http://www.bbc.co.uk/news/science-environment-20987289

Tetrapod anatomy: Backbone back-to-front in early animals

Textbooks might have to be re-written when it comes to some of the earliest land creatures, a study suggests.

By Rebecca Morelle Science reporter, BBC World Service

A visual interpretation of the body of Ichthyostega

Researchers have found that our understanding of the anatomy of the first four-legged animals is wrong.

New 3D models of fossil remains show that previous renderings of the position of the beasts' backbones were actually back-to-front.

The findings, published in the journal Nature, may even change our thinking on how the spine evolved.

The scientists looked at a group of animals called the tetrapods, examining three creatures called Ichthyostega, Acanthostega and Pederpes.

These primitive four-legged animals are of great interest to palaeontologists: they were the first creatures to haul themselves out of the oceans, paving the way for all future vertebrate life on land.

Studying how these animals are put together is key to understanding how they made this transition.

The researchers from the University of Cambridge and the Royal Veterinary College (RVC) used the European Synchrotron Radiation Facility (ESRF) to bombard the 360-million-year old fossils with high energy X-rays.

This enabled them to create detailed computer reconstructions of the prehistoric animals.

RVC's Prof John Hutchinson said: "Their vertebrae are actually structurally completely different from what everyone for the last 150 or so years has pictured. The textbook examples turn out to be wrong."

The scientists found that parts of the spine thought to face the front of the animal, in fact faced the back - and vice versa. They also discovered the earliest known evidence of a breastbone in Ichthyostega.

Prof Hutchinson said the findings provided more clues about how the early animals physically moved out of the water and on to land.

An earlier paper by the same team suggested that the tetrapods dragged themselves out of the sea, using their front legs to haul the rest of their body along the ground. The new anatomical findings backed this up, Prof Hutchinson said.

The study also shed more light on how the modern backbone evolved. He explained: "All of that anatomy [from these early land animals] was handed down to later animals. "It influenced the future evolution of the spine in everything on land. It tells us about our own development and why our own backbones developed they way they did."

http://www.livescience.com/26246-dingoes-indian-migrants-australia.html

Secret of Dingo's Down-Under Origin Revealed

Indians migrating to Australia more than 4,000 years ago may have introduced dingoes to the island continent, along with novel stone tools and new ways to remove toxins from edible plants, researchers say.

Charles Choi, LiveScience Contributor

Australia was thought to have remained largely isolated from the rest of the world between its initial colonization about 40,000 years ago by the ancestors of aboriginal Australians and the arrival of Europeans in the late 1800s. "Outside Africa, aboriginal Australians are the oldest continuous population in the world," said researcher Irina Pugach, a molecular anthropologist at the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany.

Still,researchers had not really explored the genetic history of Australians in great enough detail to address this question.

Isolated continent?

"The extent of isolation of aboriginal Australia has been debated for a long time," Pugach told LiveScience. "The Australian archaeological record documents some changes that occur in Australia around 4,000 years ago, which could have been potentially, but not necessarily, brought in from the outside."

To find out more, the researchers analyzed DNA from 344 people, including aboriginal Australians, highlanders of Papua New Guinea, Southeast Asian islanders, Indians, Nigerians, individuals of European descent living in Utah and Han Chinese from Beijing.

The scientists found a common origin for populations from Australia, New Guinea and the Mamanwa, a group from the Philippines.

The researchers estimate these groups split from one another about 36,000 years ago. This supports ideas that the groups descended from an ancient southwards migration out of Africa.

The researchers also detected substantial gene flow from Indian populations into Australia about 4,230 years ago. Scientists estimate this Indian genetic influence appears in about 10 percent of the aboriginal Australian populations they analyzed. At about the same time, the dingo first appears in the Australian fossil record, an animal that most closely resembles Indian dogs.

In addition, at about that time, "archaeologists describe a sudden shift in stone tool technologies, with new implements known as the Small Tool Tradition appearing for the first time" in Australia, Pugach said. These represented stone tools that were smaller and more finely worked than before, she explained. [Marsupial Moreover, at about that time, new techniques for altering dangerous plants to make them edible also appeared in Australia. For instance, while plants known as cycads can be toxic, soaking or fermenting their kernels can remove the poisons. "Aboriginal Australians use the fruits of these plants as an important food source despite them being highly toxic," Pugach said.

The researchers caution the migration "may not have actually been from India, but from some population somewhere else that subsequently no longer exists, but whose closest living relative — at least, among populations we examined — are Dravidian-speakers from southern India," Pugach said.

The researchers also emphasized they are not claiming some Indian group members are the ancestors of aboriginal Australians. "The migration happened about 4,000 years ago. By that time, people [had] lived in Australia for more than 40,000 years," Pugach said.

It remains uncertain why this migration might have taken place more than 4,000 years ago. Environmental changes might be one cause, "although I don't know of any significant environmental changes then," Pugach said. Then again, it could "simply be wanderlust. Humans have always liked to migrate, and don't seem to need a reason to want to do so."

Future research can analyze additional Australian populations to see how widespread this Indian influence might actually be. The scientists detailed their findings online Jan. 14 in the journal Proceedings of the National Academy of Sciences.

Irina Pugach, Frederick Delfin, Ellen Gunnarsdóttir, Manfred Kayser, Mark Stoneking Genome-wide data substantiates Holocene gene flow from India to Australia PNAS, Online Early Edition, January 2013

http://www.eurekalert.org/pub_releases/2013-01/nbi-mtt011413.php

Medicinal toothbrush tree yields antibiotic to treat TB in new way

A compound from the South African toothbrush tree inactivates a drug target for tuberculosis in a previously unseen way.

Tuberculosis causes more deaths worldwide than any other bacterial disease. At the same time as rates are increasing, resistance strains are emerging due, in part, to non-compliance with the treatment required. Many current drugs are nearly 50 years old and alternatives are needed to the long, demanding treatment schedules.

The compound under research, diospyrin, binds to a novel site on a well-known enzyme, called DNA gyrase, and inactivates the enzyme. DNA gyrase is essential for bacteria and plants but is not present in animals or humans. It is established as an effective and safe drug target for antibiotics.

"The way that diospyrin works helps to explain why it is effective against drug-sensitive and drug-resistant strains of tuberculosis," said Professor Tony Maxwell from the John Innes Centre.

In traditional medicine the antibacterial properties of the tree are used for oral health and to treat medical complaints such bronchitis, pleurisy and venereal disease. Twigs from the tree are traditionally used as toothbrushes.

Most antibiotics originate from naturals sources, such as the soil bacteria Streptomyces. Antibiotics derived from plants are less common, but they are potentially rich sources of new medicines.

"Extracts from plants used in traditional medicine provide a source for novel compounds that may have antibacterial properties, which may then be developed as antibiotics," said Professor Maxwell.

"This highlights the value of ethnobotany and the value of maintaining biodiversity to help us address global problems."

The work on diospyrin and related naphthoquinone compounds is being continued by Professor Maxwell as part of the efforts of a consortium of European researchers, More Medicines For Tuberculosis (MM4TB). The collaboration between 25 labs across Europe is dedicated to the development of new drugs for TB.

The work was carried out by postdoctoral researcher Fred Collin and will be continued by South African research assistant Natassja Bush. It is published in the Journal of Biological Chemistry: http://www.jbc.org/cgi/doi/10.1074/jbc.M112.419069.

http://www.eurekalert.org/pub_releases/2013-01/afot-ptc011413.php

Parkinson's treatment can trigger creativity

Patients treated with dopamine-enhancing drugs are developing artistic talents, reports a Tel Aviv University researcher

Parkinson's experts across the world have been reporting a remarkable phenomenon — many patients treated with drugs to increase the activity of dopamine in the brain as a therapy for motor symptoms such as tremors and muscle rigidity are developing new creative talents, including painting, sculpting, writing, and more.

Prof. Rivka Inzelberg of Tel Aviv University's Sackler Faculty of Medicine first noticed the trend in her own Sheba Medical Center clinic when the usual holiday presents from patients — typically chocolates or similar gifts — took a surprising turn. "Instead, patients starting bringing us art they had made themselves," she says.

Inspired by the discovery, Prof. Inzelberg sought out evidence of this rise in creativity in current medical literature. Bringing together case studies from around the world, she examined the details of each patient to uncover a common underlying factor — all were being treated with either synthetic precursors of dopamine or dopamine receptor agonists, which increase the amount of dopamine activity in the brain by stimulating receptors. Her report will be published in the journal Behavioral Neuroscience.

Giving in to artistic impulse

Dopamine is involved in several neurological systems, explains Prof. Inzelberg. Its main purpose is to aid in the transmission of motor commands, which is why a lack of dopamine in Parkinson's patients is associated with tremors and a difficulty in coordinating their movements.

But it's also involved in the brain's "reward system" — the satisfaction or happiness we experience from an accomplishment. This is the system which Prof. Inzelberg predicts is associated with increasing creativity.

Dopamine and artistry have long been connected, she points out, citing the example of the Vincent Van Gogh, who suffered from psychosis. It's possible that his creativity was the result of this psychosis, thought to be caused by a spontaneous spiking of dopamine levels in the brain.

There are seemingly no limits to the types of artistic work for which patients develop talents, observes Prof. Inzelberg. Cases include an architect who began to draw and paint human figures after treatment, and a patient who, after treatment, became a prize-winning poet though he had never been involved in the arts before.

It's possible that these patients are expressing latent talents they never had the courage to demonstrate before, she suggests. Dopamine-inducing therapies are also connected to a loss of impulse control, and sometimes result in behaviors like excessive gambling or obsessional hobbies. An increase in artistic drive could be linked to this lowering of inhibitions, allowing patients to embrace their creativity. Some patients have even reported a connection between their artistic sensibilities and medication dose, noting that they feel they can create more freely when the dose is higher.

Therapeutic value

Prof. Inzelberg believes that such artistic expressions have promising therapeutic potential, both psychologically and physiologically. Her patients report being happier when they are busy with their art, and have noted that motor handicaps can lessen significantly. One such patient is usually wheelchair-bound or dependent on a walker, but creates intricate wooden sculptures that have been displayed in galleries. External stimuli can sometimes bypass motor issues and foster normal movement, she explains. Similar types of art therapy are already used for dementia and stroke patients to help mitigate the loss of verbal communication skills, for example.

The next step is to try to characterize those patients who become more creative through treatment through comparing them to patients who do not experience a growth in artistic output. "We want to screen patients under treatment for creativity and impulsivity to see if we can identify what is unique in those who do become more creative," says Prof. Inzelberg. She also believes that such research could provide valuable insights into creativity in healthy populations, too.

http://arstechnica.com/science/2013/01/the-clouds-are-alive-as-microbes-fly-unfriendly-skies/

The clouds are alive as microbes fly unfriendly skies

Bacterial passengers help transform the chemistry in cloud droplets.

by Scott K. Johnson - Jan 15 2013, 2:14am TST

On a lazy summer day, you might look for animal shapes in the clouds, but you know they're not real. There's nothing alive up there but the occasional flock of airline passengers, right? Well, if you've ever had a microbiologist friend remark that a cloud reminded them of a bacterium, they were more right than you might have realized. In turns out that microbes commonly hitch a breezy ride into the clouds. And while some organisms are simply biding their time, awaiting a return to familiar terra firma, others are actively going about

their business despite their unorthodox surroundings. That's no small feat considering the conditions—it's extremely cold, UV radiation is intense, and the tiny droplets of water they often find themselves inside are acidic and chemically caustic.

Yet experiments have shown that bacteria appear to be active. And that might be important for more than just the microbes themselves. Lots of chemistry goes on in that cloud water that modifies the way clouds form and behave.

Very small particles in the atmosphere serve as "cloud condensation nuclei"—the seeds that can facilitate the formation of the droplets that make up visible clouds. Within these tiny spheres of water, dissolved substances can interact and affect the physical properties of the droplet—from the way it reflects light to the likelihood that the droplets will grow large enough to cause precipitation. Reactions can also form new particles with the ability to act as cloud condensation nuclei if the droplet evaporates instead of falling to Earth.

Past research has found that bacteria (which can serve as condensation nuclei themselves) in cloud water are capable of taking part in that chemistry, despite the cold temperatures and ultraviolet radiation. However, the experiments done so far have left out an important ingredient in the harsh cloud water cocktail—the hydrogen peroxide and hydroxyl radicals produced by UV light. These chemicals are toxic to cells.

To take the next step, a group of French researchers collected cloud water samples from high atop Puy de Dôme, a volcanic peak in central France. Half the samples were filtered to remove organisms, to serve as a baseline for comparison. Some of the samples were exposed to ultraviolet light (to drive the creation of free radicals) and the others were kept in the dark. The chemistry of the water was analyzed every 12 hours for a week. Measurements of ATP and ADP, components of the metabolic energy cycle of bacteria, showed that the organisms were indeed alive and well throughout the week despite the caustic chemistry.

In all the samples, hydrogen peroxide declined over time. (Even without ultraviolet light to split it, hydrogen peroxide will react with other compounds.) However, it was clear that the bacteria were breaking down a significant amount of the hydrogen peroxide themselves. This is likely a kind of coping mechanism—cells chemically stressed in this way produce an enzyme that helps neutralize oxidants like hydrogen peroxide and hydroxyl radicals.

Organic compounds also appear in these droplets, but the bacteria turned out to be the dominant factor behind their breakdown. For most of these chemicals, the presence of ultraviolet light (and, thus, hydroxyl radicals) was irrelevant to their stability. They only declined when there were bacteria around to munch on them. What's more, hydrogen peroxide and hydroxyl radicals didn't slow them down one bit.

So then, it's likely that bacteria really are active in clouds. And they're not just bit players—they have a significant effect on the chemistry of cloud water. They're controlling the concentration of hydroxyl radicals and forming particles that could be future condensation nuclei (making clouds that would be more reflective and less likely to generate precipitation). In order to fully understand the behavior of clouds, researchers are going to have to pay attention to the vagabond microbes eking out a living at 5,000 feet.

PNAS, 2013. DOI: 10.1073/pnas.1205743110 (About DOIs).

http://phys.org/news/2013-01-mother-trumps-marriage-co-habitation-well-being.html

Mother's education trumps marriage or co-habitation when it comes to well-being of children, study shows

It is more important for a child's well-being that they have well educated parents than that they have parents who are married or live together, according to a new study.

Phys.org - Family Relationships and Family Well Being: A Study of the Families of 9 Year Olds in Ireland, conducted by a team of researchers from University College Dublin on behalf of the Family Support Agency, is officially launched by the Minister for Children and Youth Affairs, Ms Frances Fitzgerald, TD (today). It shows that family type is not the over-riding influence on the well-being of a child.

"Once we control for parents' education and household living standards, our findings show only a slight or, in many cases, a complete absence of differences in the indicators of child well-being between children of two-parent married families, co-habiting families, step-families, and one parent families," says Professor Tony Fahey, UCD School of Applied Social Science, University College Dublin, the lead author of the study.

"All other things being equal, this research reveals that it is more important for children's well-being that they have well-educated parents (particularly in the case of the mother) than that they have parents who stay together."

For the study, the researchers measured the well-being of children in terms of cognitive development (assessed using reading and mathematics tests), social-emotional adjustment (assessed using strengths and difficulties tests), and physical health (based on mother's reports on whether the child had a chronic illness or not).

According to the findings, 79% of nine year old children in Ireland live with both their natural parents, 17.5% live in lone parent families, and 3% live in step-families (which in nearly all cases is when the natural mother has formed a second union). About one in five (20%) of never-married lone parents live with at least one grandparent, a feature of their living arrangements that the researchers found to be positive for their well-being (though not necessarily for the well-being of their children).

Better educated parents were shown to be more likely to delay the start of child-bearing until their late 20s, while the least educated mothers were more likely to have a first child before age 25. Among these 'early start' mothers, the likelihood of being unmarried lone parents was high.

The study finds that stable married families are more likely to have more children. Married couples were shown to have three children on average, while unmarried lone parents were shown to have 1.8 children on average.

"With stability in couple relationships weakest among the least educated parents and this weakness tending to reduce family size, many families of the least educated parents are now smaller than the overall average," adds Professor Fahey.

According to Professor Fahey, this is a significant reversal on the past historical situation in Ireland.

Mothers with lower secondary education or less were shown to be five to six times more likely to smoke, and more than three times more likely to show depressive symptoms than those mothers with postgraduate education.

All other things being equal, mothers who live with their parents (the child's grandparents) were half as likely as other mothers to suffer from depression or to smoke daily. This finding is mainly relevant for never-married lone mothers among whom 20% live with their own parents. "The single most important mechanism that public policy can use to combat family problems is to tackle educational disadvantage," concludes Professor Fahey.

"Recent developments in early childhood care and education, as represented especially by the introduction of a universal free pre-school year in place of a more expensive cash payment to families could be particularly beneficial and offer a model which could be extended into the future even in the context of overall reductions in public expenditure."

The study is based on a national representative sample of 8,568 children who were aged 9 in 2007-08. The sample is from the Growing Up in Ireland survey (Ireland's government-funded national study of children which commenced in 2007). *Provided by University College Dublin*

http://bit.ly/10Ha2sX

News in Brief: Chemical tied to intergenerational obesity

Mice ingesting the compound tributyltin pass effects to grandchildren

By Erin Wayman

Exposure in the womb to a chemical used in PVC and ship paint promotes obesity in mice. And the effect is long-lasting: The mice's grandchildren were also fat despite no exposure to the chemical. The work shows that the effects of an obesogen — a chemical that encourages fat accumulation — can be passed on to future generations not exposed to the chemical, researchers report online January 15 in Environmental Health Perspectives.

The compound tributyltin is often added to PVC as a stabilizer and to marine paint as an antifouling agent. Raquel Chamorro-García of the University of California, Irvine and colleagues fed pregnant mice tributyltin in their drinking water at quantities similar to what people might ingest through house dust and other sources. The mice gave birth to pups that developed more and larger fat cells, as well as fattier livers, compared with unexposed pups. These changes appear to be permanent. The children and grandchildren of these mice also had increased amounts of body and liver fat.

The findings confirmed previous work showing that tributyltin affects the function of a gene that regulates body fat production and reprograms certain stem cells to become fat cells rather than bone cells.

R. Chamorro-García et al. Transgenerational inheritance of increased fat depot size, stem cell reprogramming and hepatic steatosis elicited by prenatal exposure to the obesogen tributyltin in mice. Environmental Health Perspectives. Published online January 15, 2013.

http://www.eurekalert.org/pub_releases/2013-01/asa-pfh011513.php

Parents' financial help linked to lower college GPAs, higher graduation rates

College students who aren't studying hard may have their parents' financial support to blame.

Washington, DC - A new study by University of California, Merced, sociology professor Laura T. Hamilton found that students' GPAs decreased with increased financial support from their parents. The study also found that students with financial aid from their parents were more likely to complete college and earn a degree. The study, "More is More or More is Less? Parental Financial Investments during College," will appear in the February issue of the American Sociological Review and has been posted on the publisher's website.

"Students with parental support are best described as staying out of serious academic trouble, but dialing down their academic efforts," Hamilton wrote in the study.
Over the past several decades, colleges and universities have responded to deep cuts in external funding by increasing tuition. The costs increasingly fall on the shoulders of American parents, who often make difficult financial decisions to send their children to college. Hamilton wanted to know whether parental dollars translated to better college outcomes for children or whether they created disincentive to excel.
The answer turned out to be complex, with parental support reducing academic achievement but improving the likelihood of graduation.
"Regardless of class background, the toll parental aid takes on GPA is modest," Hamilton wrote. "Yet, any reduction in student GPA due to parental aid—which is typically offered with the best of intentions—is both surprising and important."
College students may spend their time in ways that don't reflect their parents' wishes, Hamilton said. A different study found today's college students spend an average of 28 hours a week on classes and homework combined, less than an average high school student spends in school alone. The same study also found college students spend an average of 41 hours a week on social and recreational events.
According to Hamilton's study, parental aid increased the odds of graduating within five years. Students with no parental aid in their first year of college had a 56.4 percent predicted probability of graduating, compared with 65.2 percent for students who received $12,000 in aid from their parents.
Hamilton said students might be satisficing—trying to be adequate on multiple fronts rather than trying to excel in one particular area. This makes sense in the context of today's young adult college experience, where there are great freedoms, little oversight, and many social opportunities.
Hamilton notes that many other funding sources such as grants and scholarships, work-study, student employment, and veteran's benefits do not have negative effects on student GPA. Unlike parental aid or loans, these other funding sources may come with a sense of having been earned by the student. With decreased state and federal support for higher education, however, such funds are increasingly hard for families to access.
Hamilton cautions that her results do not mean parents should cut off financial support altogether—particularly given the importance of parental funds for getting a degree. However, it is important for parents to set standards, such as a required GPA, and keep students accountable for their performance.
For the study, Hamilton relied on two nationally representative datasets collected by the National Center for Educational Statistics. The research was supported by a grant from the American Educational Research Association.

http://www.eurekalert.org/pub_releases/2013-01/uocd-bis010813.php

Body's ibuprofen, SPARC, reduces inflammation and thus bladder cancer development and metastasis

Tumors flourish in inflammed tissue; readdition of SPARC reduces inflammation and stops proliferation

Cancer researchers are increasingly aware that in addition to genetic mutations in a cancer itself, characteristics of the surrounding tissue can promote or suppress tumor growth. One of these important tissue characteristics is inflammation – most cancers prosper in and attach to inflamed tissue and so many cancers have developed ways to create it.
A University of Colorado Cancer Center study published today in the Journal of Clinical Investigation shows that the protein SPARC (Secreted Protein Acidic and Rich in Cysteine) acts much like an anti-inflammatory drug, attempting to heal tissues inflamed by tumors. Likewise, cancers – for example, bladder cancer in this study – have developed ways to turn off the production of SPARC, thus allowing growth and metastasis, especially to the lung where bladder cancer is frequently fatal.
"In fact, we show the effects of SPARC go beyond even this anti-inflammatory role. Additionally, the protein is involved in disallowing migrating cancer cells from attaching at possible metastasis sites and stopping the production of new blood vessels needed to feed tumor tissue," says Dan Theodorescu, MD, PhD, director of the University of Colorado Cancer Center and the study's senior author.
The study started by evaluating SPARC levels in human bladder cancer samples. In less aggressive cancers, both the tumor and the surrounding tissue made SPARC. In more aggressive cancers, it was just the surrounding tissue that made SPARC – the aggressive tumor itself had suppressed production of the protein. In these human bladder cancer tumors, more SPARC was associated with longer survival.
This distinction between SPARC made in the tumor and SPARC made in the surrounding tissue largely explains previous work that found high SPARC in aggressive tumors and so suggested a possible tumor-promoting role for the protein. Instead, it seems that surrounding healthy tissue may respond to a growing

tumor by increasing SPARC production, which it hopes will mute the tumor. Thus high SPARC that is in fact an attempt at tumor suppression can be coincidentally associated with aggressive tumors when the entire tumor is examined. Healthy tissue turns up SPARC to mute tumors. Aggressive cancers turn down SPARC to promote tumors.

Then Theodorescu and colleagues turned to animal models without the ability to manufacture SPARC. Not only was bladder cancer quicker to develop in these models, but the cancer was also more likely to travel to invade lung tissue. When SPARC was added to these models, tumor growth and metastasis was reduced.

"This is a comprehensive portrait of SPARC function using human and murine bladder cancer as a model, and the first to clearly distinguish between the role of SPARC generated in the tumor and the role of the protein generated in the surrounding tissue," says Theodorescu. "We hope this provides the rational basis for further exploring manipulation of SPARC as a therapeutic intervention."

http://www.sciencedaily.com/releases/2013/01/130115143852.htm

Major Step Toward an Alzheimer's Vaccine

Researchers discovered a way to stimulate the brain's natural defense mechanisms, opening the door to the development of a treatment for Alzheimer's disease and a vaccine to prevent the illness.

A team of researchers from Université Laval, CHU de Québec, and pharmaceutical firm GlaxoSmithKline (GSK) has discovered a way to stimulate the brain's natural defense mechanisms in people with Alzheimer's disease. This major breakthrough, details of which are presented January 15 in an early online edition of the Proceedings of the National Academy of Sciences (PNAS), opens the door to the development of a treatment for Alzheimer's disease and a vaccine to prevent the illness.

One of the main characteristics of Alzheimer's disease is the production in the brain of a toxic molecule known as amyloid beta. Microglial cells, the nervous system's defenders, are unable to eliminate this substance, which forms deposits called senile plaques.

The team led by Dr. Serge Rivest, professor at Université Laval's Faculty of Medicine and researcher at the CHU de Québec research center, identified a molecule that stimulates the activity of the brain's immune cells. The molecule, known as MPL (monophosphoryl lipid A), has been used extensively as a vaccine adjuvant by GSK for many years, and its safety is well established.

In mice with Alzheimer's symptoms, weekly injections of MPL over a twelve-week period eliminated up to 80% of senile plaques. In addition, tests measuring the mice's ability to learn new tasks showed significant improvement in cognitive function over the same period.

The researchers see two potential uses for MPL. It could be administered by intramuscular injection to people with Alzheimer's disease to slow the progression of the illness. It could also be incorporated into a vaccine designed to stimulate the production of antibodies against amyloid beta. "The vaccine could be given to people who already have the disease to stimulate their natural immunity," said Serge Rivest. "It could also be administered as a preventive measure to people with risk factors for Alzheimer's disease."

"When our team started working on Alzheimer's disease a decade ago, our goal was to develop better treatment for Alzheimer's patients," explained Professor Rivest. "With the discovery announced today, I think we're close to our objective."

Jean-Philippe Michaud, Maxime Hallé, Antoine Lampron, Peter Thériault, Paul Préfontaine, Mohammed Filali, Pascale Tribout-Jover, Anne-Marie Lanteigne, Rachel Jodoin, Christopher Cluff, Vincent Brichard, Rémi Palmantier, Anthony Pilorget, Daniel Larocque, and Serge Rivest. Toll-like receptor 4 stimulation with the detoxified ligand monophosphoryl lipid A improves Alzheimer's disease-related pathology. PNAS, January 15, 2013 DOI: 10.1073/pnas.1215165110

http://www.scientificamerican.com/article.cfm?id=deadly-fungus-poisons-corn-crops

Fortified by Global Warming, Deadly Fungus Poisons Corn Crops, Causes Cancer

A carcinogenic mold, its growth exacerbated by the warming climate, reached record highs in 2012

By Mollie Bloudoff-Indelicato | Tuesday, January 15, 2013 | 28

Last year's drought increased the spread of a carcinogenic mold called aspergillus (Aspergillus flavus), a fungal pathogen that poisons cattle, kills pets and has infected the 2012 corn crop, rendering significant portions of the harvest unfit for consumption.

Whereas the deadly organism mainly affects countries like China and developing African nations, many U.S. states have experienced an increase in corn contamination since 2011. Farmers are likely to see more of the carcinogen as temperatures continue to rise and droughts become more frequent.

"It's really a climate variable issue," says Barbara Stinson, founding and senior partner of Meridian Institute, a public policy organization. "We're probably looking at an increase in aflatoxin as a result of that."

A. flavus releases toxic spores that can be fatal when ingested, prompting symptoms that include jaundice, liver cancer and internal bleeding. The poison is so deadly that in 1995 Iraqi dictator Saddam Hussein confessed to

weaponizing the mold spores for use in biological warfare. The high toxicity of the mold means crops with more than 20 parts per billion—the equivalent of about 100 kernels in a truckload of corn—can't cross state lines, says Ronnie Heiniger, professor of cropping systems at North Carolina State University.

That's bad news for the agricultural industry, which suffers annual losses of more than $190 million due to aspergillus. Last year the green-black mold contaminated more than half the corn harvested in Missouri by October. In contrast, only 8 percent of the 2011 crop suffered, according to the Missouri Grain Inspection Service.

"We have a big aflatoxin problem," says Charles Woloshuk, a botanist and plant pathologist at Purdue University. "There are loads of corn coming to the [grain] elevators that have been rejected."

Grains like corn and cereals are well documented hosts of aspergillus, although the fungus is also found in oilseed, spices, tree nuts, groundnuts, milk, meat and dried fruit—all staples on which a significant portion of the world's population rely for sustenance. Drought conditions don't cause the mold, but they do help speed its expansion. Unlike the fuzzy stuff that grows on bathroom tiles or in the back of the garage, A. flavus prefers hot, dry climes—precisely like the drought afflicting more than half the U.S.

Although the international community has adopted strict legislation to regulate the acceptable amount of aflatoxin for individual countries, cases of poisoning, called aflatoxicosis, still surface regularly. Because the level of aflatoxins found in any given load of corn can be higher than the legal maximum, farmers are allowed to mix contaminated corn with safe corn to dilute the amount—but sometimes contaminants slip through the cracks.

"That's always the problem with a contaminant at these low levels—the distribution of that contaminant in that load," Heiniger says. "The detection of these contaminants is almost more of an art than a science because you're searching for this one little kernel." He adds, "If you selected one bite from that whole area and happened to hit that one kernel you'd get the contaminant."

Aflatoxin contamination is a global food security issue, but it's especially a problem in developing countries, which are often largely populated by subsistence farmers who don't have the resources, technology or infrastructure needed for adequate grain testing. Lack of education about the effects of the mold also contributes to aflatoxicosis poisoning.

"The average person can't tell whether the mold contains aflatoxin. You can't tell if it's highly toxic or an innocuous fungus," Stinson says. "So people are used to eating it and don't know that they're poisoning themselves or their children."

To make matters worse, aflatoxins react strongly to the hepatitis B virus (HBV), the most common cause of liver cancer in the world. In countries where HBV is endemic, such as in China and some African nations, ingesting the mold intensifies and speeds liver failure by acting as an immunosuppressant. Consequently, there are over 750,000 new reported cases of primary liver cancer reported yearly worldwide, making it the sixth most common cancer for humankind, according to 2008 statistics from the World Cancer Research Fund International.

The cost in human life is likely due, in part, to international trade issues. Because aspergillus standards in developed countries are so high, African nations export much of their pure commodities overseas, leaving the tainted crops at home for consumption by locals. Natural disasters that increase foreign demand for African products—like floods and droughts in industrialized countries—only compound the issue.

Researchers at the University of Pittsburgh (Pitt) estimate more than five billion people worldwide are at risk for chronic exposure through contaminated foods, according to a March 2012 study published in PLoS One.

"Strict aflatoxin standards mean that many nations will export their best-quality foods and keep contaminated foods domestically, resulting in higher aflatoxin exposure in low- or middle-income nations where hepatitis prevalence is high," wrote co-authors Felicia Wu and Hasan Guclu, both Pitt faculty members.

Whereas the U.S. is most often spared the cost in human health, the repercussions aren't nil. Dairy cows and cattle, already stressed from living in close proximity to large numbers of animals, are at particularly high risk for succumbing to aflatoxicosis, though they can handle higher doses of toxin. Pets, too, are susceptible to the poison. In 2007 aflatoxins forced a nationwide pet food recall—but not before dozens of man's best friends fell ill and died.

Researchers have not yet found an animal species immune to the aspergillus's effects. The spores are so poisonous that even destroying the contaminated crops is an ordeal. Scientists worldwide keep careful tabs on aflatoxins in a large-scale effort to avoid outbreaks of aflatoxicosis, according to Stinson.

"Our understanding is that in some cases you can't even incinerate (contaminated food) safely because the aflatoxin can get airborne and be inhaled," she says. "If there is a high level of aflatoxin…they're going to be in the position of having to store and destroy crops."

http://www.sciencedaily.com/releases/2013/01/130115153519.htm

New Technique Helps Stroke Victims Communicate

Stroke victims with Broca's aphasia have been shown to speak fluidly through a process called "speech entrainment

Stroke victims affected with loss of speech caused by Broca's aphasia have been shown to speak fluidly through the use of a process called "speech entrainment" developed by researchers at the University of South Carolina's Arnold School of Public Health.

Aphasia, a severe communication problem caused by damage to the brain's left hemisphere and characterized by halting speech, occurs in about one-third of people who have a stroke and affects personal and professional relationships. Using the speech entrainment technique, which involves mimicking other, patients showed significant improvement in their ability to speak.

The results of the study are published in a recent issue of the neurology journal Brain.

"This is the first time that we have seen people with Broca's aphasia speak in fluent sentences," said Julius Fridriksson, the study's lead researcher and a professor with the Department of Communication Sciences and Disorders at the Arnold School. "It is a small study that gives us an understanding of how the brain functions after a stroke, and it offers hope for thousands of people who suffer strokes each year."

In Fridriksson's study, 13 patients completed three separate behavioral tasks that were used to understand the effects of speech entrainment on speech production. During the "speech entrainment-audio visual" portion of the study, participants attempted to mimic a speaker in real-time whose mouth was made visible on the 3.5-inch screen of an iPod Touch and whose speech was heard via headphones.

The "speech entrainment-audio only" condition involved real-time mimicking speech presented via headphones with the screen of the iPod blank. During a spontaneous speech condition, patients spoke about a given topic without external aid.

Each patient also completed a three-week training phase where they practiced speech every day with the aid of speech entrainment. Overall, the training resulted in improved spontaneous speech production, something that is relatively rare in this population. Ultimately the patients were able to produce a short script about their stroke to tell to other people.

Neuroimaging results from the patient subjects have also given Fridriksson and his research team a greater understanding of the mechanism involved in speech entrainment.

"Preliminary results suggest that training with speech entrainment improves speech production in Broca's aphasia, providing a potential therapeutic method for a disorder that has been shown to be particularly resistant to treatment," Fridriksson said.

Click here to see an online video of speech entrainment. The video features a former Green Beret and career military officer who suffered a stroke in his 50s and has been unable to speak for about 22 years, except for a couple of phrases. The video first shows him speaking with and without audio-visual speech feedback. The patient struggles to produce spontaneous speech but is able to mimic fluent speech using audio-visual feedback.

J. Fridriksson, H. I. Hubbard, S. G. Hudspeth, A. L. Holland, L. Bonilha, D. Fromm, C. Rorden. Speech entrainment enables patients with Broca's aphasia to produce fluent speech. Brain, 2012; 135 (12): 3815 DOI: 10.1093/brain/aws301

http://www.eurekalert.org/pub_releases/2013-01/nioe-hfs011613.php

H1N1 flu shots are safe for pregnant women

NIH researcher assists in study of Norwegian women

Norwegian pregnant women who received a vaccine against the 2009 H1N1 influenza virus showed no increased risk of pregnancy loss, while pregnant women who experienced influenza during pregnancy had an increased risk of miscarriages and still births, a study has found. The study suggests that influenza infection may increase the risk of fetal loss.

Scientists at the U.S. National Institutes of Health and the Norwegian Institute of Public Health (NIPH) published their findings online Jan. 17 in the New England Journal of Medicine. The research was conducted following the H1N1 influenza pandemic that took place between spring 2009 and fall 2010. The researchers at the NIH were from the National Institute of Environmental Health Sciences (NIEHS).

Norwegian public health officials had urged pregnant women to be vaccinated. However, media reports of pregnancy losses after flu shots caused some expectant mothers to forgo vaccination.

First author Siri Haberg, M.D., Ph.D., of the NIPH and colleagues initiated the study to help address the question of vaccine safety, by taking advantage of Norway's excellent registries and medical records system. Haberg spent one year of her postdoctoral fellowship in the NIEHS Epidemiology Branch before returning home to Norway during the pandemic.

NIEHS researcher and co-author Allen Wilcox, M.D., Ph.D., said the NIPH researchers combined data from obstetrical visits, birth records, and vaccination registries to investigate whether the influenza vaccination posed a risk to pregnancy. The study found that influenza infection increased the risk of fetal loss by up to twofold. Influenza vaccination did not increase the risk of loss. Instead, the results suggest that vaccination reduces the risk of fetal loss.

"Most important is that vaccinations protect pregnant women against influenza illness, which could be harmful for both the mother and the baby," Wilcox said. "If pregnant women are worried about their fetus, then getting a flu shot is a good thing to do."

Haberg added, "Pregnant women should find it reassuring that we found no harmful effects on the fetus associated with H1N1 vaccination."

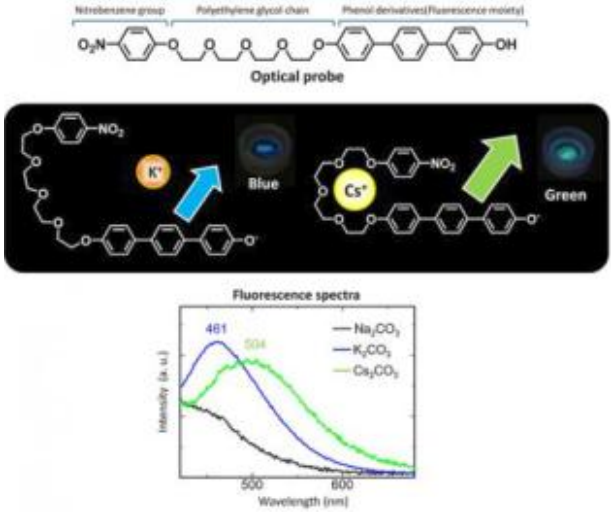
Haberg SE, Trogstad L, Gunnes N, Wilcox AJ, Gjessing HK, Samuelsen SO, Skrondal A, Cappelen I, Engeland A, Aavitsland P, Madsen S, Buajordet I, Furu K, Nafstad P, Vollset SE, Feiring B, Nokleby H, Magnus P, Stoltenberg C. 2013. Risk of fetal death after pandemic influenza infection or vaccination. N Engl J Med; doi:10.1056/NEJMoa1207210 [Online 17 January 2013].

http://phys.org/news/2013-01-millimeter-level-naked-eye-cesium-solid-surface.html

Millimeter-level naked-eye detection of Cesium location at solid surface

The NIMS International Center for Materials Nanoarchitectonics (WPI-MANA) has developed a supermolecular material which makes it possible to visualize the distribution of cesium on the surface of solids and in living organisms by fluorescence.

As a result of the accident at the Fukushima No. 1 Nuclear Power Plant following the Great East Japan Earthquake of March 2011, a large amount of radioactive substances leaked and contaminated a wide area. Among those substances, cesium 137, which is a radioactive isotope of cesium, has a long half-life of 30 years, and thus will continue to be a source of radiation in the future. The Japanese government has planned and implemented decontamination measures for the region which was contaminated by radioactive substances. However, if the distribution of cesium can be visualized, this decontamination work can be carried out more efficiently, and a reduction in the amount of contaminated waste generated by the decontamination work can also be expected. At present, research and development of a camera that enables visualization of radioactive substances is being carried out with the cooperation of industry, academia, and government agencies.



Molecular structure, mechanism of fluorescence, and fluorescence spectrum of the optical probe substance for cesium detection.

This research group developed a fluorescent probe that detects cesium using supermolecular interaction. This optical probe emits green fluorescent light when it contains cesium, thereby enabling visual confirmation of cesium distributed on the surface of a solid. It has higher spatial resolution than the existing methods of detecting radioactive substances, and makes it possible to visualize the distribution of cesium with submillimeter accuracy. The technology for detection of cesium ions, not limited to radioactive isotopes, is expected to compensate for the weaknesses of these existing methods.

When alcohol in which this optical probe has been dissolved is sprayed on soil that contains cesium, and the soil is then irradiated with an ultraviolet light, only the spots that are contaminated with cesium emit green fluorescent light. Because this enables selective removal of only the cesium-contaminated spots, a large reduction in the amount of contaminated waste generated by decontamination work can be expected.

Furthermore, when alcohol in which the optical probe has been dissolved is sprayed on the cross section of the stem of a plant immersed in water that contains cesium, and is then irradiated with an ultraviolet light, only the parts that contain cesium emit green fluorescent light. In other words, a visual understanding of the diffusion behavior and accumulation process of cesium is possible.

The results of this research make it possible to visualize the distribution of cesium with submillimeter accuracy, and thus are expected to make an important contribution to higher efficiency in decontamination work, elucidation of the cesium diffusion and accumulation process, and related issues.

These research results are scheduled for online publication in the January 2013 issue of the scientific journal Science and Technology of Advanced Materials. Provided by National Institute for Materials Science

http://www.bbc.co.uk/news/uk-scotland-21032362

Orphan drugs: Remarkable drugs at remarkable prices

It's one of the oldest debates in economics: what's the difference between what something costs and what it's worth?

By Ken Macdonald BBC Scotland Science Correspondent

The debate has been given new life by the advent of orphan drugs.

The term was coined in the US. They are "orphan drugs" for the simple reason that they were designed to treat orphan diseases - conditions so rare that only a relative handful of people are affected.

Lesley Loeliger, who lives just to the south of Glasgow, remembers the day she was diagnosed with the orphan disease Paroxysmal Nocturnal Haemoglobinuria - PNH for short. The doctor explained it was a bone marrow disease with a median survival rate of just 10 years.

Its effects were dreadful.

"I was having to be carried up and down the stairs," she says.

"I was having to be dressed and undressed. I just couldn't do anything for myself. Sometimes, when I was so bad, and I was so exhausted I couldn't even turn over in bed."

Since then, Lesley's life has been transformed by an orphan drug called Soliris.

It's an exceptional treatment at an exceptional price. At £250,000 per patient, per year, Soliris is the world's most expensive drug.

Scotland's medicines watchdog, the Scottish Medicines Consortium, says Soliris isn't cost effective and doesn't recommend its use in the NHS. But Lesley and eight other patients are receiving the treatment because the Scottish government accepts there is no other treatment suitable for them.

'Big business'

Soliris's makers Alexion say its price is fair as they bore "enormous costs and risks" in the drug's development. They say one-third of patients died within five years before Soliris was available, and governments and private insurers in more than 35 countries recognise its value.

Soliris is exceptional but not unique. More than 60 orphan drugs are approved for use in Europe. Not all are as expensive as Soliris, but taken together the sector spells big business.

Dr Kiran Meekings, of Thomson Reuters Life Sciences, has been analysing the sector.

She says the potential profits are huge: "The orphan drug market at the moment we know is $50bn and growing ... at about a rate of 6% per year.

"Soon that's going to become a very large sum of money, so with regard to the future projections, it'd be interesting to see what the market can bear."

The drugs industry says the prices of orphan drugs reflect the cost of research.

Dr Frances Macdonald, from the Association of the British Pharmaceutical Industry, says it costs roughly £1bn to bring a new drug to market.

"Also," she says, "the one medicine that makes it to market has to recover the cost of those that didn't.

"And of molecules that go into basic research, only about one in 5,000 will come through. And of those that start in phase 1 clinical trials, only about one in 10 will come through."

It seems counterintuitive - and contrary to the time-honoured teaching about economies of scale - that medicines targeted at a relatively small number of patients could be worth the effort of the pharmaceutical industry.

That was the argument which led the authorities on both sides of the Atlantic to offer incentives to develop orphan medicines: subsidies for research, tax breaks and marketing monopolies.

But Dr Carl Heneghan, director of the Centre for Evidence Based Medicine at Oxford University, fears this could backfire to the cost of the NHS.

"There are lots of orphan drugs and lots of orphan diseases still to be tackled," he says, "and actually we could start swamping healthcare payers with costs across the board with these very expensive drugs.

"And they get overwhelmed and just say actually we can't look at any of these - there's too many coming our way."

The Scottish government is investing £21m in a fund to pay for orphan drugs. A wider review is also under way into how new drugs become available on the NHS.

Ultimately, it'll come down to that difference between how much things cost - and what they're worth. And to Lesley Loeliger, Soliris is priceless: "To me this drug is a miracle.

"My family had to face the possibility of me going in 10 years. My husband had to face the chance of bringing up the children on his own.

"My mum and dad faced the possibility of losing their daughter. And I appear to be getting better."

http://bit.ly/SpcHCW

Vaccine Switch Urged for Eradication of Remaining Pockets of Polio

An inactivated virus vaccine, delivered by injection rather than orally, could be key to eradicating polio globally

By Ewen Callaway and Nature magazine | Wednesday, January 16, 2013

By sunrise on a warm December morning, Janila Shulu's team are out in the dirt roads and alleyways of Ungwan Rimi, a poor neighborhood in a predominantly Muslim section of Kaduna city in northern Nigeria. Three female health workers, accompanied by a community leader, dart from house to house, squeezing a few drops of polio vaccine into the mouths of all the young children they can find, even those who pass by on the street. By 1 p.m., after giving hundreds of doses, they stop for the day — the first of a national five-day effort.

Such campaigns are the backbone of the global push to eradicate polio, but this month the World Health Organization (WHO) in Geneva, Switzerland, proposed a shift in vaccination strategy from oral vaccines to injected ones that may have to be administered in clinics. The change is needed to mop up the last remaining pockets of polio, but experts say that it poses challenges in places such as Kaduna city, which have poor access to health care.

The new policy is an important step towards eradication, says Nicholas Grassly, an epidemiologist at Imperial College London, but implementing it will be difficult. "There are some big ifs as to whether it can happen," he says.

Jonas Salk is credited with developing the first polio vaccine in 1955, an injected vaccine containing killed virus, but the oral live vaccine devised a little later by his competitor Albert Sabin is the workhorse of the Global Polio Eradication Initiative. This public–private effort, started in 1988 and coordinated by the WHO, has cost about US$8 billion so far. The Sabin vaccine is composed of three live but crippled strains of polio. It is cheap and easy to administer, making it ideal for national campaigns that involve tens of thousands of minimally trained workers.

But the live viruses in the Sabin vaccine can revert to disease-causing forms, especially in populations where immunity is not widespread. Northern Nigeria has been battling such vaccine-derived outbreaks since 2005, and one emerged last year in Pakistan (see Nature 485, 563; 2012).

In a 4 January announcement, the WHO called for oral polio vaccine containing the polio strain type 2, one of the Sabin vaccine strains, to be phased out — perhaps in as little as two years. The wild form of type 2 has been stamped out globally, but vaccine-derived forms of the strain still circulate in Nigeria and neighboring countries. Oral polio vaccination will continue, but it will use a vaccine that protects against just the two other types of polio virus that are still circulating in their wild form in Nigeria, Pakistan and Afghanistan.

Meanwhile, the policy also calls for the introduction, as quickly as possible, of the oral vaccine's old competitor: the inactivated Salk vaccine. That costs more than ten times as much as the oral vaccine and requires trained health workers to administer it, says Roland Sutter, a vaccinologist at the WHO. But it carries no risk of causing polio. By giving children an inactivated vaccine that protects against all three subtypes of polio, health workers hope to gradually stamp out vaccine-derived outbreaks.

"You have to have a transition period" in which both oral and inactivated vaccines are used, "because if you stop cold turkey you're going to have outbreaks", says Vincent Racaniello, a virologist at Columbia University in New York City. Once the remaining wild polio types are wiped out, the WHO will phase out all oral polio vaccines.

The high cost of the inactivated polio vaccine remains a significant hurdle for the plan, which depends on a reduction in cost to less than 50 cents per dose from the current cost of more than $2, says Sutter. Boosting the immune response by including adjuvants, and delivering the vaccine under the skin instead of into muscle, could help to lower the dose required and cut costs, as could new kinds of vaccine, he says.

Health infrastructure poses another big hurdle, says Grassly. Delivering the vaccine in clinics instead of door to door will pose a challenge for Nigeria, which has one of the lowest rates of routine immunization in the world. Less than 50% of children receive a complete schedule of childhood vaccinations, and in parts of northern Nigeria that figure is around 10%.

"We as a global community have to do a much better job of integrating polio and routine immunization," says Zulfiqar Bhutta, an immunization expert at Aga Khan University in Karachi, Pakistan, and a member of the WHO committee that issued the new vaccination policy. He sees the eventual switch to inactivated vaccines as an opportunity to align polio eradication with routine immunization. "We should have done this a lot earlier," he says.

http://phys.org/news/2013-01-sustainable-concrete-newly-benefits.html

Sustainable reinforcement for concrete has newly discovered benefits

New research is enhancing jute's appeal as a reinforcement for mortar and concrete

Fashionable people may turn up their noses at jute—the cheap fiber used to make burlap, gunny sacks, twine and other common products - but new research is enhancing jute's appeal as an inexpensive, sustainable reinforcement for mortar and concrete. The study appears in ACS' journal Industrial & Engineering Chemistry Research.

Subhasish B Majumder and colleagues note that there has been a resurgence of interest in using economical, sustainable natural fibers, rather than steel or synthetic fibers, to reinforce the cement compositions used to make concrete and mortar, the world's most widely used building materials. That reinforcement makes cement compositions stronger and more resistant to cracks. Their previous research showed that jute works as a reinforcement fiber.

The new study discovered another advantage of jute, which is second only to cotton as the most widely used natural fiber. The addition of jute fibers also delays the hardening of concrete and mortar, which must be trucked to construction sites. "The prolonged setting of these fiber-reinforced cement composites would be beneficial for applications where the pre-mixed cement aggregates are required to be transported from a distant place to construction site," the report states.

More information: "Effect of Jute as Fibre Reinforcement Controlling the Hydration Characteristics of Cement Matrix" Ind. Eng. Chem. Res., Article ASAP. DOI: 10.1021/ie300607r

Abstract

The present investigation deals with the effect of jute as a natural fiber reinforcement on the setting and hydration behavior of cement. The addition of jute fiber in cement matrix increases the setting time and standard water consistency value. The hydration characteristics of fiber reinforced cement were investigated using a variety of analytical techniques including thermal, infrared spectroscopy, X-ray diffraction, and free lime estimation by titration. Through these analyses it was demonstrated that the hydration kinetics of cement is retarded with the increase in jute contents in cement matrix. A model has been proposed to explain the retarded hydration kinetics of jute fiber reinforced cement composites. The prolonged setting of these fiber reinforced cement composites would be beneficial for applications where the premixed cement aggregates are required to be transported from a distant place to the construction site. *Provided by American Chemical Society*

http://www.eurekalert.org/pub_releases/2013-01/uog-aap011713.php

Amputations among people with diabetes can be reduced by 50 percent

Every 30 seconds somebody in the world is amputated as a consequence of foot complication due to diabetes.

A new study at Sahlgrenska Academy, University of Gothenburg, Sweden, confirmes that shoe inserts, podiatry, regular checkups and other simple interventions can reduce the number of amputations by more than 50%.

Orthotic researchers at Sahlgrenska Academy, University of Gothenburg, have studied diabetic foot complications ever since 2008. They have focused on protecting the foot from overloading the foot sole in order to minimize the risk of ulcers, which may eventually lead to amputation.

The researchers have now completed a study of 114 Swedish patients with diabetes at risk of developing such ulcers. The results show that shoe inserts, podiatry, information and regular checkups can prevent ulcers, which would reduce the number of amputations by more than 50 per cent.

The participants in the study – to be presented at the International Conference on Prosthetics and Orthotics in Hyderabad, India this February – have an averaged 58 years of age and 12 years since their initial diagnosis of diabetes. The participant wore one of three different types of shoe inserts over a period of two years.

Only 0.9% of the participants developed new foot ulcers during the first year, as opposed to the figure of 3–8% that has been reported for similar diabetic populations.

"We found that good shoes and inserts can reduce pressure on the foot by 50% compared with going barefoot," doctoral student Ulla Tang says. "Our conclusion at the end of one year is that all three types of inserts effectively distribute pressure under the sole in order to minimize the risk of ulcers." The study also revealed that only 67% of diabetes patients had been offered podiatry despite the fact that 83% had calluses.

"An insert costs anywhere from SEK 850 to SEK 1,450," Ms. Tang says. "Healing a diabetic foot ulcer averages SEK 70,000, while an amputation demands up to SEK 1 million in social and healthcare resources. Ulcer prevention is not only a way of relieving suffering but a sound financial investment."

The researchers attending the conference in India are also planning to introduce a new digital tool that they have developed in collaboration with the Västra Götaland region. With the digital tool assessment of the risk for foot ulcer will be easier and reliable. The idea is that orthotist will use the instrument as a basis for the prescription of suitable shoes and insoles.

http://www.bbc.co.uk/news/health-21040254

Light in womb 'gives healthy eyes' - in mice

Light passing through the body and into the womb has an important role in the developing eye, US researchers have discovered.

By James Gallagher Health and science reporter, BBC News

A study, published in the journal Nature, showed that mice spending pregnancy in complete darkness had babies with altered eye development. It indicated tiny quantities of light were needed to control blood vessel growth in the eye. The researchers hope the findings will aid understanding of eye disorders.

Light or dark?

If you could journey inside a mouse or a person, there would not be enough light to see. However, tiny quantities of light do pass through the body. This effect has already been used to film an infection spreading through the body.

Now scientists - at the University of California, San Francisco, and Cincinnati Children's Hospital Medical Center - believe that body-penetrating light can alter the development of the eye, at least in mice.

Normally, a network of blood vessels known as the hyaloid vasculature is formed to help nourish the retina as it is constructed. However, the blood vessels would disrupt sight if they remained, so they are later removed - like scaffolding from a finished building. The researchers said this did not happen when the pregnancy was spent in total darkness. The critical period was around 16 days - which is very late in mouse gestation, but corresponds to the first trimester in people.

"It's not something subtle here, it's a major effect on the way the retina develops that requires light going through the body," said Prof Richard Lang, from Cincinnati Children's Hospital. He said it was a "huge surprise" that this was happening.

Premature babies

The researchers hope their findings may aid understanding of human diseases of the eye, as many are down to blood vessels. Some babies born prematurely develop "retinopathy of prematurity", when the blood vessels in the eye grow abnormally resulting in damage to the retina and a loss of vision. Prof Lang said: "In retinopathy of prematurity there is overgrowth of blood vessels and that's what you see in these mice."

The researchers showed that light was activating in the mice a protein, melanopsin, which also has a role in regulating the body clock, and is present in people. However, whether the same processes take place in people or other animals is unknown.

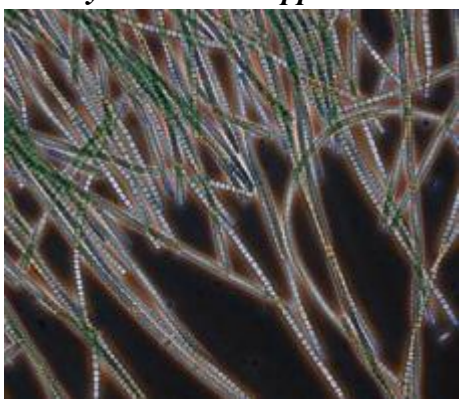
Prof Robin Ali, from University College London, said it was a "fascinating study". He said more research was still needed, but the findings may lead to considerations of light levels during pregnancy and efforts to grow retinas in the laboratory. He said: "It gives us a whole new aspect to consider in in the development of the retina. "It illustrates how much we've yet to understand about the eye."

http://www.eurekalert.org/pub_releases/2013-01/uoz-goe011713.php

Great Oxidation Event: More oxygen through multicellularity

Earth's oxygenation began at almost the same time as multicellular cyanobacteria appeared

Cyanobacteria belong to the Earth's oldest organisms. They are still present today in oceans and waters and even in hot springs. By producing oxygen and evolving into multicellular forms, they played a key role in the emergence of organisms that breathe oxygen. This has, now, been demonstrated by a team of scientists under the supervision and instruction of evolutionary biologists from the University of Zurich. According to their studies, cyanobacteria developed multicellularity around one billion years earlier than eukaryotes – cells with one true nucleus. At almost the same time as multicellular cyanobacteria appeared, a process of oxygenation began in the oceans and in the Earth's atmosphere.



This shows a multicellular cyanobacterium. **Picture: UZH**

Multicellularity as early as 2.3 billion years ago

The scientists analyzed the phylogenies of living cyanobacteria and combined their findings with data from fossil records for cyanobacteria. According to the results recorded by Bettina Schirrmeister and her colleagues, multicellular cyanobacteria emerged much earlier than previously assumed. «Multicellularity developed relatively early in the history of cyanobacteria, more than 2.3 billion years ago», Schirrmeister explains in her doctoral thesis, written at the University of Zurich.

Link between multicellularity and the Great Oxidation Event

According to the scientists, multicellularity developed shortly before the rise in levels of free oxygen in the oceans and in the atmosphere. This accumulation of free oxygen is referred to as the Great Oxidation Event, and is seen as the most significant climate event in the Earth's history. Based on their data, Schirrmeister and her doctoral supervisor Homayoun Bagheri believe that there is a link between the emergence of multicellularity and the event. According to Bagheri, multicellular life forms often have a more efficient metabolism than unicellular forms. The researchers are thus proposing the theory that the newly developed multicellularity of the cyanobacteria played a role in triggering the Great Oxidation Event.

Cyanobacteria occupied free niches

The increased production of oxygen set the Earth's original atmosphere off balance. Because oxygen was poisonous for large numbers of anaerobic organisms, many anaerobic types of bacteria were eliminated, opening up ecological 'niches'. The researchers have determined the existence of many new types of multicellular cyanobacteria subsequent to the fundamental climatic event, and are deducing that these occupied the newly developed habitats. «Morphological changes in microorganisms such as bacteria were able to impact the environment fundamentally and to an extent scarcely imaginable», concludes Schirrmeister.

Bettina E. Schirrmeister, Jurriaan M. de Vos, Alexandre Antonelli, Homayoun C. Bagheri. Evolution of multicellularity coincided with increased diversification of cyanobacteria and the Great Oxidation Event. PNAS Early Edition. January 14, 2013. doi: 10:1072/pnas.1209927110/-/DCSupplemental

Great Oxidation Event

The Great Oxidation Event refers to a period around 2.3 billion years ago. It was no longer possible for newly created oxygen to be captured in chemical compounds. Instead, it started to accumulate as oxygen in the oceans and in the atmosphere.

Previously, in the Earth's early atmosphere, there were only traces of free oxygen. All life was based exclusively on anaerobic processes – chemical reactions that did not require oxygen. With the emergence of cyanobacteria that oxidized water with the help of light and produced oxygen as a by-product, the conditions for life on Earth gradually began to transform.

http://www.eurekalert.org/pub_releases/2013-01/uob-vcf011713.php

Viagra converts fat cells

Researchers from the University of Bonn discovered the signaling pathway by which potency enhancer Viagra might be able to fight excess weight

Researchers from the University of Bonn treated mice with Viagra and made an amazing discovery: The drug converts undesirable white fat cells and could thus potentially melt the unwelcome "spare tire" around the midriff. In addition, the substance also decreases the risk of other complications caused by obesity. The results are now published in "The Journal of the Federation of American Societies for Experimental Biology" (FASEB).

Sildenafil – better known as Viagra – is used to treat erectile dysfunction. This substance prevents degradation of cyclic guanosine mono-phosphate (cGMP), which then ensures blood supply for an erection. However, another effect of Viagra has been noticed quite some time ago – mice given sildenafil over longer periods of time were resistant to obesity when fed with high-fat diet. However, the cause for this reduced weight gain had been unclear. Researchers from the University of Bonn have been able to shed some light on this sildenafil effect. "We have been researching the effect of cGMP on fat cells for quite some time now," reports Prof. Dr. Alexander Pfeifer, Director of the Institute for Pharmacology and Toxicology at the University of Bonn. "This is why sildenafil was a potentially interesting candidate for us."

Viagra converts undesirable white fat cells into beige ones

Together with the PharmaCenter of the University of Bonn, the German Federal Institute for Drugs and Medical Devices (BfArM), and the Max Planck Institute for Heart and Lung Research, the team around Prof. Pfeifer studied the effect of sildenafil on fat cells in mice. The researchers administered the potency drug to the rodents for seven days. "The effects were quite amazing," says Dr. Ana Kilic, one of Prof. Pfeifer's colleagues. Sildenafil increased the conversion of white fat cells, which are found in human 'problem areas', into beige ones in the animals. "Beige fat cells burn the energy from ingested food and convert it to heat, says Prof. Pfeifer. Because the beige fat cells can "melt the fat" and thus fight obesity, researchers are very hopeful for their potential.

Positive effect on inflammation responses

In addition, the researchers observed something else of interest. If white fat cells are further "stuffed"/accumulating lipids, they are increasing in size and can synthesize and release hormones which in turn cause inflammation thus increasing the persons risk for chronic diseases. Such inflammatory responses may

then lead to, e.g., cardio-vascular diseases resulting in heart attacks and strokes, as well as cancer and diabetes. "It seems that sildenafil prevented the fat cells in these mice from getting onto that slippery slope," reports Prof. Pfeifer. Overall, the development of white cells seems to be healthier.

More than half a billion overweight people worldwide

Globally, over half a billion people are overweight. Present study has resulted in interesting starting points for further research on this mechanism. "Sildenafil is not only able to minimize erectile problems, but it can also reduce the risks of gaining excessive weight," says Prof. Pfeifer. The researchers may have found a mechanism that allows converting the undesirable white fat cells into the "good" beige (brown-like) fat cells that "melt" away excess pounds. In addition, it might be possible to decrease complications related with obesity. "But this will need to be proven in additional studies," adds Dr. Kilic.

Caution against premature application

Despite promising data, researchers caution the public against the fallacy of thinking that popping some sildenafil will work to quickly lose the extra pounds accumulated over the holidays. "We are currently in the basic research stage, and all the studies have been exclusively performed on mice," stresses Prof. Pfeifer. It will be a long way until potentially suitable drugs for decreasing white fat cells in humans will be found.

Publication: Increased cGMP promotes healthy expansion and browning of white adipose tissue, "The Journal of the Federation of American Societies for Experimental Biology" (FASEB), Online: http://www.fasebj.org/content/early/2013/01/08/fj.12-221580.full.pdf+html (The print version of this article will appear in the April issue)

http://www.eurekalert.org/pub_releases/2013-01/uhn-cif011713.php

Critically ill flu patients saved with artificial lung technology treatment

Normally used for lung transplant patients

TORONTO - In recent weeks the intensive critical care units at University Health Network's Toronto General Hospital have used Extra Corporeal Lung Support (ECLS) to support five influenza (flu) patients in their recovery from severe respiratory problems.

ECLS systems are normally used at the hospital as a bridge to lung transplantation but increasingly, the hospital is using ECLS on patients where the usual breathing machines (ventilators) cannot support the patient whose lungs need time to rest and heal.

The ECLS systems are essentially artificial lungs that oxygenate the patient's blood outside the body, which gives lungs the chance to rest and heal. This method of oxygenation means that a ventilator is not used to help the patient breath and also means that the patient is not exposed to the possibility of further lung injury, which can happen to ventilated patients. The use of ECLS system requires expertise in its use to avoid other problems such as clots, bleeding problems and infections related to use of the device.

The lung is the only organ that, even when injured, is required to support the life of the patient while it is enduring the injury and trying to recover. The ventilators routinely used in this setting can actually add further injury to the lung on top of the original injury caused by the flu or pneumonia. This is where ECLS can play an important role by taking over the job of the lung so that the lung has a chance to be treated, rest and recover.

"ECLS is an important part of our ability to bridge patients to lung transplantation and we have a great deal of experience in its use," said Dr. Shaf Keshavjee, who directs the ECLS Program as part of the Toronto Lung Transplant Program. Dr. Keshavjee is a thoracic surgeon and the Surgeon in Chief at University Health Network. "As the technology has improved over the years, we are now able to offer this life-saving therapy to the small percentage of patients with influenza that get into severe trouble with acute lung injury.

This is part of our strategy to be prepared should we have a serious flu epidemic. The past few weeks have illustrated that our planning and training of our team has paid off. When several Ontario hospitals called us for help with their patients in serious lung failure, we were able to transfer those patients in and provide this life-saving therapy. All five patients survived to be weaned off the ECLS machines."

The use of ECLS requires insertion of a tube to remove blood from a large vein, which then has oxygen added to it and carbon dioxide removed. The blood is then pumped back into the patient through a second tube in another vein or artery. These patients are taken care of by a team of thoracic surgeons, intensivists, perfusionists and specially trained nurses in the Intensive Care Unit at TGH.

"Earlier this year, a patient arrived for urgent lung transplantation," said Dr. Eddy Fan, Intensivist and Medical Director of the ECLS Program at UHN's Toronto General Hospital. "After using ECLS, the patient's lungs healed themselves and we avoided a lung transplant. This is a remarkable outcome and our experience with flu patients is particularly rewarding for the lntensive Care Unit because we avoid the use of a ventilator which is very difficult for patients and can lead to further lung injury."

http://www.eurekalert.org/pub_releases/2013-01/haog-gtb011713.php

GI tract bacteria may protect against autoimmune disease

Researchers show that altering gut microbes protects against disease, supporting the 'hygiene hypothesis'

Toronto -- Early life exposure to normal bacteria of the GI tract (gut microbes) protects against autoimmune disease in mice, according to research published on-line in the January 17 edition of Science. The study may also have uncovered reasons why females are at greater risk of autoimmune diseases such as multiple sclerosis, rheumatoid arthritis, and lupus compared to males.

Researchers from The Hospital for Sick Children (SickKids) found that when female mice at high risk of autoimmune (type 1) diabetes were exposed to normal gut bacteria from adult male mice, they were strongly protected against the disease. In this type of mouse strain, more than 85% of females develop autoimmune diabetes due to strong genetic risk factors. In contrast, only 25% of the females developed the disease after they were given normal male gut microbes early in life.

"Our findings suggest potential strategies for using normal gut bacteria to block progression of insulin-dependent diabetes in kids who have high genetic risk," says principal investigator Dr. Jayne Danska. She is Senior Scientist in Genetics & Genome Biology at SickKids and Professor in the Departments of Immunology and Medical Biophysics at the University of Toronto.

A second unexpected finding was the effects of the gut microbe treatments on sex hormones. "We were surprised to see that when young female mice received normal gut microbes from adult males, their testosterone levels rose. We then showed that this hormone was essential for the gut microbe treatment to protect against the disease. It was completely unexpected to find that the sex of an animal determines aspects of their gut microbe composition, that these microbes affect sex hormone levels, and that the hormones in turn regulate an immune-mediated disease," says Dr. Danska.

She adds, "We don't know yet how transfer of male gut microbes into females increases their testosterone, or how this process protects against autoimmunity. This study opens up a new research arena to explore the clinical potential of altering the gut microbe community to prevent or treat immune-mediated diseases."

The hygiene hypothesis

The findings support the 'hygiene hypothesis,' which suggests that the dramatic increase in autoimmune and inflammatory diseases over the past 50 years results from changes in our exposure to microbes. Gut microbes are essential for normal development and training of the immune system, for extracting nutrients from our food, and for protecting us from some infectious diseases. "Our gut microbial community is an essential part of ourselves – bacterial cells outnumber human cells in our bodies by more than ten to one – and we live with them as partners," explains Dr. Danska.

Previous research has shown that children living on farms, exposed to a denser and more complex microbial environment, have fewer immune-mediated diseases compared to their village or urban-dwelling peers.

Today's publication is the first to identify a difference between normal gut microbes in males and females reared in identical conditions, and to show that transfer of male-sourced gut bacteria protects against autoimmune disease in females with high genetic risk.

"Our findings point to a direct relationship between normal gut microbe composition and prevention of autoimmune disease. From these discoveries we can move on to characterize the relationships between gut microbes, sex hormones, and ways to control unwanted immune responses," says Dr. Danska.

Implications for diabetes and other autoimmune diseases

The researchers' success in preventing type 1 diabetes from developing in high-risk mice suggests that similar approaches may be applicable in preventing and treating other immune diseases, particularly those showing a female sex bias, Dr. Danska says.

The paper is titled "Sex-specific differences in the gut microbiome drive testosterone-dependent protection from autoimmunity."

The paper's co-authors are from the University of Colorado Denver, the Helmholtz Centre in Leipzig, Germany, and the University of Bern in Switzerland. The study was funded by JDRF (Juvenile Diabetes Research Foundation), Canadian Institutes of Health Research, National institutes of Health (US), Genome Canada-Ontario Genomics Institute, and SickKids Foundation.

Janet G. M. Markle, Daniel N. Frank, Steven Mortin-Toth, Charles E. Robertson, Leah M. Feazel, Ulrike Rolle-Kampczyk, Martin von Bergen, Kathy D. McCoy, Andrew J. Macpherson, Jayne S. Danska (2012): Sex Differences in the Gut Microbiome Drive Hormone-Dependent Regulation of Autoimmunity. SCIENCE, 17 January 2013, DOI: 10.1126/science.1233521 http://www.sciencemag.org/content/early/recent

http://www.eurekalert.org/pub_releases/2013-01/uota-lok011713.php

Lack of key enzyme in the metabolism of folic acid leads to birth defects

Researchers at The University of Texas at Austin have discovered that the lack of a critical enzyme in the folic acid metabolic pathway leads to neural tube birth defects in developing embryos.

AUSTIN, Texas - It has been known for several decades that folic acid supplementation dramatically reduces the incidence of neural tube defects, such as spina bifida and anencephaly, which are among the most common birth defects. In some populations, folic acid supplementation has decreased neural tube defects by as much as 70 percent. However, scientists still do not fully understand how folic acid decreases neural tube defects, or why folic acid supplementation does not eliminate birth defects in all pregnancies.

"Now, we've found that mutation of a key folic acid enzyme causes neural tube defects in mice," said Dean Appling, professor of biochemistry in the College of Natural Sciences. "This is the clearest mechanistic link yet between folic acid and birth defects." Appling and his colleagues published their research in the Jan. 8 issue of Proceedings of the National Academy of Sciences (PNAS).

The scientists made the discovery using mice that lack a gene for a folic acid enzyme called Mthfd1l, which is required for cells to produce a metabolite called formate. Embryos need formate to develop normally.

"This work reveals that one of the ways that folic acid prevents birth defects is by ensuring the production of formate in the developing embryo," said Appling, "and it may explain those 30 percent of neural tube defects that cannot be prevented by folic acid supplementation."

Appling said that the mice provide researchers with a strong model system that they can use to further understand folic acid and its role in birth defects in humans. In fact, humans share the same gene for the folic acid enzyme with the mouse and all other mammals. Indeed, it has recently been discovered that point mutations in that human gene increase the risk of birth defects. Appling said that he and his colleagues would like to use the mouse system to begin looking for nutrients that could be delivered to pregnant mothers to prevent those neural tube defects that cannot be prevented by folic acid.

Ultimately, women could someday be screened for the gene that produces the enzyme. If they are deficient, steps could be taken to improve their chances for developing embryos free of neural tube defects through further nutrient supplementation.

Folic acid was discovered at The University of Texas at Austin in the 1940s by biochemists Esmond Snell and Herschel Mitchell. The U.S. has fortified all enriched cereal grain products with folic acid since 1996 to ensure that women of childbearing age receive adequate quantities of the vitamin.

Postdoctoral researcher Jessica Momb and graduate student Jordan Lewandowski were largely responsible for this research. Co-authors include graduate student Joshua Bryant, researcher Rebecca Fitch, researcher Deborah Surman, and Steven Vokes, assistant professor of biology.

http://www.eurekalert.org/pub_releases/2013-01/umso-ppi011713.php

Power's punishing impact

Research links power and tendency to punish harshly

Often, employees are shocked by what they think is a supervisor's severe reaction to a subordinate's seemingly minor transgression. The supervisors who punish them seem to be so absolutely sure that they are doing the right thing—they have a clear sense of purpose and there are no arguments to sway them.

New research by Scott Wiltermuth, a USC Marshall School of Business assistant professor of management and organization, and co-author Francis Flynn of the Stanford Graduate School of Business, found that providing a sense of power to someone instills a black-and-white sense of right and wrong (especially wrong). Once armed with this moral clarity, powerful people then perceive wrongdoing with much less ambiguity than people lacking this power, and punish apparent wrong-doers with more severity than people without power would.

The research alerts managers to some unforeseen challenges they will face as they come to hold more and more power, according to Wiltermuth. The research results appear in a forthcoming issue of the Academy of Management Journal.

"We noticed in our MBA classes that the students who seemed to feel most powerful had these absolute answers about what's right and what's wrong," said Wiltermuth.

"We found the same phenomenon when we made other people feel powerful, and we also found the resulting clarity led people to punish questionable behavior more severely. That link between power and more severe punishment could cause a huge problem for managers. What a manager sees as appropriate punishment could be seen as absolutely draconian by other people."

Wiltermuth and Flynn set up four experiments in which they made some individuals feel powerful—giving them the ability to control resources and administer rewards or punishments. When presented with cases of

transgressions, the powerful participants were more likely to say "yes, the behavior is immoral," "no, it is not immoral".
Very few powerful people answered with "it depends," which was a much more popular answer among the less powerful. Owing to this certainty, the participants made to feel powerful felt that the transgressions deserved harsher punishments.
Significantly, the researchers found that moral clarity was more clearly connected to delivering punishments than administering bonuses for good behavior. "Our findings do not imply that having this moral clarity leads people to obtain power. Rather, the findings imply that once you obtain power you become more likely to see things in black-and-white," he said.
These links between power, clarity and punishment can lead to organizational problems in the private and public sector, Wiltermuth warned. People without power could begin protesting a manager's decisions, which can erode the manager's—and the organization's—authority and ability to operate.
In the public sector, using the U.S. Congress as an example—Wiltermuth pointed to the dead certainty in which elected officials often make their case. "You ask yourself, 'How can they talk about these complex issues in such black and white terms?' The short attention spans of the media and their constituencies may explain some of it, but it may also be that politicians are so powerful that they may actually see issues in black-and-white terms more than the rest of us do."
Wiltermuth is continuing his research into the relationships between managerial power and how it affects organizations. "I am now most interested in exploring how we can reduce this moral clarity and create a healthy sense of doubt."

http://www.eurekalert.org/pub_releases/2013-01/uoma-wwa011713.php

Why wolves are forever wild, but dogs can be tamed

Dogs and wolves are genetically so similar, it's been difficult for biologists to understand why wolves remain fiercely wild, while dogs can gladly become 'man's best friend'

AMHERST, Mass. – Dogs and wolves are genetically so similar, it's been difficult for biologists to understand why wolves remain fiercely wild, while dogs can gladly become "man's best friend." Now, doctoral research by evolutionary biologist Kathryn Lord at the University of Massachusetts Amherst suggests the different behaviors are related to the animals' earliest sensory experiences and the critical period of socialization. Details appear in the current issue of Ethology.
Until now, little was known about sensory development in wolf pups, and assumptions were usually extrapolated from what is known for dogs, Lord explains. This would be reasonable, except scientists already know there are significant differences in early development between wolf and dog pups, chief among them timing of the ability to walk, she adds.
To address this knowledge gap, she studied responses of seven wolf pups and 43 dogs to both familiar and new smells, sounds and visual stimuli, tested them weekly, and found they did develop their senses at the same time. But her study also revealed new information about how the two subspecies of Canis lupus experience their environment during a four-week developmental window called the critical period of socialization, and the new facts may significantly change understanding of wolf and dog development.
When the socialization window is open, wolf and dog pups begin walking and exploring without fear and will retain familiarity throughout their lives with those things they contact. Domestic dogs can be introduced to humans, horses and even cats at this stage and be comfortable with them forever. But as the period progresses, fear increases and after the window closes, new sights, sounds and smells will elicit a fear response.
Through observations, Lord confirmed that both wolf pups and dogs develop the sense of smell at age two weeks, hearing at four weeks and vision by age six weeks on average. However, these two subspecies enter the critical period of socialization at different ages. Dogs begin the period at four weeks, while wolves begin at two weeks. Therefore, how each subspecies experiences the world during that all-important month is extremely different, and likely leads to different developmental paths, she says.
Lord reports for the first time that wolf pups are still blind and deaf when they begin to walk and explore their environment at age two weeks. "No one knew this about wolves, that when they begin exploring they're blind and deaf and rely primarily on smell at this stage, so this is very exciting," she notes.
She adds, "When wolf pups first start to hear, they are frightened of the new sounds initially, and when they first start to see they are also initially afraid of new visual stimuli. As each sense engages, wolf pups experience a new round of sensory shocks that dog puppies do not."
Meanwhile, dog pups only begin to explore and walk after all three senses, smell, hearing and sight, are functioning. Overall, "It's quite startling how different dogs and wolves are from each other at that early age,

given how close they are genetically. A litter of dog puppies at two weeks are just basically little puddles, unable to get up or walk around. But wolf pups are exploring actively, walking strongly with good coordination and starting to be able to climb up little steps and hills."
These significant, development-related differences in dog and wolf pups' experiences put them on distinctly different trajectories in relation to the ability to form interspecies social attachments, notably with humans, Lord says. This new information has implications for managing wild and captive wolf populations, she says.
Her experiments analyzed the behavior of three groups of young animals: 11 wolves from three litters and 43 dogs total. Of the dogs, 33 border collies and German shepherds were raised by their mothers and a control group of 10 German shepherd pups were hand-raised, meaning a human was introduced soon after birth.
At the gene level, she adds, "the difference may not be in the gene itself, but in when the gene is turned on. The data help to explain why, if you want to socialize a dog with a human or a horse, all you need is 90 minutes to introduce them between the ages of four and eight weeks. After that, a dog will not be afraid of humans or whatever else you introduced. Of course, to build a real relationship takes more time. But with a wolf pup, achieving even close to the same fear reduction requires 24-hour contact starting before age three weeks, and even then you won't get the same attachment or lack of fear."

http://www.abc.net.au/news/2013-01-16/scientists-hail-potential-cure-for-aids/4466766

Scientists hail 'potential cure for AIDS'

Scientists from the Queensland Institute of Medical Research say they have made a breakthrough that could lead to a potential cure for AIDS.

By Stephanie Smail

Associate Professor David Harrich says they have discovered how to modify a protein in HIV so that, instead of replicating, it protects against the infection. "I consider that this is fighting fire with fire," he said. "What we've actually done is taken a normal virus protein that the virus needs to grow, and we've changed this protein, so that instead of assisting the virus, it actually impedes virus replication and does it quite strongly."
Associate Professor Harrich says the modified protein cannot cure HIV but it has protected human cells from AIDS in the laboratory. "This therapy is potentially a cure for AIDS," he said. "So it's not a cure for HIV infection, but it potentially could end the disease. "So this protein present in immune cells would help to maintain a healthy immune system so patients can handle normal infections."
More than 30,000 people have been diagnosed with HIV in Australia. If clinical trials are successful, one treatment could be effective enough to replace the multiple therapies they currently need.
"Drug therapy targets individual enzymes or proteins and they have one drug, one protein," Associate Professor Harrich said. "They have to take two or three drugs, so this would be a single agent that essentially has the same effect. "So in that respect, this is a world-first agent that's able to stop HIV with a single agent at multiple steps of the virus lifecycle."
He says the new treatment has the potential to make big improvements in the quality of life for those carrying HIV. "I think what people are looking for is basically a means to go on and live happy and productive lives with as little intrusion as possible," he said. "You either have to eliminate the virus infection or alternatively you have to eliminate the disease process and that's what this could do, potentially for a very long time."
Professor Harrich says animal trials are due to start this year and early indications are positive.
"This particular study is going to have some hurdles to jump through, but so far every test that we have put this protein through has passed with flying colours," he said. "This particular year we're moving this into animal models, and based on the preliminary data we have done we expect that this will proceed really quickly."
The research is published in the journal Human Gene Therapy.

http://www.bbc.co.uk/news/world-asia-21055206

Australian amateur prospector finds massive gold nugget

An amateur prospector in the Australian state of Victoria has astonished experts by unearthing a gold nugget weighing 5.5kg (177 ounces).

The unidentified man, using a handheld metal detector, found the nugget on Wednesday, lying 60cm underground near the town of Ballarat. Its value has been estimated at more than A$300,000 ($315,000: £197,000). Local gold experts say gold has been prospected in the area for decades, but no such discovery had been made before. "I have been a prospector and dealer for two decades, and cannot remember the last time a nugget over 100 ounces (2.8kg) has been found locally," said Cordell Kent, owner of the Ballarat Mining Exchange Gold Shop.
"It's extremely significant as a mineral specimen. We are 162 years into a gold rush and Ballarat is still producing nuggets - it's unheard of."

A video of the Y-shaped nugget was posted on YouTube on Wednesday by user TroyAurum. He wrote that the man who found it had said it "sounded like the bonnet of a car through the headphones.
"It was lying flat (broad side up) and he carefully dug it up."
Gold currently trades in Australia at about A$1,600 per ounce, meaning the discovery would be worth about A$283,200, but its rarity and the fact it weighs more than a kilogram would add a premium, said Mr Kent.
He told Australian media the prospector had been using a state-of-the-art metal detector, which meant he was able to find the gold relatively deep underground in an area which had been searched many times in the past.
The man had only made small finds before, he said, but was a "person that really deserved it".
"A finding like this gives people hope. It's my dream to find something like that, and I've been prospecting for more than two decades," the Ballarat Courier quoted him as saying.
"I've got no doubt there will be a lot of people who will be very enthusiastic about the goldfields again, it gives people hope," said Mr Kent. "There's nothing like digging up money, it's good fun."

http://www.eurekalert.org/pub_releases/2013-01/ci-sae011813.php

Studying ancient Earth's geochemistry

Evidence that some of the tectonic processes such as those taking place today, were occurring as early as 3.8 billion years ago

Washington, D.C.— Researchers still have much to learn about the volcanism that shaped our planet's early history. New evidence from a team led by Carnegie's Frances Jenner demonstrates that some of the tectonic processes driving volcanic activity, such as those taking place today, were occurring as early as 3.8 billion years ago. Their work is published in Geology.
Upwelling and melting of the Earth's mantle at mid-ocean ridges, as well as the eruption of new magmas on the seafloor, drive the continual production of the oceanic crust.
As the oceanic crust moves away from the mid-ocean ridges and cools it becomes denser than the underlying mantle.
Over time the majority of this oceanic crust sinks back into the mantle, which can trigger further volcanic eruptions. This process is known as subduction and it takes place at plate boundaries.
Volcanic eruptions that are triggered by subduction of oceanic crust are chemically distinct from those erupting at mid-ocean ridges and oceanic island chains, such as Hawaii.
The differences between the chemistry of magmas produced at each of these tectonic settings provide 'geochemical fingerprints' that can be used to try to identify the types of tectonic activity taking place early in the Earth's history.
Previous geochemical studies have used similarities between modern subduction zone magmas and those erupted about 3.8 billion years ago, during the Eoarchean era, to argue that subduction-style tectonic activity was taking place early in the Earth's history.
But no one was able to locate any suites of volcanic rocks with compositions comparable to modern mid-ocean ridge or oceanic island magmas that were older than 3 billion years and were also free from contamination by continental crust.
Because of this missing piece of the puzzle, it has been ambiguous whether the subduction-like compositions of volcanic rocks erupted 3.8 billion years ago really were generated at subduction zones, or whether this magmatism should be attributed to other processes taking place early in the Earth's history.
Consequently, evidence for subduction-related tectonics earlier than 3 billion years ago has been highly debated in scientific literature.
Jenner and her team collected 3.8 billion-year-old volcanic rocks from Innersuartuut, an island in southwest Greenland, and found the samples have compositions comparable to modern oceanic islands, such as Hawaii.
"The Innersuartuut samples may represent the world's oldest recognized suite of oceanic island basalts, free from contamination by continental crust", Jenner said. "This evidence strengthens previous arguments that subduction of oceanic crust into the mantle has been taking place since at least 3.8 billion years ago."
The authors acknowledge support from an Australian International Postgraduate Research Scholarship, a Ringwood Scholarship, an ARC Discovery grant, and a NERC grant.

http://phys.org/news/2013-01-software-outsources-job-china.html

US software engineer outsources his job to China

"Bob" the software engineer was becoming a modern workplace legend on Thursday as word spread that he had secretly outsourced his own job to China and sat at his desk watching cat videos.

The tale of Bob blazed across the Internet after being told in a Verizon security team blog post about the most "memorable" case investigators handled last year.

What started as a look into a mysterious secure connection from China to a US-based company's network ended with the discovery that a worker was idling away time at his desk while a Chinese consulting firm did his job at a fraction of his salary. Evidence even suggested he had the same scam going at other companies, according to the blog post by Andrew Valentine of the Verizon RISK Team.

"All told, it looked like he earned several hundred thousand dollars a year, and only had to pay the Chinese consulting firm about fifty grand annually," Valentine said. "The best part? For the last several years in a row he received excellent remarks. His code was clean, well-written, and submitted in a timely fashion."

Bob's quarterly performance reviews consistently described him as "the best developer in the building," according to Valentine.

Bob provided secure access to his company's network so Chinese consultants could work on computer code while he was at his desk, giving the appearance he was doing his job, the investigation determined.

Examination of Web browsing history showed that a typical work day for Bob consisted of surfing Reddit and watching cat videos online before going to lunch.

He spent afternoons at online commerce site eBay as well as social networks Facebook and LinkedIn, and then end his "work" days with an email updating bosses on projects, Valentine said. Verizon did not identify the company or the worker, describing him as an inoffensive, quiet family man in his mid-40s who had been with the company a long time and whom "you wouldn't look at twice in an elevator." *(c) 2013 AFP*

http://www.sciencedaily.com/releases/2013/01/130118072250.htm

Simple Blood Test Can Help Identify Trauma Patients at Greatest Risk of Death

A simple, inexpensive blood test performed on trauma patients upon admission can help doctors easily identify patients at greatest risk of death

A simple, inexpensive blood test performed on trauma patients upon admission can help doctors easily identify patients at greatest risk of death, according to a new study by researchers at Intermountain Medical Center in Salt Lake City.

The Intermountain Medical Center research study of more than 9,500 patients discovered that some trauma patients are up to 58 times more likely to die than others, regardless of the severity of their original injuries. Researchers say the study findings provide important insight into the long-term prognosis of trauma patients, something not previously well understood.

"The results were very surprising," said Sarah Majercik, MD, an Intermountain Medical Center surgeon and trauma researcher, whose team discovered that a tool developed at Intermountain Medical Center, called the Intermountain Risk Score, can predict mortality among trauma patients.

Dr. Majercik will present the findings from the study on January 18 at the 27th annual Scientific Session of the Eastern Association for the Surgery of Trauma in Phoenix.

The Intermountain Risk Score is a computerized tool available to physicians that combines factors like age, gender, and common blood tests known as the complete blood count (CBC) and the basic metabolic profile (BMP) to determine an individual's mortality risk.

All of the components of the tool have been helpful in evaluating individuals with medical problems like heart failure or chronic pulmonary disease. But until now, the benefit of the tool had not been tested for trauma patients hospitalized due to an accident or traumatic injury, rather than an underlying condition.

"As surgeons, we don't often use all of the CBC results in evaluating a patient who needs surgery for a bleeding spleen or after a motor vehicle accident, said Dr. Majercik. "There are certain values, such as hemoglobin, hematocrit, and platelets that we scrutinize closely as part of good clinical care, but then other parts, such as the red blood cell distribution width (RDW) that we pay no attention to at all in the acute setting. These factors are generally overlooked, even though they are part of the CBC that every trauma patient gets when he or she arrives in the emergency room."

Date from the Intermountain Risk Score tool will allow physicians to take additional precautions with patients who are at greatest risk, and also give doctors important information to consider when talking about prognosis with patients and families.

Dr. Majercik and her colleague Benjamin Horne, PhD, director of cardiovascular and genetic epidemiology at the Intermountain Medical Center Heart Institute, reviewed the cases of 9,538 patients who had been admitted to the hospital with trauma during a six-year period.
Using the tool, the Intermountain Medical Center categorized patients according to high, moderate, and low risk levels. Some surprising findings emerged:

High-risk men were nearly 58 times more likely to die within a year than low-risk men. Men with a moderate risk were nearly 13 times more likely to die than those with low risk.

High-risk women were 19 times more likely to die within a year than low-risk women. And women with moderate risk were five times more likely to die than those with low risk.

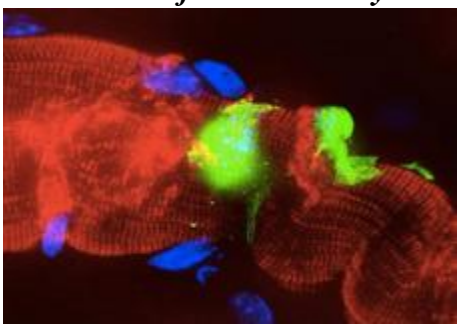
"Some risk factors will be already apparent for physicians, but others aren't intuitive," said Dr. Horne.
For example, a trauma patient may look completely healthy apart from his or her injury. But if the Intermountain Risk Score tool uncovers an irregular red blood cell distribution width -- a common sign of anemia -- that will increase his risk of dying.
"It's a standard part of the CBC test, but it's not usually taken into consideration when treating a patient with injuries," said Dr. Horne. "Based on the findings of our research, it's something that should be looked at as part of the care plan model."
Dr. Majercik and Dr. Horne believe their research will give physicians a simple, fast way to better understand their patients' condition, and may lead to new treatment approaches that could reduce the risk of death.

http://www.wired.com/wiredscience/2013/01/leprosy-reprograms-the-body/

Leprosy Reprograms the Body

Leprosy reprograms certain nerve cells to become like stem cells and uses them to infiltrate the body's muscle and nervous systems

By Gisela Telis, ScienceNOW



Leprosy has plagued humans for thousands of years, but that doesn't mean it has revealed all of its secrets. A new study in mice suggests the disfiguring disease employs a bit of biological trickery to do its damage: It reprograms certain nerve cells to become like stem cells and uses them to infiltrate the body's muscle and nervous systems. This is the first time that scientists have seen bacteria reprogram cells in this way, and experts say the find could lead to the development of new treatments for leprosy and other neurodegenerative diseases.

Reprogrammed cells (green) fuse with and become skeletal muscles (red), spreading infection as they go. Cell nuclei are shown in blue. **Image: Masaki et al./Cell**

More than 200,000 people worldwide are diagnosed with leprosy (also known as Hansen's disease) each year. Despite its ancient origins and almost mythic status, however, leprosy remains mysterious. Researchers know that it's caused by the bacterium Mycobacterium leprae, and that it leaves sufferers with deforming lesions and a debilitating loss of sensation in their hands and feet. But they don't know how the infection spreads throughout the body or why it damages nerves so extensively. In part, that's because it's hard to investigate: the bacterium that causes leprosy can't be grown in a lab, so it can only be studied in infected humans, armadillos, and genetically engineered mice.
To answer some of those lingering questions, biologist Anura Rambukkana of the University of Edinburgh in the United Kingdom and his colleagues seized on another known detail of the disease: its predilection for infecting Schwann cells, specialized cells that sheathe the nerves and help transmit nervous system signals. The researchers isolated Schwann cells from mice and infected them with M. leprae - and were soon surprised by what they saw.
The bacteria transformed the cells, turning off genes that were expressed in mature Schwann cells and turning on genes associated with earlier stages of cell development. The cells became immature and, like certain kinds of stem cells found in bone marrow and other tissues, could now turn into bone and muscle cells. "We thought, 'Oh, my God, this is a vehicle for going anywhere in the body,' " Rambukkana recalls.
When the team reintroduced the altered cells into the mice, some of the cells migrated to muscle tissues and spread the bacteria wherever they went. The results suggest that M. leprae hijacks Schwann cells, destroying their ability to insulate and support the nervous system, so it can use them to infiltrate other tissues in the body, the team reports online today in Cell.
Rambukkana hopes that future studies will shed more light on how the leprosy bacterium transforms Schwann cells. Understanding the process could help doctors diagnose leprosy at earlier stages and possibly stop it in its

tracks, he says. “It can also help us find new ways to generate stem cells for therapeutic approaches, so we can treat other neurodegenerative diseases,” such as multiple sclerosis.
There’s one caveat, says developmental neurobiologist Michael Wegner of the University of Erlangen-Nuremberg in Germany who was not involved in the study. The study doesn’t prove that M. leprae co-opts human Schwann cells in the same way, he notes. But it does offer a plausible mechanism in “a fascinating study that uses state-of-the-art methodology.”
Dermatologist and leprosy researcher Robert Modlin of the David Geffen School of Medicine at the University of California, Los Angeles, agrees. “I was amazed—this is a really creative, out-of-the-box study,” Modlin says. “It raises mind-provoking questions about how it could relate to humans. It has real potential.”

http://www.sciencedaily.com/releases/2013/01/130118112626.htm

Handheld Mobile Device Performs Laboratory-Quality HIV Testing

A handheld mobile device can check patients' HIV status with just a finger prick

New research appearing in Clinical Chemistry, the journal of AACC, shows that a handheld mobile device can check patients' HIV status with just a finger prick, and synchronize the results in real time with electronic health records. This technology takes a step toward providing remote areas of the world with diagnostic services traditionally available only in centralized healthcare settings.
Of the 34 million people infected with HIV worldwide, 68% of them live in sub-Saharan Africa, with South and Southeast Asia bearing the second greatest burden of disease. Many HIV-infected people in these regions are unable to get tested or treated because they can't easily travel to centralized healthcare centers. This creates an extreme economic burden on already-poor nations, with the epidemic estimated to cause a 1.5% annual loss in gross domestic product each year for the worst-affected countries. It has also created 16.6 million AIDS orphans -- children who have lost one or both parents to the disease.
A low-cost mobile device that performs HIV testing could help combat these trends, and the overall global epidemic, by enabling the diagnosis and treatment of HIV-infected people in resource-limited settings. In this study, a team including Curtis D. Chin, PhD, and Yuk Kee Cheung, PhD, designed a device that captures all the essential functions of enzyme-linked immunosorbent assays, the most commonly used laboratory diagnostic for HIV. The authors show that the device performs laboratory-quality HIV testing in 15 minutes using finger-pricked whole blood.
The device also detects weakly positive samples, and uses cellphone and satellite networks to automatically synchronize test results with patient health records from anywhere in the world. Because of this real-time data upload, this mobile device will allow policymakers and epidemiologists to monitor disease prevalence across geographical regions quickly and effectively. This could improve effectiveness in allocating medications to different communities, and patient care in general.
C. D. Chin, Y. K. Cheung, T. Laksanasopin, M. M. Modena, S. Y. Chin, A. A. Sridhara, D. Steinmiller, V. Linder, J. Mushingantahe, G. Umviligihozo, E. Karita, L. Mwambarangwe, S. L. Braunstein, J. van de Wijgert, R. Sahabo, J. E. Justman, W. El-Sadr, S. K. Sia. Mobile Device for Disease Diagnosis and Data Tracking in Resource-Limited Settings. Clinical Chemistry, 2013; DOI: 10.1373/clinchem.2012.199596

http://phys.org/news/2013-01-judas-fish-asian-carp.html

'Judas' fish could help wipe out Asian carp

Methods used to eradicate feral pigs and goats in Hawaii, Australia, the Galapagos Islands and southern United States could be employed in Minnesota to fight the Asian carp invasion.

"It should work," said Peter Sorensen, director of the new Minnesota Aquatic Invasive Species Research Center at the University of Minnesota. Sorensen said the lessons learned elsewhere using "Judas" animals to locate and kill unwanted species could be used here to fight Asian carp. They are called "Judas" animals because, as the biblical reference implies, they betray.
Radio-collared Judas pigs, sheep and goats have been released into the wild, then tracked until they lead officials to difficult-to-find herds of the same unwanted species. "Basically most animals are really social, so they are very good at finding each other," Sorensen said. "Then they send in the helicopters and blast them."
This week, he will use Judas fish implanted with tracking devices to locate the common carp in Staring Lake in Eden Prairie. Though carp are dispersed in lakes during the summer, they congregate in the winter, and the Judas fish reveal to researchers exactly where they are.
A commercial fisherman then will net the mass of unwanted carp, estimated at about 26,000 fish, which root up vegetation, causing lakes to go turbid. Water quality and fish habitat usually improve after carp are removed.
Sorensen started using the method in 2008 as part of his carp research.
"It's been very successful," he said. "Carp are really social animals - one will always lead you to another."
Sorensen said officials could apply the same method to seek out and destroy Asian carp.

"First we'd have to figure out how to sterilize them," he said. "You wouldn't want to release fertile animals." Common carp implanted with transmitters and released don't have to be sterilized because there already are so many in the lake. "There's been some research on sterilizing fish, so it's doable, but not a lot of effort has been put into it," Sorensen said. "Until now, no one had a good reason to sterilize fish." Sorenson's new Aquatic Invasive Species Research Center is just getting started, and he is awaiting more funding for such research.
Sorensen is convinced the Judas fish method would work with Asian carp, and it could be tried now before lakes and rivers are teeming with them, as they are with common carp. "Right now would be a great time to do it," he said. "Let's say there were five silver carp at the Coon Rapids dam; they probably are all together. If you put in a sixth fish (with a tracking device), I bet it would find the other five in a day." Then all could be netted. "Chasing these animals around isn't getting us anywhere," he said. "They are wily. Just let them show us the way."
No established populations of Asian carp - including big-head, silver, or grass carp - are known in Minnesota. However, individual specimens have been caught by commercial fishermen in the Mississippi and St. Croix rivers. And water sampling by the DNR found DNA evidence of silver carp in the Mississippi and St. Croix rivers as far north as the Twin Cities.
Asian carp can consume 5 to 20 percent of their body weight each day, often outcompeting native fish for food and disrupting the aquatic ecosystems that support more desirable fish and plants. Big-head carp can weigh up to 110 pounds and silver carp up to 60 pounds. Department of Natural Resources officials said recently that a barrier of noise and bubbles at the Ford Dam near Fort Snelling, costing at least $12 million, is the best option to stop the spread of invasive Asian carp to Minnesota's northern lakes. But even if that is built and works, it wouldn't help the St. Croix or Minnesota river systems.
Sorensen said he also is working on implanting hormones that make carp sexually attractive to other fish. Sorensen said the Judas method doesn't remove 100 percent of the carp from lakes, but "it's a big step forward." Sorensen has used Judas fish to remove common carp from two west-metro lakes, Lake Riley in Eden Prairie and Lake Lucy in Chanhassen, as well as Lake Gervais in Little Canada. The Judas technique has been used in Yellowstone National Park to try to wipe out non-native lake trout in Yellowstone Lake. And it's been deployed to destroy non-native goats and feral pigs in the Galapagos Islands, Hawaii, Australia and New Zealand. Southern states, including Texas, Arkansas, Oklahoma and New Mexico, have used the technique on feral pigs, too. Next up could be Asian carp.

http://www.livescience.com/26401-how-women-can-avoid-backlash-in-salary-negotiations.html

Psychology Plays Key Role in Women's Salary Negotiations

Closing the gender gap between men and women's salaries could depend on better negotiation tactics, new research finds.

Chad Brooks, BusinessNewsDaily Contributor

The study, by researchers at Harvard and Carnegie Mellon universities, shows that women can successfully negotiate higher salaries. But unlike men, they have to pay attention to the approach they use in order to avoid social backlash.
"The anticipation of social backlash or pay discrimination is taxing for women and undermining of their human potential," said the study authors, Harvard's Hannah Riley Bowles and Carnegie Mellon's Linda Babcock.
As part of the study, researchers had more than 400 participants watch a video in which a recently promoted female employee negotiated a new salary. In some of the videos, the woman expressed concern for her relationship with her manager, including phrases such as, "I hope it's OK to ask you about this," and, "My relationships with people here are very important to me." In others, she negotiated her salary while alluding to another offer she had received; in still other videos, she did both.
Researchers then asked participants a series of questions about whether they would enjoy working with the woman and if they would grant her the raise she requested.
Alluding to another offer increased the likelihood that the women would get the pay they desired, researchers found, and showing concern for business relationships helped mitigate social repercussions. However, combining these strategies was not successful and didn't help avoid social backlash.
In the second part of the study, the researchers showed 177 college-educated Americans with work experience short episodes in which female and male employees negotiated their salaries using different techniques. Researchers then asked the participants to rate their willingness to work with the negotiators, both male and female, as well as the participants' inclination to grant the requested compensation.
After watching episodes in which female negotiators legitimized their compensation requests and communicated concern for organizational relationships, the study's participants found the women to be more relational, found their requests for compensations to be more legitimate and did not socially punish them for

negotiating higher pay. Conversely, men who expressed the same relational concern as they negotiated were no more successful than when they used a direct-negotiation approach.
"While gender constraints are real, they are not inescapable," the authors said. "We expect men to be in charge because they are, and we expect men to earn more because typically they do … every woman who reduces the gender gap in pay and authority reforms the social structures that keep women in their place."
The study was recently published in Psychology of Women Quarterly.

http://www.sciencedaily.com/releases/2013/01/130118125950.htm

Wind in the Willows Boosts Biofuel Production

Trees Grown Diagonally Produce Five Times More Biofuel

Willow trees cultivated for 'green energy' can yield up to five times more biofuel if they grow diagonally, compared with those that are allowed to grow naturally up towards the sky.
This effect had been observed in the wild and in plantations around the UK, but scientists were previously unable to explain why some willows produced more biofuel than others.
Now British researchers have identified a genetic trait that causes this effect and is activated in some trees when they sense they are at an angle, such as where they are blown sideways in windy conditions.
The effect creates an excess of strengthening sugar molecules in the willows' stems, which attempt to straighten the plant upwards. These high-energy sugars are fermented into biofuels when the trees are harvested in a process that currently needs to be more efficient before it can rival the production of fossil fuels.
Willow is cultivated widely across the UK, destined to become biofuels for motor vehicles, heating systems and industry. The researchers say that in the future all willow crops could be bred for this genetic trait, making them a more productive and greener energy source.
The study was led by Dr Nicholas Brereton and Dr Michael Ray, both from the Department of Life Sciences at Imperial College London, who worked with researchers at Rothamsted Research, and the University of the Highlands and Islands' Agronomy Institute (at Orkney College UHI). The study is published in the journal Biotechnology for Biofuels.
Dr Brereton said: "We've known for some time that environmental stresses can cause trees to naturally develop a slightly modified 'reaction wood' and that it can be easier to release sugars from this wood. This is an important breakthrough, our study now shows that natural genetic variations are responsible for these differences and this could well be the key to unlocking the future for sustainable bioenergy from willow."
The researchers conducted a trial in controlled laboratory conditions on a rooftop in central London at the Gro-dome facility at Imperial's South Kensington Campus. They cultivated some willows at an angle of 45 degrees, and looked for any genetic differences between these plants and those allowed to grow naturally straight upwards.
The team then looked for the same effect with willows growing in natural conditions on Orkney Island, off the northern-most coast of Scotland, where winds are regularly so strong that the trees are constantly bent over at severe angles. Their measurements confirmed that the willows here could release five times more sugar than identical trees grown in more sheltered conditions at Rothamsted Research in the south of the UK.
Dr Angela Karp at Rothamsted Research who leads the BBSRC-funded BSBEC-BioMASS project said "We are very excited about these results because they show that some willows respond more to environmental stresses, such as strong winds, by changing the composition of their wood in ways that are useful to us. As breeders this is good news because it means we could improve willow by selecting these types from the huge diversity in our collections".
This work forms part of the BBSRC Sustainable Bioenergy Centre (BSBEC) where it is linked with other programmes aimed at improving the conversion of biomass to fuels. Coupled with work at Rothamsted Research, where the National Willow Collection is held, the new results will help scientists to grow biofuel crops in climatically challenging conditions where the options for growing food crops are limited, therefore minimising conflicts of food versus fuel.

About Willow Trees

Traditionally grown for wicker furniture and baskets, and an ancient medicinal plant whose chemical contents were the precursors to Aspirin, willows are now seen as important crops for energy and the environment. Willow requires less than a tenth of the fertiliser used for most cereal crops, and its shoots re-grow quickly after they are harvested. Environmental groups also say that willow plantations are also attractive to a variety of wildlife, making a positive impact on local biodiversity.

Nicholas JB Brereton, Michael J Ray, Ian Shield, Peter Martin, Angela Karp, Richard J Murphy. Reaction wood – a key cause of variation in cell wall recalcitrance in willow. Biotechnology for Biofuels, 2012; 5 (1): 83 DOI: 10.1186/1754-6834-5-83

http://www.newscientist.com/article/dn23082-japan-to-build-worlds-largest-offshore-wind-farm.html

Japan to build world's largest offshore wind farm

It's goodbye nuclear, hello renewables as Japan prepares to build the world's largest offshore wind farm this July.

15:19 16 January 2013 by Rob Gilhooly, Tokyo

By 2020, the plan is to build a total of 143 wind turbines on platforms 16 kilometres off the coast of Fukushima, home to the stricken Daiichi nuclear reactor that hit the headlines in March 2011 when it was damaged by an earthquake and tsunami.

The wind farm, which will generate 1 gigawatt of power once completed, is part of a national plan to increase renewable energy resources following the post-tsunami shutdown of the nation's 54 nuclear reactors. Only two have since come back online.

The project is part of Fukushima's plan to become completely energy self-sufficient by 2040, using renewable sources alone. The prefecture is also set to build the country's biggest solar park.

The wind farm will surpass the 504 megawatts generated by the 140 turbines at the Greater Gabbard farm off the coast of Suffolk, UK – currently the world's largest farm. This accolade will soon pass to the London Array in the Thames Estuary, where 175 turbines will produce 630 megawatts of power when it comes online later this year. The Fukushima farm will beat this, too.

Massive construction

The first stage of the Fukushima project will be the construction of a 2-megawatt turbine, a substation and undersea cable installation. The turbine will stand 200 metres high. If successful, further turbines will be built subject to the availability of funding.

To get around the cost of anchoring the turbines to the sea bed, they will be built on buoyant steel frames which will be stabilised with ballast and anchored to the 200-metre-deep continental shelf that surrounds the Japanese coast via mooring lines.

Once the farm is running at full power, the intention is that it will supply electricity to the powerful grid which Fukushima's two nuclear power plants were connected to, reducing transmission costs.

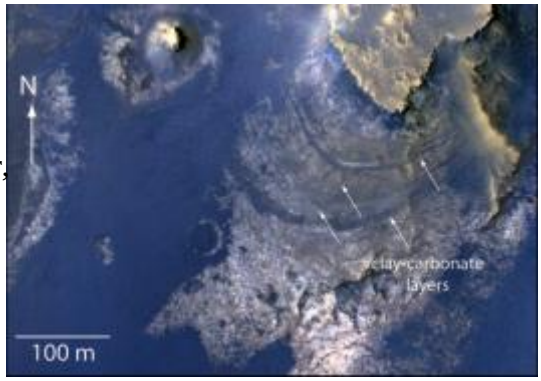
Project manager Takeshi Ishihara of the University of Tokyo insists that the area's seismic activity won't be an issue for the turbines. His team have carried out computer simulations and water tank test to verify the safety of the turbines not just in the event of an earthquake or tsunami but also in other extreme conditions such as typhoons. "All extreme conditions have been taken into consideration in the design," he says.

Another contentious issue is the facility's impact on the fishing industry, which has already been rocked by the nuclear accident. Ishihara insists it is possible to turn the farm into a "marine pasture" that would attract fish. While there was some objections to the project by local people, Ishihara says is confident he has won them round. "This is hard work, but will be resolved this month," he says. "This project is important – I think it is impossible to use nuclear power in Fukushima again."

http://phys.org/news/2013-01-martian-crater-held-groundwater-fed-lake.html

Study: Martian crater may once have held groundwater-fed lake

A NASA spacecraft is providing new evidence of a wet underground environment on Mars that adds to an increasingly complex picture of the Red Planet's early evolution.



Phys.org - The new information comes from researchers analyzing spectrometer data from NASA's Mars Reconnaissance Orbiter, which looked down on the floor of McLaughlin Crater. The Martian crater is 57 miles (92 kilometers) in diameter and 1.4 miles (2.2 kilometers) deep. McLaughlin's depth apparently once allowed underground water, which otherwise would have stayed hidden, to flow into the crater's interior.

Layered, flat rocks at the bottom of the crater contain carbonate and clay minerals that form in the presence of water. McLaughlin lacks large inflow channels, and small channels originating within the crater wall end near a level that could have marked the surface of a lake.

This view of layered rocks on the floor of McLaughlin Crater shows sedimentary rocks that contain spectroscopic evidence for minerals formed through interaction with water. **Image credit: NASA/JPL-Caltech/Univ. of Arizona**

Together, these new observations suggest the formation of the carbonates and clay in a groundwater-fed lake within the closed basin of the crater. Some researchers propose the crater interior catching the water and the underground zone contributing the water could have been wet environments and potential habitats. The findings are published in Sunday's online edition of Nature Geoscience.

"Taken together, the observations in McLaughlin Crater provide the best evidence for carbonate forming within a lake environment instead of being washed into a crater from outside," said Joseph Michalski, lead author of the paper, which has five co-authors. Michalski also is affiliated with the Planetary Science Institute in Tucson, Ariz., and London's Natural History Museum.
Michalski and his co-authors used the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) on the Mars Reconnaissance Orbiter (MRO) to check for minerals such as carbonates, which are best preserved under non-acidic conditions.
"The MRO team has made a concerted effort to get highly processed data products out to members of the science community like Dr. Michalski for analysis," said CRISM Principal Investigator Scott Murchie of the Johns Hopkins University Applied Physics Laboratory in Laurel, Md. "New results like this show why that effort is so important."
Launched in 2005, the Mars Reconnaissance Orbiter and its six instruments have provided more high-resolution data about the Red Planet than all other Mars orbiters combined. Data are made available for scientists worldwide to research, analyze and report their findings.
"A number of studies using CRISM data have shown rocks exhumed from the subsurface by meteor impact were altered early in Martian history, most likely by hydrothermal fluids," Michalski said. "These fluids trapped in the subsurface could have periodically breached the surface in deep basins such as McLaughlin Crater, possibly carrying clues to subsurface habitability."
McLaughlin Crater sits at the low end of a regional slope several hundreds of miles, or kilometers, long on the western side of the Arabia Terra region of Mars. As on Earth, groundwater-fed lakes are expected to occur at low regional elevations. Therefore, this site would be a good candidate for such a process.
"This new report and others are continuing to reveal a more complex Mars than previously appreciated, with at least some areas more likely to reveal signs of ancient life than others," said Mars Reconnaissance Orbiter Project Scientist Rich Zurek of NASA's Jet Propulsion Laboratory, Pasadena, Calif.
More information: DOI: 10.1038/ngeo1706 ; dx.doi.org/10.1038/ngeo1706

http://www.bbc.co.uk/news/science-environment-21082617

Gamma-ray burst 'hit Earth in 8th Century'

A gamma ray burst, the most powerful explosion known in the Universe, may have hit the Earth in the 8th Century.

By Rebecca Morelle Science reporter, BBC World Service

In 2012 researchers found evidence that our planet had been struck by a blast of radiation during the Middle Ages, but there was debate over what kind of cosmic event could have caused this.
Now a study suggests it was the result of two black holes or neutron stars merging in our galaxy.
This collision would have hurled out vast amounts of energy. The research is published in the journal Monthly Notices of the Royal Astronomical Society.

Gamma-ray bursts can occur when two neutron stars merge

Nature's snapshot

Last year, a team of researchers found that some ancient cedar trees in Japan had an unusual level of a radioactive type of carbon known as carbon-14. In Antarctica, too, there was a spike in levels of a form of beryllium - beryllium-10 - in the ice.
These isotopes are created when intense radiation hits the atoms in the upper atmosphere, suggesting that a blast of energy had once hit our planet from space.
Using tree rings and ice-core data, researchers were able to pinpoint that this would have occurred between the years AD 774 and AD 775, but the cause of the event was a puzzle.
The possibility of a supernova - an exploding star - was put forward, but then ruled out because the debris from such an event would still be visible in telescopes today.
Another team of US physicists recently published a paper suggesting that an unusually large solar flare from the Sun could have caused the pulse of energy. However some others in the scientific community disagree because they do not think that the energy produced would tally with the levels of carbon-14 and beryllium-10 found.
So now German researchers have offered up another explanation: a massive explosion that took place within the Milky Way.

One of the authors of the paper, Professor Ralph Neuhauser, from the Institute of Astrophysics at the University of Jena, said: "We looked in the spectra of short gamma-ray bursts to estimate whether this would be consistent with the production rate of carbon-14 and beryllium-10 that we observed - and [we found] that is fully consistent."

These enormous emissions of energy occur when black holes, neutron stars or white dwarfs collide - the galactic mergers take just seconds, but they send out a vast wave of radiation.

Prof Neuhauser said: "Gamma-ray bursts are very, very explosive and energetic events, and so we considered from the energy what would be the distance given the energy observed.

"Our conclusion was it was 3,000 to 12,000 light-years away - and this is within our galaxy."

Although the event sounds dramatic, our medieval ancestors might not have noticed much.

If the gamma-ray burst happened at this distance, the radiation would have been absorbed by our atmosphere, only leaving a trace in the isotopes that eventually found their way into our trees and the ice. The researchers do not think it even emitted any visible light.

Rare events

Observations of deep space suggest that gamma ray-bursts are rare. They are thought to happen at the most every 10,000 years and at the least once in a million years in a galaxy.

Prof Neuhauser said it was unlikely Planet Earth would see another one soon, but if we did, this time it could make more of an impact.

If a cosmic explosion happened at the same distance as the 8th Century event, it could knock out our satellites.

But if it occurred even closer - just a few hundred light-years away - it would destroy our ozone layer, with devastating effects for life on Earth.

However, this, said Prof Neuhauser, was "extremely unlikely".

Commenting on the research, Professor Adrian Melott from the University of Kansas, US, said that although he thought a short gamma-ray burst was a possible conclusion, his group's research suggested that a solar flare was more likely based on observations of Sun-like stars in our galaxy.

He said: "A solar proton event and a short gamma-ray burst are both possible explanations, but based on the rates that we know about in the Universe, the gamma-ray burst explanation is about 10,000 times less likely to be true in that time period."