He said mud samples taken from an area near Minamitorishima island, some 2,000 kilometres (1,250 miles) southeast of Tokyo, indicated deposits amounted to around 220 times the average annual amount used by industry in Japan.
The seabed contained a substantial amount of dysprosium -- a rare earth mineral used in the engines for hybrid cars, he said. "Specifically on dysprosium, I estimate at least 400 years worth of Japan's current consumption is in the deposits," said the professor, who examined mud samples taken from the seabed around 5,600 metres (18,300 feet) down. "We can start drilling in the mud, using oil extraction technology, within three years at the earliest and start producing rare earth minerals within five years," he said.
The find would be the first time large scale rare-earth deposits had been discovered inside Japan's exclusive economic zone, local media said. Rare earths are used to make a wide range of high tech products, including powerful magnets, batteries, LED lights, electric cars, iPods, lasers, wind turbines and missiles. China currently produces more than 90 percent of the world's supply of rare earths, but has clamped down on exports of them in a move Beijing says is aimed at protecting its environment and conserving supplies.
But Japan, the European Union and the United States claim China is unfairly benefiting its own industries by restricting exports.
The confirmation of a significant find of rare earths in Japanese territory would be welcome news for Japan's hi-tech industries who were caught in a political spat between Tokyo and Beijing in 2010 when China squeezed supplies. "I would like to see the Japanese government recognise the existence of the rare earth deposits and soon start making investment in developing the area," said professor Kato.

http://www.eurekalert.org/pub_releases/2012-06/uom-edi062812.php

Epilepsy drugs increase risk of fractures and falls

New research has shed light on the high risk of fractures, falls, and osteoporosis among epilepsy patients using antiepileptic drugs (AEDs) with most patients unaware of the risks associated with taking the drugs.

The study led by the University of Melbourne and published in the prestigious Neurology journal, found that people taking antiepileptic drugs are up to four times more likely to suffer spine, collarbone and ankle fractures and are more likely to have been diagnosed with osteoporosis. The study also revealed that these patients are more than four times as likely as non-users of antiepileptic drugs to have been diagnosed with osteoporosis. In addition, treatment affected balance with results showing almost double the falls rate in female patients taking the medication compared with non-users.
Chief Investigator, Prof John Wark from the University of Melbourne's Department of Medicine at the Royal Melbourne Hospital said this research revealed new information critical to understanding the higher risk for

fractures and falls in epilepsy patients taking antiepileptic medication. "We believe patients need to be offered better information to help them to avoid these risks and prevent injury," he said.

More than 70 percent of epilepsy patients who participated in the study were unaware of the increased risk of fractures, decreased bone mineral density and falls associated with taking antiepileptic medications.

"No published studies have explored epilepsy patients' awareness of the effects of AEDs on bone health, fracture risk and falls. This study indicates that awareness of these issues is poor, despite our study population attending specialist epilepsy clinics at a centre with a major interest in this area," said Prof Wark.

"Most patients indicated they would like to be better informed about these issues, suggesting that more effective education strategies are warranted and would be well-received." "Epilepsy patients should be assessed regularly for their history of falls and fractures for appropriate management strategies to be offered."

The study compared 150 drug users with 506 non-users. All drug users were epilepsy outpatients at the Royal Melbourne Hospital, over 15 years old and had been taking AEDs for a minimum of three months.

Collaborators include La Trobe University, the National Ageing Research Institute, and the University of Malaya, Malaysia.