http://www.eurekalert.org/pub_releases/2010-12/chb-ssh121310.php

Study shows how flu infections may prevent asthma

Activating the right immune cells in infants could lead to new vaccine

Boston, Mass. - In a paper that suggests a new strategy to prevent asthma, scientists at Children's Hospital Boston and their colleagues report that the influenza virus infection in young mice protected the mice as adults against the development of allergic asthma. The same protective effect was achieved by treating young mice with compound isolated from the bacterium Helicobacter pylori (H. pylori), a bacterium that colonizes the stomach and is best known for causing ulcers and increasing the risk of gastric cancers.

The findings, published online December 13 in the Journal of Clinical Investigation, provide a potential immunological mechanism in support of the "hygiene hypothesis," an idea that attributes the increasing rate of asthma and allergies to the successful reduction of childhood infections with vaccines and antibiotics. The hygiene hypothesis is also supported by epidemiological studies associating certain childhood infections, such as respiratory viral infections or gastrointestinal infection with H. pylori, with a lower risk of developing asthma.

"Some infections appear to result in important protective effects against asthma," says Dale Umetsu, MD, PhD, of Children's Division of Immunology, a senior author of the paper, and Professor of Pediatrics at Harvard Medical School. "But we certainly don't want to give people dangerous infections to prevent asthma. So if we can understand how infections prevent asthma, we may be able to replicate the good parts and avoid the bad parts of infection and develop new treatments for children to prevent asthma."

In mice, influenza A infection appeared to confer its benefits by expanding an immature cell type in the lung known as natural killer T (NKT) cells, part of the innate immune system. The same beneficial NKT cells in the lung could be expanded by several NKT-stimulating molecules known as glycolipids, including one isolated from H. pylori. The active infectious agents protected against asthma only if the mice were exposed when very young (2 weeks). "Flu infection in adult mice makes the allergic reaction worse," says Ya–Jen Chang, PhD, first author and a postdoctoral fellow in Umetsu's lab.

Previous studies examining the hygiene hypothesis have focused on the adaptive immune system, which features immune cells that are slow to respond but are able to develop long-term memory, such as those stimulated by each year's flu vaccine or those involved in seasonal allergies.

In contrast, the new paper examines the innate immune system, which responds rapidly to infections and shapes adaptive immune responses. This study specifically focuses on NKT cells, one of the first responders to many infections. Previous work by Umetsu's team implicated NKT cells as a cause of asthma. http://www.childrenshospital.org/newsroom/Site1339/mainpageS1339P1sublevel194.html. In contrast, the latest study reports on a new subset of inhibitory NKT cells that seem to prevent allergic reactions in the airways -- if stimulated at the right time by the right infectious agents or the right glycolipid.

"In the absence of influenza A or the H. pylori compound, we see an expansion of NKT cells that cause asthma and allergies," says Umetsu. "We're now trying to understand how to specifically activate the inhibitory subset of NKT cells. Treatments focused on specifically expanding this inhibitory subset of cells in children might prevent the development of asthma."

The researchers want to explore the therapeutic applications of the H. pylori glycolipid compound, synthesized by British lipid biochemist Petr Illarionov, PhD. "It might be a good candidate for an asthma vaccine," says Chang. Umetsu wants to test the next generation of glycolipid compounds, and to illuminate their specific mechanism of action, with a more detailed characterization of the inhibitory NKT cells.

Funding: US National Institutes of Health, including stimulus funding from the 2009 Recovery Act; Bunning Food Allergy Project; and Ministry of Education, Culture, Sports, Science, and Technology of Japan.
Disclosure: Children's Hospital Boston has filed for a provisional patent on the glycolipid compound formula to treat or prevent inflammatory disease.

http://www.eurekalert.org/pub_releases/2010-12/uoc--uo121310.php

UCSF 'fountain of youth' pill could restore aging immune system

UCSF researchers have identified an existing medication that restores key elements of the immune system that, when out of balance, lead to a steady decline in immunity and health as people age.

The team found that extremely low doses of the drug lenalidomide can stimulate the body's immune-cell protein factories, which decrease production during aging, and rebalance the levels of several key cytokines – immune proteins that either attack viruses and bacteria or cause inflammation that leads to an overall decline in health. The initial study, which was designed to define the dose range of such a therapy in a group of 13

patients, could lead to a daily pill to boost immunity in the elderly, the researchers said. Data will appear in the January issue of the journal Clinical Immunology, and can be found online at www.elsevier.com/locate/yclim.

The identification of a drug to reverse the immunological decline in aging, known as immunosenescence, is the culmination of years of research by Edward J. Goetzl, MD, at UCSF and the National Institute on Aging, into how cytokine levels change as people age, how that varies by gender, and which changes dictate whether someone will be healthy into their 90s or begin a downward cycle of decline starting in middle age.

"No one's really talking about longevity and lifespan now, but about 'health span,'" said Goetzl, director of UCSF Allergy and Immunology Research, which focuses on developing new diagnostics and treatments for allergic and immunological diseases. "If, at age 50, your cytokine levels are the same as they were at 25, you'll probably stay healthy as you age," he said. "But if they're heading downhill, we need to do something about it. If you could take a low-dosage pill with no side effects, wouldn't you do it?"

In 2009, Goetzl had studied a group of 50 elderly adults through the National Institute on Aging, examining their levels of key cytokines – Interleukin (IL)-2, IFN-gamma and IL-17 – and discovered that truly healthy 70-80 year old women had the same levels of those as did healthy 20 year olds.

However, elderly men and frail women who showed increased levels of inflammatory diseases and weakened defenses against infections tended to have lower levels of the first two cytokines, which are protective, and higher levels of IL-17, which is linked to inflammation. That imbalance, the researchers found, began in late middle age.

They then set out to find a drug that could raise IL-2 and IFN-gamma and either have no effect on IL-17 or lower it. "We now had a profile – in humans – that we could take to test tubes to say, 'Does this drug have a desirable effect?'" Goetzl said. "Our job was to find a therapy that not only works, but does so at a dose range with no side effects."

The team focused on three classes of drugs, among them the one that includes lenalidomide – a derivative of thalidomide – which is undergoing a renaissance, Goetzl said.

First introduced in the late 1950s as a sedative, thalidomide was never approved in the United States, but was withdrawn from the world market in 1961 after causing severe birth defects in infants whose mothers took the drug to reduce nausea during pregnancy.

In recent years, however, lenalidomide has been found to be an effective co-therapy for some cancers, particularly multiple myeloma and kidney tumors, as well as leprosy, at doses of 5 mg to 20 mg per day. Those cancers are tied to a drop in IL-2, the main cytokine that Goetzl's team had linked to declines in aging immune systems.

In this study, the team tested the drug in healthy seniors, each of whom were matched in race, gender and national origin to a healthy young adult participant. They found that extremely low levels of lenalidomide – 0.1 μM – optimally stimulated IL-2 production in the young people (21-40 years) roughly sevenfold, but stimulated IL-2 production in patients over age 65 by 120-fold, restoring them to youthful levels for up to five days. At that dosage, the drug also increased IFN-gamma up to six fold in the elderly patients, without suppressing IL-17 generation.

The researchers also found that lenalidomide had many other beneficial effects on the elderly participants' T cells, including better migration throughout the body, more efficient patrolling activity and longer survival after defending the body against an infection. The team plans to begin larger-scale clinical trials in 2011 to test the drug's effectiveness and hopes for broader availability within a few years.

The research was supported by a grant from the Kenneth Rainin Foundation and by the Intramural Research Program of the National Institute on Aging. The authors declare no conflicts of interest.

The first author on the paper is Mei-Chuan Huang, who, along with Goetzl and co-author Janice B. Schwartz, is from the UCSF departments of Microbiology-Immunology and of Medicine. Co-authors are Nigel Greig, Weiming Luo, David Tweedie, Dan Longo, Luigi Ferrucci and William B. Ershler, all from the National Institute on Aging, of the National Institutes of Health, in Baltimore.

http://www.eurekalert.org/pub_releases/2010-12/wuis-hig120710.php

How Iapetus got its ridge

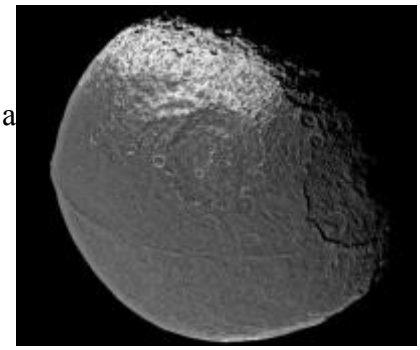
Scientists have an ingenious explanation for the strange ridge belting Saturn's outermost moon, Iapetus

For centuries, people wondered how the leopard got its spots. The consensus is pretty solid that evolution played a major role.

But it's only been five years since the arrival of high-resolution Cassini Mission images of Saturn's bizarre moon Iapetus that the international planetary community has pondered the unique walnut shape of the large (735 kilometer radius) body, considered by many to be one of the most astonishing features in the solar system.

And there's no consensus as to how a mysterious large ridge that covers more than 75 percent of the moon's equator was formed. It's been a tough nut to crack.

But now a team including an outer solar system specialist from Washington University in St. Louis has proposed a giant impact explains the ridge, up to 20 kilometers tall and 100 kilometers wide.



William B. McKinnon, PhD, Washington University professor of earth and planetary sciences in Arts & Sciences, and his former doctoral student, Andrew Dombard, PhD, associate professor of earth and environmental sciences at the University of Illinois Chicago (UIC), propose that at one time Iapetus itself had a satellite, or moon, created by a giant impact with another big body. The sub-satellite's orbit, they say, would have decayed because of tidal interactions with Iapetus, and it would have gradually migrated towards Iapetus. At some point, the researchers say, the tidal forces would have torn the sub-satellite apart, forming a ring of debris around Iapetus that would eventually slam into the moon near its equator.

A ridge that follows the equator of Saturn's moon Iapetus gives it the appearance of a giant walnut. The ridge, photographed in 2004 by the Cassini spacecraft, is 100 kilometers (62 miles) wide and at times 20 kilometers (12 miles) high. (The peak of Mount Everest, by comparison, is 5.5 miles above sea level.) Scientists are debating how the ridge might have formed. **Credit: NASA/JPL/SSI**

"Imagine all of these particles coming down horizontally across the equatorial surface at about 400 meters per second, the speed of a rifle bullet, one after the other, like frozen baseballs," says McKinnon. "Particles would impact one by one, over and over again on the equatorial line. At first the debris would have made holes to form a groove that eventually filled up."

"When you have a debris ring around a body, the collisional interactions steal energy out of the orbit," explains Dombard. "And the lowest energy state that a body can be in is right over the rotational bulge of a planetary body - the equator. That's why the rings of Jupiter, Saturn, Uranus and Neptune are over the equator."

"We have a lot of corroborating calculations that demonstrate that this is a plausible idea," says Dombard, "but we don't yet have any rigorous simulations to show the process in action. Hopefully, that's next."

Other planetary scientists believe the ridge was created by endogenic (within the planet) activity such as volcanism or mountain-building forces.

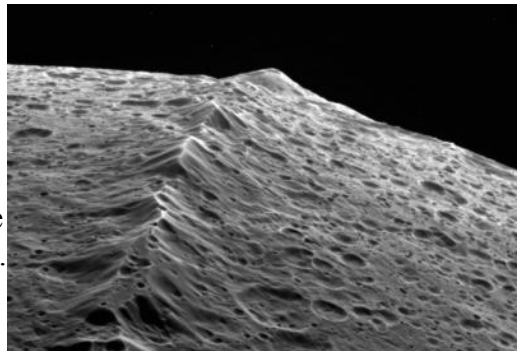
"Some people have proposed that the ridge might have been caused by a string of volcanic eruptions, or maybe it's a set of faults," McKinnon notes. "But to align it all perfectly like that — there is just no similar example in the solar system to point to such a thing."

"There are three critical observations that any model for the formation of the ridge has to satisfy," says Dombard. "They are: Why the feature is sitting on the equator; why only on the equator, and why only on Iapetus. I think we have something here that explains all those observations."

Dombard will make a presentation on the preliminary findings Wed., Dec. 15, 2010, at the fall meeting of the American Geophysical Union in San Francisco. The team also included Andrew F. Cheng of the Johns Hopkins Applied Physics Laboratory, and Jonathan P. Kay, a graduate student at UIC.

Dombard says that Iapetus's Hill sphere — the zone close to an astronomical body where the body's gravity dominates satellites — is far bigger than that of any other major satellite in the outer solar system, accounting for why Iapetus is the only body known to have such a ridge.

"Only Iapetus could have had the orbital space for the sub-satellite to then evolve and come down toward its surface and break up and supply the ridge," he says.



One of the supporting calculations the team performed was an estimation for how long it would take the orbit to decay so that the material would reach the point where the tidal forces would tear it apart into a debris disk.

"We're looking at only 100,000 years for a sub-satellite relatively close (to Iapetus) to a billion years for a body that's at the limit of where you could have a stable satellite in orbit around Iapetus," Dombard says. "These time scales are certainly plausible considering we have several billion years of time to work with. And longevity is important, because if it happens too fast all geological trace will be lost."

In 2007 Cassini flew within a few thousand kilometers of Iapetus's surface to take this dramatic picture of the ridge. A movie of the flyby is available at the NASA site devoted to Saturn. **Credit: NASA/JPL/SSI**

McKinnon notes that there are other examples in the solar system of giant impacts creating moons that orbit planets, notably our own Moon and Pluto's moon Charon.
"Our Moon and Pluto's, too, are actually retreating from the Earth and Pluto," he says. "But if we were to bring our Moon inside what is called geosynchronous altitude, that special altitude where TV broadcast satellites (and other objects) are able to hover over one spot on Earth as they orbit, then the Moon would actually spiral in toward Earth. Eventually our Moon would break into a ring of particles as it got very close and was torn apart by tides, and then those particles would enter the atmosphere and bombard the Earth at the equator."
http://sciencenews.org/view/generic/id/67424/title/Rooting_for_swarm_intelligence_in_plants

Rooting for swarm intelligence in plants

Researchers argue for a type of vegetative group decision making usually associated with animals

By Susan Milius

They're underfoot and underappreciated. But the roots of a plant may demonstrate the remarkable wisdom of crowds just as swarms of honeybees or humans can.

Three plant scientists now propose that roots growing this way and that in their dark and dangerous soil world may fit a definition for what's called swarm intelligence. Each tip in a root system acquires information at least partly independently, says plant cell biologist František Baluška of the University of Bonn in Germany. If that information gets processed in interactions with other roots and the whole tangle then solves what might be considered a cognitive problem in a way that a lone root couldn't, he says, then that would be swarm intelligence.

The decisions that emerge from groups of individuals have intrigued a wide range of researchers, for in some cases crowds show an eerie wisdom. Honeybees looking for a new home can collectively pick excellent nest sites even as individual scouts advocate for a variety of choices. And combining people's estimates of how many marbles are in a jar or what an animal at a country fair would yield in pounds of butchered meat often come quite close to the correct answer.

Plant life may exhibit collective decision making too, Baluška and his colleagues propose in the December Trends in Ecology and Evolution. They urge researchers to look beyond the animal kingdom and into the behavior of plant roots for evidence of crowd wisdom. Information could pass among root tips via secreted chemicals, released gases or perhaps even electrical activity that connects "brainlike" command centers in root tips, the researchers propose. But however the information travels, the interactions could yield swarmlike decisions about where and how much to grow.

Intelligently swarming roots are plausible, responds Jens Krause of Humboldt University in Berlin, who earlier this year published a review of research on animal and human swarm intelligence. Now he says he wants to see research presenting a full case for particular examples in plants.

"Applying the notion of swarm intelligence to plants, and not just to animals," Krause says, "is interesting in the sense that swarm intelligence might provide a drive for group living in organismal life in general."

A plant can deploy a considerable number of roots — 13,815,672 for a barley plant according to a classic study Baluška cites. The best evidence for swarm intelligence, Baluška speculates, might be found in exploring how myriad roots grow to exploit nutrient bonanzas that they come across in the soil. Roots also must compete with the roots of other plants for food and water; news from these skirmishes apparently travels far from the front. In earlier experiments dividing a plant's roots between two pots, the segment in a private pot still shows a response if its counterparts in another container meet some nutrient-sucking intruder. And cutting off part of a root system triggers a reaction elsewhere.

The mechanism behind this — how one root finds out what another is up to — may be the most controversial part of the smart-roots idea. In their recent commentary, Baluška and colleagues recognize a range of possibilities, but in other papers have explored the idea that news travels via nerve-like electrical signals. Hormonal signals seeping along millimeter-by-millimeter would be too slow, they reason. Contrary to the usual view of plants as living the slow life, they do need fast information transfer.

The idea that plants basically have nerves — a conclusion that grows out of hard-to-interpret observations of electrical activity in plant tissue — has ignited a thunderstorm of its own among plant scientists in recent years.

"The use of the word intelligence (with or without swarm) simply humanizes (or animalizes, since they talk about swarms) the situation," says David Robinson or the University of Heidelberg in Germany. Such "silly" terminology, in his words, "reduces serious plant science to the level of esoterics."

However, he's not disputing the ability of plants to solve complicated strategic problems. "Of course," he says, "it's well known that roots have 'cognitive' abilities."

http://www.physorg.com/news/2010-12-wild-salmon-decline-sea-lice.html

Wild salmon decline was not caused by sea lice from farm salmon: study

A new UC Davis study contradicts earlier reports that salmon farms were responsible for the 2002 population crash of wild pink salmon in the Broughton Archipelago of western Canada.

The Broughton crash has become a rallying event for people concerned about the potential environmental effects of open-net salmon farming, which has become a $10 billion industry worldwide, producing nearly 1.5 million tons of fish annually. The new study, to be published online this week in Proceedings of the National Academy of Sciences, does not determine what caused the crash, but it acquits the prime suspect: small skin parasites called sea lice.

The study's lead author is Gary Marty, a veterinary pathologist and research associate at the UC Davis School of Veterinary Medicine. An expert in fish diseases, Marty has been studying the health of pink salmon since the 1989 Exxon Valdez oil spill in Alaska. "For anybody concerned about the effect of farm salmon on wild salmon, this is good news," Marty said. "Sea lice from fish farms have no significant effect on wild salmon population productivity."

The new study is the first to analyze 20 years of fish production data and 10 years of sea-lice counts from every salmon farm in the Broughton Archipelago and compare them against 60 years of population counts of adult pink salmon. The study concludes that farm fish are indeed the main source of sea lice on the area's juvenile wild pink salmon, but it found no statistical correlation between lice levels on the farms and the lifetime survival of wild pink salmon populations.

Pink salmon (Oncorhynchus gorbuscha) are the most abundant wild salmon species in the Broughton Archipelago. When they are a few months old, juvenile pink salmon leave the streams where they were born. They mature at sea, then return to their native streams to spawn and die two years after their parents.

Because of their two-year lifespans, the pink salmon born in odd-numbered years are genetically different from those born in even-numbered years. In the 60-year record, both lines of pink salmon have had tremendous, unexplained population swings, even before fish farms were established in the late 1980s.

Sea lice are natural parasites of adult pink salmon. The adult louse, about the size of a small watermelon seed, attaches itself to a fish's skin and feeds on its host. Minor lice infestations are not harmful to pink salmon, but a severe infestation can weaken or kill the smallest fish (those about the size of a paperclip). On fish farms, veterinarians treat the fish with medicated feed when lice populations become too high.

The Broughton fish farms raise Atlantic salmon (Salmo salar) in net-sided pens in the water. Wild pink salmon are separated from the farm fish only by the mesh of the net enclosures. Lice freely pass from wild fish to farm fish, and vice-versa.

Record high numbers of wild pink salmon returned to spawn in rivers of the Broughton Archipelago in 2000 and 2001, but only 3 percent of that number returned in 2002, and only 12 percent in 2003.

Also, in 2001, the first examination of Broughton juvenile pink salmon found that more than 90 percent had lice. In the next two years, when the salmon numbers plummeted, the hypothesis arose that sea lice from fish farms were to blame. Calls went up for the farms to move the fish from open-net pens to closed containers. And government regulators ordered farmers to use stricter anti-lice treatments.

In the new study, Marty and his colleagues were able to see, year by year, how many lice were on the farms when the young pink salmon went to sea, and how many of those salmon returned to spawn. The results were surprising. "The salmon that returned in such low numbers in 2002 were exposed as juveniles to fewer sea lice than were the salmon that returned in record high numbers in 2001," Marty said. "Sea lice from farm fish could not have caused the 2002 wild salmon population crash."

Marty's co-authors are Sonja Saksida, director of the British Columbia Centre for Aquatic Health Sciences in Campbell River, and Terrance Quinn, professor of fish population dynamics at the Juneau Center of the School of Fisheries and Ocean Sciences at the University of Alaska Fairbanks. Quinn is a world authority on mathematical modeling of fish populations. Saksida is a veterinarian and the first researcher given access to confidential records from all the Broughton aquaculture companies.

Marty is also the fish pathologist for the British Columbia Ministry of Agriculture and an affiliate faculty member of the University of Alaska School of Fisheries and Ocean Sciences.

Marty said that even though the trio used much of the same fish and lice data used in previous studies, they reached a different conclusion for two reasons: First, the fish farmers gave Saksida their records, and second, the old and new data were analyzed using methods common in veterinary medical science that were not used in many of the previous studies.

"The major lesson of this study is that we cannot settle for simple explanations for wild-animal population declines. There are very complex interactions among disease, environment and animal population health.

Sustainability studies must engage all the science specialties to pursue a better understanding of these relationships," Marty said. *Provided by University of California - Davis*

http://www.physorg.com/news/2010-12-solar-voyager-spacecraft.html

No more solar wind for Voyager 1 spacecraft

(PhysOrg.com) -- *The 33-year odyssey of NASA's Voyager 1 spacecraft has reached a distant point at the edge of our solar system where there is no outward motion of solar wind.*

Now hurtling toward interstellar space some 10.8 billion miles from the sun, Voyager 1 has crossed into an area where the velocity of the hot ionized gas, or plasma, emanating directly outward from the sun has slowed to zero. Scientists suspect the solar wind has been turned sideways by the pressure from the interstellar wind in the region between stars.

The event is a major milestone in Voyager 1's passage through the heliosheath, the turbulent outer shell of the sun's sphere of influence, and the spacecraft's upcoming departure from our solar system.

"The solar wind has turned the corner," said Ed Stone, Voyager project scientist based at the California Institute of Technology in Pasadena, Calif. "Voyager 1 is getting close to interstellar space."

Our sun gives off a stream of charged particles that form a bubble known as the heliosphere around our solar system. The solar wind travels at supersonic speed until it crosses a shockwave called the termination shock. At this point, the solar wind dramatically slows down and heats up in the heliosheath.

Launched on Sept. 5, 1977, Voyager 1 crossed the termination shock in December 2004 into the heliosheath. Scientists have used data from Voyager 1's Low-Energy Charged Particle Instrument to deduce the solar wind's velocity. When the speed of the charged particles hitting the outward face of Voyager 1 matched the spacecraft's speed, researchers knew that the net outward speed of the solar wind was zero. This occurred in June, when Voyager 1 was about 10.6 billion miles from the sun.

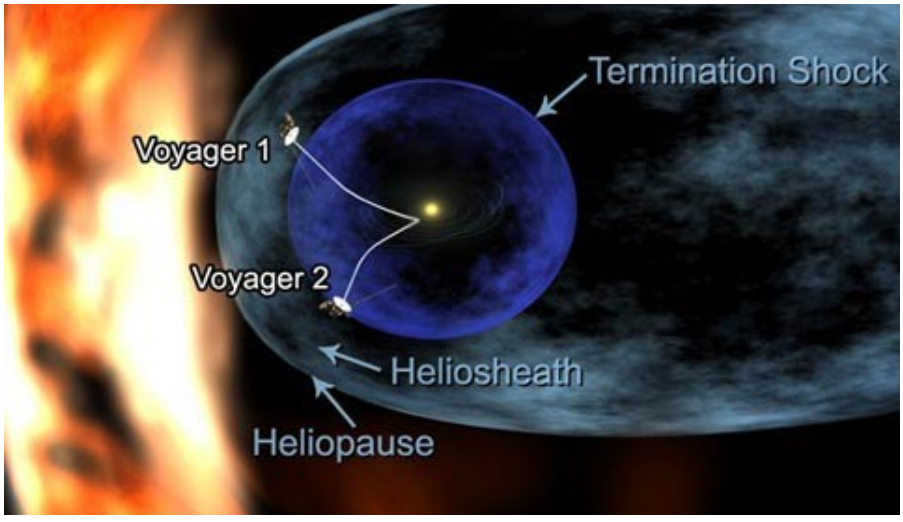
Because the velocities can fluctuate, scientists watched four more monthly readings before they were convinced the solar wind's outward speed actually had slowed to zero. Analysis of the data shows the velocity of the solar wind has steadily slowed at a rate of about 45,000 mph each year since August 2007, when the solar wind was speeding outward at about 130,000 mph. The outward speed has remained at zero since June.

The results were presented at the American Geophysical Union meeting in San Francisco.

"When I realized that we were getting solid zeroes, I was amazed," said Rob Decker, a Voyager Low-Energy Charged Particle Instrument co-investigator and senior staff scientist at the Johns Hopkins University Applied Physics Laboratory in Laurel, Md. "Here was Voyager, a spacecraft that has been a workhorse for 33 years, showing us something completely new again."

Scientists believe Voyager 1 has not crossed the heliosheath into interstellar space. Crossing into interstellar space would mean a sudden drop in the density of hot particles and an increase in the density of cold particles. Scientists are putting the data into their models of the heliosphere's structure and should be able to better estimate when Voyager 1 will reach interstellar space. Researchers currently estimate Voyager 1 will cross that frontier in about four years.

"In science, there is nothing like a reality check to shake things up, and Voyager 1 provided that with hard facts," said Tom Krimigis, principal investigator on the Low-Energy Charged Particle Instrument, who is based at the Applied Physics Laboratory and the Academy of Athens, Greece. "Once again, we face the predicament of redoing our models."



Artist concept of the two Voyager spacecraft as they approach interstellar space. ***Image credit: NASA/JPL***

A sister spacecraft, Voyager 2, was launched in Aug. 20, 1977 and has reached a position 8.8 billion miles from the sun. Both spacecraft have been traveling along different trajectories and at different speeds. Voyager 1 is traveling faster, at a speed of about 38,000 mph, compared to Voyager 2's velocity of 35,000 mph. In the next few years, scientists expect Voyager 2 to encounter the same kind of phenomenon as Voyager 1.

Provided by JPL/NASA

http://www.eurekalert.org/pub_releases/2010-12/uol-nar121410.php

New asthma research breaks the mold

Study finds cause of allergic reaction could be growing in your lungs

Scientists investigating the allergic reactions that asthmatics suffer towards a common mould have discovered that many people with asthma actually had the mould growing in their own lungs.

The research led by University of Leicester scientists at Glenfield Hospital has been published in the December 2010 issue of the American Journal of Respiratory and Critical Care Medicine.

The team based in the Institute for Lung Health at the University of Leicester and Glenfield Hospital examined the impact on asthmatics of a common environmental mould, Aspergillus fumigates, usually found in soil and compost heaps.

Professor Andy Wardlaw from the University of Leicester said: "Asthma is a very common condition where the breathing tubes (bronchi) can go into spasm making it difficult to breathe. Around a fifth of adults with severe asthma, which they have had for a long time, get permanent (fixed) narrowing of their bronchi. It is known that A. fumigatus can grow in the lungs of some people with asthma and mould allergy, which can cause severe lung damage.

"This problem is thought to only affect a very small number of people with asthma; however, about half of people with severe asthma have evidence of allergy to moulds like A. fumigatus."

Researchers in the Institute for Lung Health at the University of Leicester and Glenfield Hospital, Leicester, carried out a study funded by the Midlands Asthma and Allergy Research Association (MAARA, a Midlands based charity funding research into asthma and allergy research. www.maara.org) and the European Regional Development Fund (ERDF), to determine whether the problem of A. fumigatus growing in the lungs is more common than previously thought, and whether this could explain the fixed narrowing of the airways that occurs in some people with asthma.

Professor Wardlaw added: "Our study showed that 6 out of 10 people with asthma who were allergic to A. fumigatus grew the mould from their sputum. We also found that if you were allergic to A. fumigatus you had more narrowing of the airways than if you were not allergic, and this was worse in patients from whom A. fumigatus was grown.

"Our research concluded that it is possible that fixed narrowing of breathing tubes in many people with asthma could be caused by A. fumigatus growing in their lungs.

"Treating individuals from whom A. fumigatus is detected with antibiotics against the mould may prevent fixed narrowing of the airways. "

http://www.eurekalert.org/pub_releases/2010-12/uoc-vby121410.php

Vaccine boosts your immune system

YOUR BODY'S OWN VACCINE: Researchers at BRIC, the University of Copenhagen, have discovered for the first time a protein normally found in the body that can act to prevent chronic tissue inflammation.

When administered in the form of a therapeutic vaccine it is able to effectively prevent and treat a number of different inflammatory disease models for multiple sclerosis (MS), rheumatoid arthritis (RA), skin hypersensitivity and allergic asthma (AA).

The article, entitled, "Endogenous collagen peptide activation of CD1d-restricted NKT cells ameliorates multiple tissue-specific inflammation in mice", is published by the prestigious Journal of Clinical Investigation.

Led by a Danish researcher and the result of a translational collaboration involving researchers in Sweden and Germany, the article culminates a decade's long search for ways to combat inflammation and inflammatory diseases. The study was led by Principal Investigator Shohreh Issazadeh-Navikas.

She said, "The implications of the findings are large as they shed light on an important way that the body combats inflammation and autoimmunity. Moreover, they establish a therapeutic approach for using the newly discovered protein as a treatment for multiple conditions."

Many inflammatory and autoimmune diseases are chronic and affect a large majority of people. Moreover, there is an inflammatory component to many common diseases, such as Alzheimer's, Parkinson's, RA, AA, MS, type II diabetes and cancers. The vaccine discovered by the researchers boosts special cells of the immune system, called NKT cells. NKT cells are a type of T cell that exert profound and diverse regulatory effects in disease, from autoimmunity to responses to pathogens and cancer. For over two decades since their discovery NKT cells have traditionally been considered to be activated by lipid antigens presented by CD1 molecules. However, Professor Issazadeh-Navikas' group was able to show for the first time the ability of a self peptide to activate NKT cells to suppress many tissue-specific inflammatory conditions including experimental autoimmune diseases. This highly significant and novel finding offers a new perspective on the ways in which

the body combats inflammation in both health and disease. In addition, the researchers identified the activation requirements and signaling pathway through which they exert their function.

Professor Issazadeh-Navikas highlighted, "Our data offer a novel perspective on the physiological role of these cells in maintenance of tissue homeostasis and reduction of inflammation".

The findings significantly advance the fields of autoimmunity, antigen presentation, and NKT cells. They provide mechanistic insight into the biology of these cells and their roles in disease and point the way to therapies to treat many of the common conditions of mankind.

http://www.eurekalert.org/pub_releases/2010-12/jaaj-uom120910.php

Use of methods to protect lungs after brain death increases number of lungs suitable for donation

Use of certain measures for lung preservation after brain death in potential organ donors resulted in a nearly doubling of lungs eligible for donation, compared to a conventional strategy that is used, according to preliminary research published in the December 15 issue of JAMA.

Of patients with relatively normal pulmonary function at the time of brain death, only 15 percent to 20 percent of these patients' lungs are subsequently suitable for transplantation, which may be the result in part from the ventilatory strategy used after brain death. There is controversy as to the best ventilatory strategy to use in these situations, according to background information in the article.

Luciana Mascia, M.D., Ph.D., of San Giovanni Battista Molinette Hospital, University of Turin, Italy, and colleagues conducted a study to examine whether a protective lung strategy in patients diagnosed as having brain death would decrease the development of lung dysfunction and increase the number of lungs available for transplantation. The randomized controlled trial was conducted at 12 European intensive care units from September 2004 to May 2009. Potential donors were randomized to the conventional ventilatory strategy or the protective ventilatory strategy, with this strategy including several differences such as use of lower tidal volumes (the volume of air inhaled and exhaled at each breath) and higher positive end-expiratory pressure levels (increasing the air pressure in the lungs and air passages near the end of expiration so that an increased amount of air remains in the lungs following expiration). The trial was stopped after enrolling 118 patients (59 in the conventional ventilatory strategy and 59 in the protective ventilatory strategy) because of termination of funding.

The researchers found that the number of patients in the conventional strategy who met lung donor eligibility criteria at the end of the 6-hour observation period was 32 (54 percent) compared with 56 (95 percent) in the protective strategy. The number of patients in whom lungs were harvested was 16 (27 percent) in the conventional strategy compared with 32 (54 percent) in the protective strategy. Further analyses showed that donor eligibility at the end of the 6-hour observation period was associated with the protective strategy and with use of vasoactive drugs (an agent that causes constriction or dilation of blood vessels) at randomization.

"The median [midpoint] intensive care unit length of stay for patients who received lungs from donors in the conventional strategy was 12 days compared with 8 days for patients who received lungs from donors in the protective strategy. The 6-month survival rate was 69 percent (11/16) for patients who received lungs from donors in the conventional strategy compared with 75 percent (24/32) for patients who received lungs from donors in the protective strategy," the authors write. They add that the number of other organs harvested (hearts, livers and kidneys) did not differ between the 2 groups.

"In conclusion, our results suggest that the use of a lung protective strategy prevents the decline of pulmonary function consequent to brain death and roughly doubled the number of lungs available for transplantation."

(JAMA. 2010;304[23]:2620-2627. Available pre-embargo to the media at www.jamamedia.org)

Editor's Note: Please see the article for additional information, including other authors, author contributions and affiliations, financial disclosures, funding and support, etc.

Editorial: Improving the Supply of Donor Organs

This study breaks important new ground in providing a solid evidence base for the care of potential organ donors and testing techniques of organ preservation, writes Mark S. Roberts, M.D., M.P.P., of the University of Pittsburgh, in an accompanying editorial.

"The study by Mascia et al provides sobering evidence that conventional lung preservation practices, which have been used for many years, are remarkably inefficient in their task and that improved lung preservation strategies can markedly increase the proportion of donated lungs that are transplanted. This article should provide encouragement to continue to apply such rigorous methods to improve the viability of potential donor organs and to take better care of the gift of life."

(JAMA. 2010;304[23]:2643-2644. Available pre-embargo to the media at www.jamamedia.org)

http://www.eurekalert.org/pub_releases/2010-12/bmj-syf121310.php

Submerging your feet in alcohol will not get you drunk

Research: Testing the validity of the Danish urban myth that alcohol can be absorbed through feet: Open labeled self experimental study

Research in the Christmas issue published on bmj.com today explodes the Danish myth that it is possible to get drunk by submerging your feet in alcohol. The authors, led by Dr Peter Lommer Kristensen from the Hillerød Hospital in Denmark, say it was important that the myth underwent scientific scrutiny to prevent students wasting their time experimenting with this activity.

Three adult volunteers took part in the study. None of them suffered from any chronic skin or liver disease and they were not addicted to alcohol or psychoactive drugs. The participants were not members of any local Alcoholics Anonymous groups and had not been implicated in any serious accidents or socially embarrassing events related to alcohol in the week prior to the study.

The volunteers drank no alcohol for 24 hours before the experiments and they provided a blood sample before submerging their feet in a washing-up bowl containing three bottles of Karloff Vodka. The participants then kept their feet in the vodka for three hours and provided blood samples every half an hour.

The group undertook a self-assessment for signs of drunkenness – they rated themselves on a scale of 0 to 10 on self-confidence, urge to speak and the number of times they desired spontaneous hugs.

The results show that after the three hours there was no increase in the concentration of alcohol in the participants' blood stream.

Kristensen concludes "that the Danish urban myth about being able to get drunk by submerging feet in strong alcoholic beverages is just that; a myth.

He adds that the study has many implications including evidence that driving a vehicle or skippering a boat with boots full of Vodka seems to be safe, and brewery workers cannot become intoxicated by 'falling' into a brewery vat.

http://www.eurekalert.org/pub_releases/2010-12/ehs-ici121410.php

Inhaled corticosteroids increase diabetes mellitus risk

According to new study published in the American Journal of Medicine

New York, NY, December 14, 2010 – Inhaled corticosteroids are widely used in the treatment of asthma and chronic obstructive pulmonary disease (COPD). However, these drugs may be associated with diabetes development and progression. In a study published in the most recent issue of The American Journal of Medicine, researchers found that inhaled corticosteroids were associated with a 34% increase in the rate of diabetes onset and in the rate of diabetes progression. At the highest inhaled doses the risk increased by 64% in diabetes onset and 54% in diabetes progression.

Although inhaled corticosteroids are recommended only for patients with the most severe COPD, current practice has led to their use in less severe cases. In fact, over 70% of all patients with COPD are using inhaled corticosteroids. Since COPD and diabetes tend to increase with age, it is particularly important to assess any possible interaction between inhaled corticosteroid use and deterioration in glycemic control.

Investigators from McGill University and the Lady Davis Institute of the Jewish General Hospital, Montreal, Quebec, used data from over 380,000 patients treated for respiratory diseases identified in the Quebec health insurance databases. 30,167 patients developed diabetes during 5 ½ years of follow-up and another 2099 who progressed from oral hypoglycemic treatment to insulin.

Lead investigator Samy Suissa, PhD, Center for Clinical Epidemiology, Lady Davis Research Institute, Jewish General Hospital, Montreal, Quebec, Canada, and the Department of Epidemiology and Biostatistics and Department of Medicine, McGill University, observed that "high doses of inhaled corticosteroids commonly used in patients with COPD are associated with an increase in the risk of requiring treatment for diabetes and of having to intensify therapy to include insulin. Therefore, patients instituting therapy with high doses of inhaled corticosteroids should be assessed for possible hyperglycemia and treatment with high doses of inhaled corticosteroids limited to situations where the benefit is clear."

This large cohort allowed the accurate estimation of relative risk. There have been other major randomized trials that have not shown a significant association of inhaled corticosteroids and diabetes onset. In this study, the authors found an incidence of diabetes onset of 14.2 per 1000 patients per year. At that rate, previous studies may not have had sufficient data to detect the excess risk. "These are not insubstantial numbers," commented Dr. Suissa. "Over a large population the absolute numbers of affected people are significant."

The article is "Inhaled Corticosteroids and the Risks of Diabetes Onset and Progression" by Samy Suissa, PhD, Abbas Kezouh, PhD, Pierre Ernst, MD, MSc. It appears in The American Journal of Medicine, Volume 123, Issue 11 (November 2010) published by Elsevier.

http://www.physorg.com/news/2010-12-severe-rheumatoid-arthritis-cases.html

Smoking behind more than a third of severe rheumatoid arthritis cases

Smoking accounts for more than a third of cases of the most severe and common form of rheumatoid arthritis, indicates research published online in the Annals of the Rheumatic Diseases.

And it accounts for more than half of cases in people who are genetically susceptible to development of the disease, finds the study.

The researchers base their findings on more than 1,200 people with rheumatoid arthritis and 871 people matched for age and sex, but free of the disease. The patients came from 19 health clinics in south and central Sweden, while their healthy peers were randomly selected from the population register. All the participants were aged between 18 and 70. They were quizzed about their smoking habits and grouped into three categories, depending on how long they had smoked.

Blood samples were taken to assess all the participants' genetic profile for susceptibility to rheumatoid arthritis and to gauge the severity of their disease, as indicated by their antibody levels.

More than half of those with rheumatoid arthritis (61%) had the most severe form of the disease, which is also the most common form, as judged by testing positive for anticitrullinated protein/peptide antibody (ACPA).

Those who were the heaviest smokers - 20 cigarettes a day for at least 20 years - were more than 2.5 times as likely to test positive for ACPA. The risk fell for ex-smokers, the longer they had given up smoking. But among the heaviest smokers, the risk was still relatively high, even after 20 years of not having smoked.

Based on these figures, the researchers calculated that smoking accounted for 35% of ACPA positive cases, and one in five cases of rheumatoid arthritis, overall. Although this risk is not as high as for lung cancer, where smoking accounts for 90% of cases, it is similar to that for coronary artery heart disease, say the authors.

Among those with genetic susceptibility to the disease, and who tested positive for ACPA, smoking accounted for more than half the cases (55%). Those who smoked the most had the highest risk.

The authors point out that several other environmental factors may contribute to an increased risk of rheumatoid arthritis, including air pollutants and hormonal factors. But they suggest that their findings are sufficient to prompt those with a family history of rheumatoid arthritis to be advised to give up smoking.

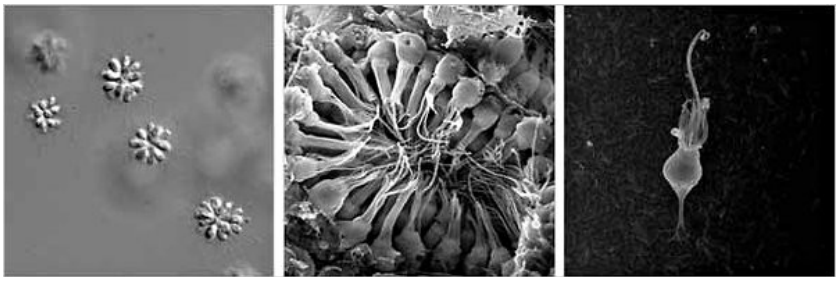
Provided by British Medical Journal

http://www.nytimes.com/2010/12/14/science/14creatures.html

In a Single-Cell Predator, Clues to the Animal Kingdom's Birth

By SEAN B. CARROLL

The Environmental Protection Agency is worried about a lot of things in our water — polychlorinated biphenyls, dibromochloropropane, Cryptosporidium parvum — to name just a few of the dozens of chemicals or organisms they monitor. However, in nearly every creek and lake, and throughout the oceans, there is one important group of multisyllabic microbes that the E.P.A. does not track, and until recently, most biologists heard and knew very little about — the choanoflagellates.



Before you spit out that glass of water or dunk your swimsuit in Clorox, relax. These tiny organisms are harmless. They are important for other reasons. They are part of the so-called nanoplankton and play critical roles in the ocean food chain. Choanoflagellates are voracious single-cell predators.

RELATIVES Recent studies suggest that choanoflagellates are cousins to all animals in the same way that chimpanzees are cousins to humans. From left, a choanoflagellate colony, feeding cells of sponges that resemble choanoflagellates and a choanoflagellate with its long flagellum and collar of filaments. There can be millions of choanoflagellates in a gallon of sea water. **Left and Right, Mark Dayel, Center: Scott Nichols**

The beating of their long flagellum both propels them through the water and creates a current that helps them to collect bacteria and food particles in the collar of 30 to 40 tentaclelike filaments at one end of the cell.

There can be thousands to millions of choanoflagellates in a gallon of sea water, which may filter 10 to 25 percent of coastal surface water per day. Choanoflagellates in turn serve as food for planktonic animals like crustacean larvae, which are consumed by larger animals, and so on up the food chain.

Theirs is a humble existence compared with the larger, more charismatic residents of the oceans like lobsters, fish, squids and whales.

But recent studies suggest that these obscure organisms are among the closest living single-celled relatives of animals. In other words, choanoflagellates are cousins to all animals in the same way that chimpanzees are cousins to humans. Just as the study of great apes has been vital to understanding human evolution, biologists are now scrutinizing choanoflagellates for clues about one of the great transitions in history — the origin of the animal kingdom.

For most of the first 2.5 billion years of life on Earth, most species were microscopic, rarely exceeding one millimeter in size, and unicellular. Many different kinds of larger life forms, including fungi, animals and plants, subsequently evolved independently from separate single-celled ancestors.

The evolution of multicellularity was a critical step in the origin of each of these groups because it opened the way to the emergence of much more complex organisms in which different cells could take on different tasks. And the emergence of larger organisms drove profound changes in ecology that changed the face of the planet.

Scientists are eager to understand how transitions from a unicellular to multicellular lifestyle were accomplished. Reconstructing events that happened more than 600 million years ago, in the case of animals, is a great challenge. Ideally, one would have specimens from just before and immediately after the event. But the unicellular ancestor of animals and those first animals are long extinct. So information has to be gleaned from living sources.

This is where comparisons between choanoflagellates and animals come into play. The close kinship between choanoflagellates and animals means that there once lived a single-celled ancestor that gave rise to two lines of evolution — one leading to the living choanoflagellates and the other to animals.

Choanoflagellates can tell us a lot about that ancestor because any characteristics that they share with animals must have been present in that ancestor and then inherited by both groups. By similar logic, whatever animals have but choanoflagellates lack probably arose during animal evolution.

There are striking physical resemblances between choanoflagellates and certain animal cells, specifically the feeding cells of sponges, called choanocytes. Sponge choanocytes also have a flagellum and possess a collar of filaments for trapping food. Similar collars have been seen on several kinds of animals cells. These similarities indicate that the unicellular ancestor of animals probably had a flagellum and a collar, and may have been much like a choanoflagellate.

But even more surprising and informative resemblances between choanoflagellates and animals have been revealed at the level of DNA. Recently, the genome sequence of one choanoflagellate species was analyzed by a team led by Nicole King and Daniel Rokhsar at the University of California, Berkeley.

They identified many genetic features that were shared exclusively between choanoflagellates and animals. These included 78 pieces of proteins, many of which in animals are involved in making cells adhere to one another.

The presence of so many cell adhesion molecules in choanoflagellates was very surprising. The scientists are trying to figure out what all of those molecules are doing in a unicellular creature. One possibility is that the molecules are used in capturing prey.

Whatever the explanation, the presence of those genes in a unicellular organism indicates that much of the machinery for making multicellular animals was in place long before the origin of animals. It may be that rather than evolving new genes, animal ancestors simply used what they had to become multicellular. There may be selective advantages to forming colonies, like avoiding being eaten by other small predators. And in fact, some choanoflagellates do form multicellular colonies at stages of their life cycle.

Dr. King and her colleagues Stephen Fairclough and Mark Dayel investigated one such species to determine whether colony formation occurred by dividing cells staying together, the way animal embryos form, or by individual cells aggregating together, as some protists like slime molds do.

The scientists found that colonies formed exclusively by dividing cells staying together. They suggested that the ancient common ancestor of choanoflagellates and animals was capable of forming simple colonies and that this property may well have been a first step on the road to animal evolution.

The world is full of microbes, and we spend a lot of worry and effort trying to keep them off and out of our bodies. It is humbling to ponder that still swimming within that microscopic soup are our distant cousins.

This article has been revised to reflect the following correction:

Correction: December 14, 2010

An earlier version of this article misspelled the surname of a researcher at the University of California, Berkeley. He is Mark Dayel, not Doyel. And a credit for a picture of feeding cells of sponges misspelled the photographer's surname. He is Scott Nichols, not Nichol.

http://www.bbc.co.uk/news/science-environment-11992299

Life may have survived 'Snowball Earth' in ocean pockets

By Neil Bowdler Science reporter, BBC News

Life may have survived a cataclysmic global freeze some 700 million years ago in pockets of open ocean.

Researchers claim to have found evidence in Australia that turbulent seas still raged during the period, where micro-organisms may have clung on for life. Conditions on what is dubbed Snowball Earth were so harsh that most life is thought to have perished. Details are published in the journal Geology.

The researchers in Britain and Australia claim to have found deposits in the remote Flinders Ranges in South Australia which bear the unmistakable mark of turbulent oceans.

They say the sediments date to the Sturtian glaciation some 700 million years ago, one of two great ice ages of the Cryogenian period associated with the Snowball Earth hypothesis.

The Flinders Ranges in South Australia where the sedimentary evidence was found The evidence comes from the Flinders Ranges in South Australia These sediments, they say, prove pockets of open ocean waters must have existed during the period, perhaps supporting microscopic life.

The Snowball Earth hypothesis suggests the land and oceans of our planet were thrown into a deep freeze, the like of which has never been seen before or since.

"For the first time, we have very clear evidence that storms were affecting the sea floor," said Dr Dan Le Heron of Royal Holloway, University of London, who led the research. "That means we have to have pockets or oases within this Snowball Earth that are free of ice. "We see a very particular type of feature in sedimentary rocks called 'hummocky cross-bedding'. These features can only form where storm waves sweep up sand from the ocean floor, slosh it back and forth and create a bed of sandstone."

These ocean pockets could explain how some microorganisms survived the period and went on to flourish and diversify during the later Cambrian period. "This could be one of the ideal places for early organisms to start thriving and for evolution to really start kicking in."

'Slushball' Earth

The Snowball Earth hypothesis is just that - a hypothesis - and while most agree on the evidence for a deep freeze, argument remains over the causes and the extent to which the entire globe froze during the Sturtian and Marinoan glaciations. Some wonder how any life could have survived such a deep freeze.

Professor Doug Benn of the University Centre in Svalbard, who admits to being more a "Slushball" Earth theorist, said: "The paper supports the idea that the Earth was not completely frozen throughout one of the extreme glaciations in the late Precambrian."

"The Snowball model was ground-breaking in its time, but now it has to be replaced by a more dynamic - and even more interesting - picture of how the Earth functioned in the distant past," he said.

http://news.nationalgeographic.com/news/2010/12/101214-mars-liquid-water-life-bacteria-human-mission-science-space/

Mars Has Liquid Water Close to Surface, Study Hints

Brian Handwerk for National Geographic News

Pools of liquid water may even now exist just a few meters below the Martian surface, according to new research. The finding hints that humans may one day be able to tap into Mars's watery bounty.

Although the surface of Mars is too frigid for liquid water to be stable, pockets of water underground could be kept warm enough by an insulating blanket of porous sediment, an international team writes in the November issue of the journal Icarus. The new theory is based on studies of Mars's biggest outflow channels, which stretch for hundreds of kilometers across the southern circum-Chryse region.

The ancient channels were likely carved by gushing torrents of water, each hundreds to thousands of times larger than the Mississippi River. These massive rivers are believed to have erupted from underground sources, suggesting that shallow groundwater reservoirs were once relatively common in Mars's upper crust.

In fact, collapsed terrain on the floors of the outflow channels could be showing where some now empty reservoirs once existed. (Related: "Ancient Mars Had Vast Ocean, New Evidence Shows.")

Thermal modeling then revealed an intriguing possibility, said study leader J. Alexis Palmero Rodriguez, of the Planetary Science Institute in Arizona.

"If you have a few tens of meters of porous, fine-grain sediments, dunes, or alluvial deposits, you can create a thermal anomaly that would produce melting or perhaps stabilize existing water at shallow depths," he said.

"At present, Martian heat flow"—heat moving from the planet's interior toward its surface—"is four times lower [than when the channels were formed some three billion years ago], so you need four times the thickness, maybe 120 meters [395 feet] of porous sediments," he continued.

"But that's still very shallow and may be accessible to humans."

Mars Groundwater Would Be Easy to Tap

If they exist, today's Martian groundwater reservoirs might be similar to the aquifers that lie beneath icy permafrost in Earth's northern regions, said study co-author Jeffrey Kargel, a research scientist at the University of Arizona in Tucson.

That means Martian reservoirs might be found by searching for deep dunes overlying known water-rich areas, such as salt beds or glacial ice. (See "Mars Water Discovered, 'Tasted' by Lander—A First.")

And because the water would lie below unconsolidated sediments, not solid rock, drilling for water could be relatively easy and inexpensive—creating a valuable resource for any future humans exploring the planet.

***Sand dunes ripple across the plains near the mouth of a giant outflow channel on Mars*. Photograph courtesy NASA/JPL/University of Arizona**

"Water is fundamental to sustaining long-term human settlements on Mars," study leader Rodriguez said. "In addition, hydrogen extracted from water can be used as fuel."

The study also has bearing on the search for extraterrestrial life: Subsurface aquatic environments have been suggested as likely spots for microbes to develop on Mars.

"From a biological perspective, the presence of liquid water is the only constraint for life development on Mars, given the presence of different energy sources and alternative radiation-protection mechanisms," said co-author Alberto Fairén of NASA's Ames Research Center in California.

For example, molecular adaptations could have enabled bacteria or other microorganisms to survive in the Martian underground without energy from the sun, just as some microbes thrive in icy subsurface areas on Earth, Fairén added.

Still in Search of Liquid Evidence

Of course, debates about liquid water on Mars will likely continue until liquid evidence emerges, said Jeff Andrews-Hanna, a geophysicist at the Colorado School of Mines who is unaffiliated with the new research.

"This shallow groundwater would be a prime target for future Mars missions, if it does indeed exist," he said. "But the distribution of water beneath the surface of Mars today remains a controversial topic."

For example, other recent research—published in December 2009 by Robert Grimm and Scott Painter in the journal Geophysical Research Letters—argues that the Martian subsurface must be largely dry today, he said.

That research modeled the ways ancient climate change on Mars moved water and carbon dioxide through the planet's subsurface. The scientists concluded that ice would have sublimated—turned directly from liquid to gas—and any groundwater would have subsequently evaporated at low latitudes.

"In this view," Andrews-Hanna said, "the only water on Mars today is the ice trapped in the permafrost near the polar regions and in a few other local deposits."

http://www.eurekalert.org/pub_releases/2010-12/acs-dfr121510.php

Does fluoride really fight cavities by 'the skin of the teeth?'

***In a study that the authors describe as lending credence to the idiom, "by the skin of your teeth," scientists are reporting that the protective shield** fluoride forms on teeth is up to 100 times thinner than previously believed.*

It raises questions about how this renowned cavity-fighter really works and could lead to better ways of protecting teeth from decay, the scientists suggest. Their study appears in ACS' journal Langmuir.

Frank Müller and colleagues point out that tooth decay is a major public health problem worldwide. In the United States alone, consumers spend more than $50 billion each year on the treatment of cavities. The fluoride in some toothpaste, mouthwash and municipal drinking water is one of the most effective ways to prevent decay. Scientists long have known that fluoride makes enamel — the hard white substance covering the surface of teeth — more resistant to decay. Some thought that fluoride simply changed the main mineral in enamel, hydroxyapatite, into a more-decay resistant material called fluorapatite.

The new research found that the fluorapatite layer formed in this way is only 6 nanometers thick. It would take almost 10,000 such layers to span the width of a human hair. That's at least 10 times thinner than previous studies indicated. The scientists question whether a layer so thin, which is quickly worn away by ordinary chewing, really can shield teeth from decay, or whether fluoride has some other unrecognized effect on tooth enamel. They are launching a new study in search of an answer.

The authors acknowledge support from Deutsche Forschungsgemeinschaft and Saarland Ministry of Finances.
ARTICLE FOR IMMEDIATE RELEASE "Elemental Depth Profiling of Fluoridated Hydroxyapatite: Saving Your Dentition by the Skin of Your Teeth?"

http://www.eurekalert.org/pub_releases/2010-12/afps-apm121510.php

A positive mood allows your brain to think more creatively

***People who watch** funny videos on the internet at work aren't necessarily wasting time.*

They may be taking advantage of the latest psychological science—putting themselves in a good mood so they can think more creatively.

"Generally, positive mood has been found to enhance creative problem solving and flexible yet careful thinking," says Ruby Nadler, a graduate student at the University of Western Ontario. She and colleagues Rahel Rabi and John Paul Minda carried out a new study published in Psychological Science, a journal of the Association for Psychological Science. For this study, Nadler and her colleagues looked at a particular kind of learning that is improved by creative thinking.

Students who took part in the study were put into different moods and then given a category learning task to do (they learned to classify sets of pictures with visually complex patterns). The researchers manipulated mood with help from music clips and video clips; first, they tried several out to find out what made people happiest and saddest. The happiest music was a peppy Mozart piece, and the happiest video was of a laughing baby. The researchers then used these in the experiment, along with sad music and video (a piece of music from Schindler's List and a news report about an earthquake) and a piece of music and a video that didn't affect mood. After listening to the music and watching the video, people had to try to learn to recognize a pattern.

Happy volunteers were better at learning a rule to classify the patterns than sad or neutral volunteers. "If you have a project where you want to think innovatively, or you have a problem to carefully consider, being in a positive mood can help you to do that," Nadler says. And music is an easy way to get into a good mood. Everyone has a different type of music that works for them—don't feel like you have to switch to Mozart, she says.

Nadler also thinks this may be a reason why people like to watch funny videos at work. "I think people are unconsciously trying to put themselves in a positive mood"—so that apparent time-wasting may actually be good news for employers.

The APS journal Psychological Science is the highest ranked empirical journal in psychology. For a copy of the article "Better Mood and Better Performance: Learning Rule Described Categories Is Enhanced by Positive Mood" and access to other Psychological Science research findings, please contact Keri Chiodo at 202-293-9300 or kchiodo@psychologicalscience.org.

http://www.eurekalert.org/pub_releases/2010-12/dumc-sds120910.php

Scientists decode secrets of a very common virus that can cause cancer

DURHAM, N.C. – *About 90 percent of people are infected at some time in their lives with Epstein-Barr virus (EBV), usually with no ill effects.*

But individuals with compromised immune systems, such as people with organ transplants or HIV infection, have a greater risk of cancer occurring because of this virus. Scientists at the Duke Cancer Institute have discovered a pathway that infected cells use to root out EBV infections, a finding that has implications for understanding the human response to cancer-causing viruses in general.

"Using cell culture studies, we have uncovered a major pathway that the infected host cell activates to prevent an oncogenic virus from causing cancer," said senior author Micah Luftig, Ph.D., Assistant Professor of Molecular Genetics and Microbiology. "We proposed that the cell was sensing that the virus is trying to take over. When this oncogenic stress response is activated, it keeps the virus in check, and now we know why."

The Luftig group also learned how the Epstein-Barr virus overcomes the cell's response. "The findings may eventually yield therapies to benefit people who don't have good immune systems and who need protection from a threatening EBV infection," Luftig said.

This work appears in the Dec. 15 online issue of Cell Host and Microbe.

Very early in many people's lives, there is a huge expansion of immune system B cells infected with EBV. But thanks to the oncogenic stress response and a strong immune system, the majority of these infected cells are killed off and the person remains healthy. Luftig and his group, including lead authors Pavel Nikitin and Chris

Yan, found two enzymes, called kinases, which were critical in mediating this oncogenic stress response and preventing unchecked B-cell cell growth, called immortalization.

When the scientists blocked the ATM and Chk2 kinases, unchecked growth resulted in 10 times more infected cells. This burgeoning cell growth is related to several types of cancer, including post-transplant lymphoproliferative disorder, in which a transplant patient gets a form of lymphoma because of B-cell proliferation, and HIV-associated B-cell lymphomas among others.

"This finding can be extended to the general case of any oncogene being activated that might start the process of tumor formation," Luftig said. "About 20 percent of all human cancers are caused by infectious agents, where about 80 percent of these infections are viral." Another example of a viral infection leading to cancer is the human papillomavirus, implicated in cervical cancer.

Epstein-Barr virus infection can mean different courses for different people. In children 4-5 years old, a first infection with the virus may cause a mild illness, but if this primary infection happens during adolescence, the person may suffer a case of mononucleosis with heavy fatigue and other symptoms. In immune-compromised people, the virus can do much worse damage and cause forms of lymphoma.

Other authors include Eleonora Forte, Alessio Bocedi, Jay Tourigny, Katherine Hu, Jing Guo, David Tainter and Elena Rusyn of the Duke Department of Molecular Genetics and Microbiology, and Amee Patel, Sandeep Dave and William Kim of the Duke Institute for Genome Sciences & Policy as well as Rob White and Martin Allday of the Imperial College London.

For more information about Luftig lab's studies: http://mgm.duke.edu/faculty/luftig/index.htm

Funding for this study came from the American Cancer Society, the National Cancer Institute, the Duke Center for AIDS Research, the Duke Comprehensive Cancer Center, and Golfers Against Cancer.

http://www.eurekalert.org/pub_releases/2010-12/uoc-awo121510.php

Atomic weights of 10 elements on periodic table about to make an historic change

Researchers from around the world compile more reliable data that will help science and industry

For the first time in history, a change will be made to the atomic weights of some elements listed on the Periodic table of the chemical elements posted on walls of chemistry classrooms and on the inside covers of chemistry textbooks worldwide. The new table, outlined in a report released this month, will express atomic weights of 10 elements - hydrogen, lithium, boron, carbon, nitrogen, oxygen, silicon, sulfur, chlorine and thallium - in a new manner that will reflect more accurately how these elements are found in nature.

"For more than a century and a half, many were taught to use standard atomic weights — a single value — found on the inside cover of chemistry textbooks and on the periodic table of the elements. As technology improved, we have discovered that the numbers on our chart are not as static as we have previously believed," says Dr. Michael Wieser, an associate professor at the University of Calgary, who serves as secretary of the International Union of Pure and Applied Chemistry's (IUPAC) Commission on Isotopic Abundances and Atomic Weights. This organization oversees the evaluation and dissemination of atomic-weight values.

Modern analytical techniques can measure the atomic weight of many elements precisely, and these small variations in an element's atomic weight are important in research and industry. For example, precise measurements of the abundances of isotopes of carbon can be used to determine purity and source of food, such as vanilla and honey. Isotopic measurements of nitrogen, chlorine and other elements are used for tracing pollutants in streams and groundwater. In sports doping investigations, performance-enhancing testosterone can be identified in the human body because the atomic weight of carbon in natural human testosterone is higher than that in pharmaceutical testosterone.

The atomic weights of these 10 elements now will be expressed as intervals, having upper and lower bounds, reflected to more accurately convey this variation in atomic weight. The changes to be made to the Table of Standard Atomic Weights have been published in Pure and Applied Chemistry and a companion article in Chemistry International.

For example, sulfur is commonly known to have a standard atomic weight of 32.065. However, its actual atomic weight can be anywhere between 32.059 and 32.076, depending on where the element is found. "In other words, knowing the atomic weight can be used to decode the origins and the history of a particular element in nature," says Wieser who co-authored the report.

Elements with only one stable isotope do not exhibit variations in their atomic weights. For example, the standard atomic weights for fluorine, aluminum, sodium and gold are constant, and their values are known to better than six decimal places.

"Though this change offers significant benefits in the understanding of chemistry, one can imagine the challenge now to educators and students who will have to select a single value out of an interval when doing chemistry calculations," says Dr. Fabienne Meyers, associate director of IUPAC.

"We hope that chemists and educators will take this challenge as a unique opportunity to encourage the interest of young people in chemistry and generate enthusiasm for the creative future of chemistry."

The University of Calgary has and continues to contribute substantially in the study of atomic weight variations. Professor H. Roy Krouse created the Stable Isotope Laboratory in the Department of Physics and Astronomy in 1971. Early work by Krouse established the wide natural range in the atomic weight of significant elements including carbon and sulfur. Currently, researchers at the University of Calgary in physics, environmental science, chemistry and geoscience are exploiting variations in atomic weights to elucidate the origins of meteorites, to determine sources of pollutants to air and water, and to study the fate of injected carbon dioxide in geological media.

This fundamental change in the presentation of the atomic weights is based upon work between 1985 and 2010 supported by IUPAC, the University of Calgary and other contributing Commission members and institutions.

http://www.eurekalert.org/pub_releases/2010-12/aaoo-pot121510.php

Put on the brakes after foot or ankle surgery

Study finds that immobilization devices significantly reduce braking response time

Patients recovering from a right foot injury or surgery should think twice about how soon they want to begin driving again. According to a new study from the Journal of Bone and Joint Surgery (JBJS), it takes much longer to brake when the driver is wearing an immobilization device - like a splint or brace, than it does when wearing normal footwear.

Driving is important to many people's social and professional lives, so when a person's right ankle or foot must be immobilized after an injury or surgery, one of the first questions an orthopaedic surgeon hears is, "When can I start driving again?"

To answer this question, researchers measured emergency braking time in people using a brake adapted for use by the left foot, or wearing a short leg cast, a controlled ankle-motion boot, or normal footwear. The results showed that all of the devices, except for normal footwear, impaired the drivers' ability to brake quickly.

"We did not find a device that was as safe as normal footwear," says CPT Thomas Dowd, MD, an orthopaedic surgeon in the Department of Orthopedics and Rehabilitation at Brooke Army Medical Center in Fort Sam Houston, Texas. "We only tested emergency braking situations, but it's reasonable to assume that if a person cannot stop quickly in an emergency, it may not be safe for that person to be driving."

Study details and findings:

* Compared with an individual wearing normal footwear, an individual traveling at a highway speed of 60 miles per hour (mph) (96.6 km/hr) would travel an additional 9.2 feet (2.8 m) during emergency braking when wearing a right lower-extremity controlled-ankle-motion boot.
* A driver wearing a right lower-extremity short leg cast would travel an additional 6.1 feet (1.9 m) before coming to an emergency stop.
* A driver using a left-foot braking adapter would travel an additional 6.0 feet (1.8 m).
* At a community-driving speed of 35 mph (56.3 km/hr), these same individuals would travel an additional 5.4 feet (1.6 m), 3.6 ft (1.1 m), and 3.5 feet (1.1 m), respectively. These changes in distance traveled might represent the difference between being involved in or avoiding a collision in an emergency setting.
* The effect of immobilization devices on fine braking scenarios such as navigating a curve or driving in stop-and-go traffic is unknown, but according to study authors, it is likely to be greater.
* The test subjects were healthy adults who had not recently undergone surgery or sustained an injury, so their braking response times are likely to be somewhat better than individuals having discomfort or other symptoms due to their medical condition.

"Based on our findings," Dr. Dowd said, "we cannot recommend that any patient return to driving using a brake adapter or wearing an immobilization device on the right foot. Orthopaedic surgeons need to educate their patients about these safety concerns when discussing the best time to begin driving again."

Other relevant facts and statistics noted in the study:

* The ability to perform an emergency stop is essential for safe driving and can be represented by total brake-response time, reaction time, and braking time.
* Survey studies indicated that more than 90 percent of orthopaedic surgeons would generally not recommend that a patient drive while immobilized in a right lower-extremity short leg cast.
* Under the terms of most insurance policies, the insurer is not obligated to cover accidents in which the driver was still recovering from an earlier injury or operation.

Disclosure: Dr. Orr, Dr. Dowd, Dr. Rush, Dr. Hsu, Dr. Ficke, and Dr. Kirk have nothing related to this study to disclose.

http://www.eurekalert.org/pub_releases/2010-12/osu-afe121510.php

Ancient forest emerges mummified from the Arctic

SAN FRANCISCO -- ***The northernmost mummified forest ever found in Canada is revealing how plants struggled to endure a long-ago global cooling.***

Researchers believe the trees -- buried by a landslide and exquisitely preserved 2 to 8 million years ago -- will help them predict how today's Arctic will respond to global warming. They also suspect that many more mummified forests could emerge across North America as Arctic ice continues to melt. As the wood is exposed and begins to rot, it could release significant amounts of methane and carbon dioxide into the atmosphere -- and actually boost global warming.

Joel Barker, a research scientist at Byrd Polar Research Center and the School of Earth Sciences at Ohio State University and leader of the team that is analyzing the remains, will describe early results at the American Geophysical Union meeting in San Francisco on Friday, December 17.

Over the summer of 2010, the researchers retrieved samples from broken tree trunks, branches, roots, and even leaves -- all perfectly preserved -- from Ellesmere Island National Park in Canada.

"Mummified forests aren't so uncommon, but what makes this one unique is that it's so far north. When the climate began to cool 11 million years ago, these plants would have been the first to feel the effects," Barker said. "And because the trees' organic material is preserved, we can get a high-resolution view of how quickly the climate changed and how the plants responded to that change."

Barker found the deposit in 2009, when he was camping on Ellesmere Island for an unrelated research project. He followed a tip from a national park warden, who had noticed some wood sticking out of the mud next to a melting glacier. This summer, he returned with colleagues for a detailed study of the area.

Analysis of the remains has only just begun, but will include chemical and DNA testing.

For now, the researchers have identified the species of the most common trees at the site -- spruce and birch. The trees were at least 75 years old when they died, but spindly, with very narrow growth rings and under-sized leaves that suggest they were suffering a great deal of stress when they were alive.

"These trees lived at a particularly rough time in the Arctic," Barker explained. "Ellesmere Island was quickly changing from a warm deciduous forest environment to an evergreen environment, on its way to the barren scrub we see today. The trees would have had to endure half of the year in darkness and in a cooling climate. That's why the growth rings show that they grew so little, and so slowly."

Colleagues at the University of Minnesota identified the wood from the deposit, and pollen analysis at a commercial laboratory in Calgary, Alberta revealed that the trees lived approximately 2 to 8 million years ago, during the Neogene Period. The pollen came from only a handful of plant species, which suggests that Arctic biodiversity had begun to suffer during that time as well. The team is now working to identify other mummified plants at the site, scanning the remains under microscopes to uncover any possible seeds or insect remains.

Now that the forest is exposed, it's begun to rot, which means that it's releasing carbon into the atmosphere, where it can contribute to global warming.

Team member David Elliot, professor emeritus of earth sciences at Ohio State, said that the mummified forest on Ellesmere Island doesn't pose an immediate threat to the environment, though.

"I want to be clear -- the carbon contained in the small deposit we've been studying is trivial compared to what you produce when you drive your car," he said. "But if you look at this find in the context of the whole Arctic, then that is a different issue. I would expect other isolated deposits to be exposed as the ice melts, and all that biomass is eventually going to return to carbon dioxide if it's exposed to the air."

"It's a big country, and unless people decide to walk all across the Canadian Arctic, we won't know how many deposits are out there," he added.

Other collaborators on the project include Yu-Ping Chin, professor of earth sciences at Ohio State, and Joel Jurgens and Robert Blanchette, both plant pathologists at the University of Minnesota.

This research was funded by an EArly-concept Grant for Exploratory Research from the National Science Foundation.

http://www.physorg.com/news/2010-12-transplant-aids.html

Report: Transplant may have cured man of AIDS

A very unusual blood transplant appears to have cured an American man living in Berlin of infection with the AIDS virus, but doctors say the approach is not practical for wide use.

The man, who is in his 40s, had a blood stem cell transplant in 2007 to treat leukemia. His donor not only was a good blood match but also had a gene mutation that confers natural resistance to HIV. Now, three years later, the recipient shows no signs of leukemia or HIV infection, according to a report in the journal Blood.

"It's an interesting proof-of-concept that with pretty extraordinary measures a patient could be cured of HIV," but it is far too risky to become standard therapy even if matched donors could be found, said Dr.

Michael Saag of the University of Alabama at Birmingham. He is past chairman of the HIV Medicine Association, an organization of doctors who specialize in treating AIDS.

Transplants of bone marrow - or, more commonly these days, of blood stem cells - are done to treat cancer, and their risks in healthy people is unknown. It involves destroying the person's native immune system with powerful drugs and radiation, then replacing it with donor cells to grow a new immune system. Mortality from the procedure or its complications can be 5 percent or more, Saag said.

"We can't really apply this particular approach to healthy individuals because the risk is just too high," especially when drugs can keep HIV in check in most cases, Saag said. Unless someone with HIV also had cancer, a transplant would not likely be considered, he said.

When the Berlin man's case first surfaced two years ago, Dr. Anthony Fauci, director of the National Institute of Allergy and Infectious Diseases, said the procedure was too expensive and risky to be practical as a cure but that it might give more clues to using gene therapy or other methods to achieve the same result.

More information: AIDS information: http://www.aidsinfo.nih.gov and http://www3.niaid. ... ics/HIVAIDS/

http://www.bbc.co.uk/news/health-12001044

Listeria warning to cancer patients

By Helen Briggs Health reporter, BBC News

Advice for pregnant women on avoiding soft cheeses and certain other foods should be extended to cancer patients, according to public health experts.

Research by the Health Protection Agency found cancer patients were at increased risk of food poisoning from listeria bacteria. The illness, which is rare, is linked to foods like soft cheeses and pate.

Cancer Research UK said patients undergoing chemotherapy should be particularly careful.

Martin Ledwick, head information nurse, said: "Currently patients who are receiving high doses of chemotherapy should be advised to take precautions to avoid food-born infections.

"This study may suggest that this advice should be extended to all cancer patients having any type of treatment that compromises their immunity.

"However, as it is not clear from the work what type of treatments the cancer patients with listeria were having, it's not certain whether this precaution is absolutely necessary for all cancer patients."

Food poisoning

Listeria is a rare but serious illness caused by food containing the bacterium Listeria monocytogenes.

If caught during pregnancy, it can cause miscarriage. The infection can also lead to blood poisoning or meningitis in people with a weak immune system. Cases are on the rise in the UK, particularly in the over-60s.

A team from the Health Protection Agency (HPA) reviewed 1,413 people, excluding pregnant women, who had listeria between 1999 and 2009 in England.

Current health advice on listeria

Vulnerable groups are advised to avoid the following:
Pre-packed or delicatessen sliced meats
Soft cheeses - brie, camembert and chevre (goat's cheese)
Smoked fish
All kinds of pate including vegetable varieties
Pre-prepared cooked and chilled meals
Pre-prepared sandwiches
Unpasteurised milk
Source: HPA

Most of these had underlying conditions, which put them at increased risk of catching listeria. Cancer patients had a particularly high risk - almost five times that of people with other illnesses such as diabetes.

The highest rate was among those with cancers of the blood.

Dr Bob Adak of the HPA said: Our research has shown that those receiving cancer treatment or suffering from a variety of conditions, including diabetes, kidney or liver disease, should be offered appropriate health advice on how to avoid listeria.

"At present this is given passively and mainly to pregnant women, but clearly there are other groups of people who need to be advised on what they can do to protect their health.

"Listeria can cause serious illness or even death in those people who have serious underlying health conditions.

"Taking steps to avoid infection is a very important part of managing their health and these groups need to be made aware of how they should do this."

http://news.discovery.com/human/salvia-drug-hallucinogen-101215.html

How Salvia Produces a High

The hallucinogen has been all over the news lately after Miley Cyrus' now infamous video. But how exactly does it work?

content provided by Laura Sanders, Science News

Researchers are closer to understanding how a bong packed with leaves of Salvia divinorum gave Smiley Miley the giggles. Although shamans in Mexico have been chewing the leaves of the hardy mint relative for

centuries (and without any prompting from an infamous YouTube video of Miley Cyrus smoking it), little is known about what the plant's psychoactive substance, salvinorin A, actually does to humans -- despite its increasing popularity as a recreational drug.

A new study provides some data: The hallucinogen kicks off an unusually intense and short-lasting high, with no obvious ill effects, researchers report in an upcoming Drug and Alcohol Dependence paper.

"This is a landmark paper because it's the first paper in which authentic salvinorin A was administered to human volunteers under controlled conditions, and it was shown to be hallucinogenic," says psychiatrist and pharmacologist Bryan Roth of the University of North Carolina at Chapel Hill, who was not involved in the research. "All we had before were anecdotal reports, where people had bought salvia extract from their local smoke shop."

While the study is small and can't vouch for the safety of salvia, the results lend some hard science to the current legislative fray around the substance, which is criminalized in some states but not regulated federally.

"A lot of folks don't know what to do with this," says study coauthor Matthew W. Johnson, an experimental psychologist at Johns Hopkins University School of Medicine in Baltimore. "So we were trying to study this thing that is really uncharacterized under any formal conditions."

Johnson and his colleagues recruited four volunteers who had used hallucinogens such as LSD or psilocybin in the past. Over 20 sessions, the participants inhaled various doses of highly purified salvinorin A or a placebo while researchers monitored their vital signs and queried them about their experiences.

The effects of the salvinorin A were remarkably strong, consistent and fast-acting, peaking about two minutes after inhalation, and nearly disappearing by 20 minutes.

As doses increased across sessions, volunteers reported stronger and stronger hallucinations, which included cartoonlike images, revisiting childhood memories and contact with an entity. "With this drug, at its peak intensity, people describe popping out and visiting a completely different world. Some people say it seems like another dimension or maybe the spirit world," Johnson says. "They report these very profound experiences in these highly altered states of consciousness."

The researchers saw no changes in blood pressure or heart rate, even at the highest doses of salvinorin A. Other hallucinogenic compounds, such as LSD and psilocybin, moderately raise blood pressure and heart rate, Johnson says. But because the study used a small number of healthy volunteers, it can't make broad statements about the overall safety or the long-term effects of the substance. The team is currently expanding the numbers of participants.

Studies in animals have shown that salvinorin A acts on molecules in the brain called kappa-opioid receptors. These receptors are part of the pain-dulling opioid system but are not the same receptors that addictive opiates target.

Most of the evidence so far suggests that salvinorin A is not likely to hopelessly hook its users, Johnson says. "There's more work that needs to be done, but it's not looking like this is going to be the next cocaine or methamphetamine or heroin in the sense of a highly reinforcing, highly addicting new drug."

Researchers think the kappa-opioid receptor is important for a type of chronic pain, so understanding salvinorin A's effects on the receptor might lead to better pain treatments. What's more, tweaking the kappa-opioid receptor with salvinorin A-like compounds might one day treat neurological disorders in which a person's view of reality is altered, such as schizophrenia, depression or Alzheimer's disease.

"It's clear that when you give this compound to humans, it transports them to an alternative reality," Roth says. "So what that suggests to me and to others is that this receptor is very important for consciousness and how we view reality."

http://www.eurekalert.org/pub_releases/2010-12/sri-srs121610.php

Scripps Research scientists show prions mutate and adapt to host environment

Findings point to normal prion protein as most effective therapeutic target for 'mad cow' and related diseases

JUPITER, FL, Scientists from the Florida campus of The Scripps Research Institute have shown that prions, bits of infectious protein that can cause fatal neurodegenerative disease such as bovine spongiform encephalopathy (BSE) or "mad cow disease," have the ability to adapt to survive in a new host environment.

In this regard, although they lack DNA and RNA, they behave much like viruses, producing distinct self-perpetuating structural mutations that provide a clear evolutionary advantage.

The study was published this week in the online Early Edition the journal Proceedings of the National Academy of Sciences.

"We found that when a particular prion strain is transferred from brain cells to a different cell line, its properties gradually change, giving rise to a variant strain that is better adapted to this new cellular

environment," said Charles Weissmann, M.D., Ph.D., the head of Scripps Florida's Department of Infectology, who led the study. "If those same prions are subsequently transferred to another cell line, they change again, adapting to these new host cells. And if returned to the brain, the prions gradually regain their original properties. We found physical evidence that, at least in one case, the fold of the prion changed when its properties changed."

Darwinian Evolution Without DNA

These new findings come approximately one year after Weissmann and colleagues published a study in the January 1, 2010 edition of the journal Science that showed that prions were capable of Darwinian evolution.

That earlier study also showed that prions can develop large numbers of mutations and that these mutations can bring about such evolutionary adaptations as drug resistance, a phenomenon previously known to occur only in bacteria and viruses. This study also suggested that the normal prion protein – which occurs naturally in mammalian cells – may prove to be a more effective therapeutic target than its abnormal toxic relation.

"Because prions can adapt to changing environments, it now becomes clear that it will be more difficult than originally thought to find drugs that will work against them," Weissmann said. "But if you could develop a drug that inhibits formation of the normal prion protein, you could, in essence, starve the infectious prions and prevent them from reproducing. This approach to treatment, although technically demanding, can be envisaged because, as we have shown earlier, deprivation of PrP is not detrimental to health – at least to the health of mice."

Folding and Misfolding

Prions, which are composed solely of protein, are classified by distinct strains, characterized by their incubation time and the disease they cause. In addition to BSE/mad cow disease in cattle, diseases caused by prions include scrapie in sheep, chronic wasting disease in deer, and variant Creutzfeldt-Jakob disease in humans. Prions have the ability to reproduce, despite the fact that they contain no nucleic acid genome.

Mammalian cells normally produce cellular prion protein or PrPC. During infection, abnormal or misfolded protein – known as PrPSc – converts the normal host prion protein into its toxic form by changing its conformation or shape. The end-stage consists of large sheets (polymers) of these misfolded proteins, which causes massive tissue and cell damage.

"The infectious prion protein can fold in different ways, and depending on the fold, a different prion strain results," Weissmann said. "As long as prions are maintained in the same host, they retain their characteristic fold, so that strains breed true."

When prions multiply, however, that fold is not always reproduced correctly, so a prion population contains many variants, albeit at low levels.

The new study found that when a prion population is transferred to a different host, one of the variants may replicate faster – an evolutionary advantage – and become the dominant strain. This new population also contains variants, one of which may be selected over others when transferred to a different host.

"The result is that prions, although devoid of genetic material, behave similarly to viruses and other pathogens, in that they can mutate and undergo evolutionary selection," Weissmann said. "They do it by changing their fold, while viruses incur changes in their nucleic acid sequence."

Diverse Yet Related

The new study suggests that prion populations constitute a "quasi-species" similar in nature to RNA viruses and retroviruses, such as flu viruses and HIV.

The idea of a quasi-species was first conceived by Manfred Eigen, a German biophysicist who won the Nobel Prize in Chemistry in 1967.

Basically, a quasi-species is a complex, self-perpetuating population of diverse and related entities that act as a whole. It was Weissmann, however, who in 1978 provided the first confirmation of the theory through the study of a particular bacteriophage – a virus that infects bacteria – while he was director of the Institut für Molekularbiologie in Zürich, Switzerland.

But that's where the comparison ends, Weissmann said.

"The fact that they behave like viruses doesn't mean they're anything like a virus," he said. "A bicycle is like a car in that it gets you from one place to the other, but they're not the same. The end effect is the same, however. Prions and viruses are both able to change their structure to survive."

The first author of the study, "Transfer of a Prion Strain to Different Hosts Leads to Emergence of Strain Variants," is Sukhvir P. Mahal of Scripps Research. Other authors include Shawn Browning, Jiali Li, and Irena Suponitsky-Kroyter, also of Scripps Research. For more information, see http://www.pnas.org/content/early/2010/12/13/1013014108.abstract .

The study was supported by the National Institutes of Health and the Alafi Family Foundation.

http://www.eurekalert.org/pub_releases/2010-12/uocm-adm121310.php

Age doesn't matter: New genes are as essential as ancient ones

Surprise finding reverses core evolutionary biology assumptions on development

New genes that have evolved in species as little as one million years ago – a virtual blink in evolutionary history - can be just as essential for life as ancient genes, startling new research has discovered.

Evolutionary biologists have long proposed that the genes most important to life are ancient and conserved, handed down from species to species as the "bread and butter" of biology. New genes that arise as species split off from their ancestors were thought to serve less critical roles – the "vinegar" that adds flavor to the core genes.

But when nearly 200 new genes in the fruit fly species Drosophila melanogaster were individually silenced in laboratory experiments at the University of Chicago, more than 30 percent of the knockdowns were found to kill the fly. The study, published December 17 in Science, suggests that new genes are equally important for the successful development and survival of an organism as older genes.

"A new gene is as essential as any other gene; the importance of a gene is independent of its age," said Manyuan Long, PhD, Professor of Ecology & Evolution and senior author of the paper. "New genes are no longer just vinegar, they are now equally likely to be butter and bread. We were shocked."

The study used technology called RNA interference to permanently block the transcription of each targeted gene into its functional product from the beginning of a fly's life. Of the 195 young genes tested, 59 were lethal (30 percent), causing the fly to die during its development. When the same method was applied to a sample of older genes, a statistically similar figure was found: 86 of 245 genes (35 percent) were lethal when silenced.

Because the young genes tested only appeared between 1 and 35 million years ago, the data suggests that new genes with new functions can become an essential part of a species' biology much faster than previously thought. A new gene may become indispensable by forming interactions with older genes that control important functions, said Sidi Chen, University of Chicago graduate student and first author of the study.

"New genes come in and quickly interact with older genes, and if that interaction is favorable by helping the organism survive or reproduce better, it is favored by natural selection and stays in the genome," Chen said. "After a while, it becomes essential, and the organism literally cannot live without the gene any more. It's something like love: You fall in love with someone and then you cannot live without them."

The indispensable nature of new genes also questions long-held beliefs about the shared features of development across different species. In 1866, German zoologist Ernst Haeckel famously hypothesized that "ontogeny recapitulates phylogeny" after observing that the early steps of development are shared by animals as different as fly and man.

Biologists subsequently predicted and confirmed that the same ancient, essential genes would be the conductors of this early development in all species. This principle enabled the use of model organisms, including flies, mice, and rats, to be used for research on the mechanisms of human disease.

Intriguingly, in the new study, deleting many of the new genes causes flies to die during middle or late stages of development, while older genes were lethal during early development. So while ancient genes essential for the early steps of development are shared, newer genes unique to each species may take over the later developmental stages that make each species unique. For example, many new genes in the study were found to be involved with metamorphosis, the mid-life stage that drastically transforms the body plan in animals.

"This may change the way we view the developmental program," Long said. "Each species has a different species-specific developmental program shaped by natural selection, and we can no longer say that from Drosophila to humans the development of different organisms is just encoded by the same genetic program. The story is much more complicated than what we used to believe."

As such, a full understanding of biological diversity may require a new focus on genes unique to each organism.

"I think it has important implications on human health," Chen said. "Animal models have proven to be very useful and important for dissecting human disease. But if our intuition is correct, some important health information for humans will reside in the unique parts of the human genome."

The newfound importance of young genes and unique developmental programs may have a dramatic impact on the field, Long said. The discovery will also inspire new research directions examining how quickly new genes can become essential and their exact role in species-specific development.

"Biologists have long assumed, quite reasonably, that ancient genes have survived natural selection because they are essential to life and that new genes are generally less critical to an organism's development," said Irene Eckstrand, PhD, who manages Dr. Long's and other evolutionary biology grants at the National Institutes of

Health. "This important study suggests that this assumption is flawed, unlocking new questions that could lead to a deeper understanding of evolutionary processes and their impact on human health."

The study, "New genes in Drosophila quickly become essential," is published in the December 17 issue of Science. Chen, Long, and Yong Zhang of the University of Chicago are authors of the study.

The work was funded by grants from the National Institute of General Medical Sciences, the National Science Foundation, and the Chicago Biomedical Consortium.

http://www.scientificamerican.com/article.cfm?id=us-report-sets-ground-rules

US report sets ground rules for artificial life

Synthetic biology needs oversight not over-regulation, commission finds.

By Meredith Wadman

A presidential commission has released a report that recommends White-House level oversight of U.S. research in synthetic biology-but it stops short of calling for new laws or changes to existing regulations that govern the nascent field, whether in university labs or do-it-yourselfers' garages.

It also claims to navigate a middle road between unbridled experimentation and a regulatory straightjacket that could stifle the most promising applications of synthetic biology, from malaria medicine to biofuels.

"The Commission endorses neither a moratorium on synthetic biology until all risks are identified and mitigated, nor unfettered freedom for scientific exploration," writes the 13-member Presidential Commission for the Study of Bioethical Issues, in its report released on December 16.

Rather, the commission writes, the field can proceed responsibly by embracing "an ongoing process of prudent vigilance that carefully monitors, identifies, and mitigates potential and realized harms over time."

Commission chair Amy Gutmann told Nature that the commission is not suggesting that a new White House "czar" position be created, but rather that existing structures in the Executive Office of the President-perhaps the Office of Science and Technology Policy, or top science adviser John Holdren-step in to oversee what is at present a fractured enterprise. "What the agencies could not assure us is that they have a coordinated effort on oversight," says Gutmann.

The first recommendation in the 188-page report is that the new White House body compile an exhaustive evaluation of current U.S. government funding for synthetic biology and make it public within 18 months.

Suicide genes

The report was commissioned in May, on the same day that J. Craig Venter and colleagues published the first synthetic bacterial genome. Responding to an avalanche of media attention, President Barack Obama asked his bioethics commission to delve into synthetic biology and make policy recommendations. The commission's research included three public meetings and testimony from ethicists, scientists, policy experts, religious thinkers and others.

Its 18 recommendations, based on five ethical principles defined by the commissioners, include mandatory ethics training for engineers working in the area-as biologists are now required to have. It also asks the White House coordinating body to identify gaps in the risk assessment practices required before synthetic organisms are released, and says that synthetic microbes should be engineered to include "suicide genes" or laboratory-dependent nutritional requirements that would limit their lifespans in the event of inadvertent release.

Notably, it does not call for separate oversight of do-it-yourself synthetic biologists, stating that "presently there appears to be no serious risk of completely novel organisms being constructed in non-institutional settings including in the [do-it-yourself] community." Accordingly, "the Commission sees no need to imposed unique limits on this group." Another recommendation tries to anticipate future media reactions to new, eye-catching achievements in the field, with the establishment of an independent organization-Gutmann suggests the moniker "biofactcheck.org"-that would poke holes in sensational or overstated claims.

The report won praise from some quarters, including the do-it-yourself community.

"The commission is being very forward-thinking by including considerations about amateur and non-institutional practitioners in the report," says Jason Bobe, co-founder of DIYbio.org, and organisation whose website says it is "dedicated to making biology an accessible pursuit for citizen scientists, amateur biologists and biological engineers who value openness and safety."

I think they tried to put DIYbio in perspective and were able to get beyond much of the hype," Bobe adds.

Future risks

But critics pounced on the report, saying it does not go far enough in anticipating and forestalling the potential risks of synthetic biology, including its use for producing bioweapons or the inadvertent escape of engineered microbes into the environment.

"It is very thin gruel," says Richard Ebright, a molecular biologist at Rutgers University in New Brunswick, New Jersey. Ebright argued that the combination of "intellectual freedom" and a corollary "regulatory

parsimony" as one of the comission's five guiding ethical principles "resulted in a Commission report that suggests no substantive oversight and that is fundamentally empty."

Ebright would have liked the commission to require, for instance, mandatory local-level review of synthetic biology activities, along the lines of the IRB system used for human-subjects research. He also wanted mandatory national-level reviews of the subset of research of highest concern, such as the production of pathogens and toxins.

Others praised the report's call for open-ended watchfulness of the field going forward. "The overriding message of the report is that review of synthetic biology needs to be an ongoing affair, not a one-off thing. I think that's right," says Greg Kaebnick, a research scholar at the Hastings Center in Garrison, New York, which is conducting a two-year ethical review of synthetic biology.

Still, Kaebnick isconcerned by the report's numerous references to the futuristic nature of synthetic biology, and its relaxed attitude about the potential for more immediate dangers.

"I don't think the applications are that far off," says Kaebnick. "And the possiblity that things are in the future should not be offered as a reason to be confident about the risks."

http://www.physorg.com/news/2010-12-young-internet.html

Old catching up to young on US Internet: study

Older folks are closing ground on youngsters quick to leap on hot Internet trendsa Pew Research Center study shows

Older folks are closing ground on youngsters quick to leap on hot Internet trends such as social networking and online shopping, according to a Pew Research Center study. While members of a Millennial Generation made up people ages 18 to 33 are still way ahead in areas such as using smartphones to connect online, their dominance is slipping in many Internet arenas, the US study concluded.

"Even in areas that are still dominated by Millennials, older generations are making notable gains," study authors said in their findings. “Some of the areas that have seen the fastest rate of growth in recent years include older adults' participation in communication and entertainment activities online, especially in using social network sites such as Facebook."

Approximately half of "Younger Boomers" ages 46-55 used online social networks in May as compared to just 20 percent two years earlier, according to the study. The fastest adoption of social networks took place with people 74 years of age or older, with use quadrupling in two years to 16 percent of the group, the study found.

Overall use of online social networks by US adults of all ages nearly doubled in two years to 61 percent, while 83 percent of Millennials are members of such Internet communities, according to the research.

While Millennials are still more prone to watch online video, other generations are adopting the habit. About 55 percent of "Older Boomers" ages 56 to 64 have watched video online, as have one-in-five members of the "G.I. Generation" ages 74 and older. Older Internet users were also taking increasingly to getting news online.

Millennials were more inclined to send text messages or play online games, while older folks were more likely to visit government websites or check financial information on the Internet.

Online activities that proved popular to Internet users of all ages included shopping, banking, email, searches, and rating products or services.

"Searching for health information, an activity that was once the primary domain of older adults is now the third most popular online activity for all internet users 18 and older," the study said.

The only online activity that had its popularity eroded was blogging, with people evidently opting to express themselves in forms such as Twitter messages and Facebook status updates, according to the research.

http://www.scientificamerican.com/article.cfm?id=black-plants-and-twilight-zones

Black Plants and Twilight Zones: New Evidence Prompts Rethinking of Extraterrestrial Life

Discoveries of distant planets are challenging theorists to think deeply about extraterrestrial life

By Bryn Nelson

Astronomers have long searched for a planet that could harbor life outside our solar system. When reports came in earlier this fall of the not too hot, not too cold exoplanet Gliese 581g, it was like the answer to a dream. “If it’s confirmed, I think it’s definitely the planet we’ve been waiting for, for a long time,” says Rory Barnes, an astrobiologist at the University of Washington who wasn’t involved in the research.

The wait may continue for a while. Soon after University of California, Santa Cruz, astronomer Steven Vogt and his collaborators reported the “Goldilocks” exoplanet, a rival Swiss group said it could not find evidence for Gliese 581g in its own data set. Confirming the new find, based on 11 years of subtle and indirect telescope-based measurements, could require several more years.

The tantalizing data, though, have already galvanized astronomers to step up their research on the conditions necessary for extraterrestrial life. The possibility that Gliese 581g may exist, they say, has added a new urgency for more sophisticated supercomputer models of life on other Earth-size planets.

Scientists, theoretical astrophysicists among them, combine astronomical observations with what they know about life on Earth to build simulations of exoplanet environments. Amid a recent surge of detected planets, realistic models could provide critical guidance for future missions seeking out signs of life in the universe. Recently Gliese 581g has become a focal point for this research. Its nearly circular orbit around a red dwarf star would position it at the optimal distance for temperatures permitting liquid water on the surface—an essential feature for life. The red dwarf, though, emits only 1 percent of the light from our sun. Photosynthetic organisms on the planet would likely absorb as much of the weaker starlight as possible, making them appear black, according to modeling by Nancy Kiang of the NASA Goddard Institute for Space Studies in New York City and collaborators at the University of Washington–based Virtual Planetary Laboratory.

A day in the life: An artist's rendering of Gliese 581g. Image: Ron Miller

Preliminary calculations also support the idea that one side of Gliese 581g always faces its star and roasts in temperatures up to 64 degrees Celsius, whereas the planet's dark side sees relentless North Pole–like winters. This positioning, still a matter of debate, might leave a more livable zone awash in a "perpetual sunset," as Vogt calls it. If such a hypothesis proves correct, Kiang says the specific wavelengths of light reaching each longitude could even prompt a rainbowlike gradient of plant colors with pigments adapted to absorb the light streaming across the surface.

Beyond energizing theorists, Gliese 581g has whet astronomers' appetites for what many expect to be hundreds of similar discoveries outside our solar system. "Either we've been very lucky and we won't find another one again for a long time," Vogt says, "or there's a lot of them out there."

http://www.physorg.com/news/2010-12-fda-avastin-breast-cancer.html

FDA: Avastin should not be used for breast cancer (Update)

(AP) -- *Federal health authorities are recommending the blockbuster drug Avastin no longer be used to treat breast cancer, saying recent studies failed to show the drug's original promise to help slow the disease.*

The Food and Drug Administration's decision is supported by many cancer experts but is sure to draw resistance from cancer patients and some doctors who fiercely defend the drug and say it should remain available. FDA officials stressed that the recommendation is only a preliminary step toward revoking the drug's approval for breast cancer. Swiss drugmaker Roche has refused to voluntarily withdraw the indication, and under law the company has 15 days to request a public meeting on the issue, according to the FDA.

"Today's decision was a difficult one for the agency but certainly not unique," said Dr. Janet Woodcock, director of FDA's drug center. "The FDA is responsible for assuring that the products we approve for patients are both effective and safe."

The FDA approved Avastin for breast cancer in 2008 based on studies suggesting it halted the spread of breast cancer for more than five months. But follow-up studies showed that the delay lasted no more than three months, and patients suffered dangerous side effects.

"Given the number of serious and life-threatening side effects, the FDA does not believe there is a favorable risk-to-benefit ratio," said Dr. Richard Pazdur, FDA's chief of cancer drug review.

In a separate announcement Thursday, the European Medicines Agency said it would keep the drug available for breast cancer.

If the FDA does revoke Avastin's breast cancer approval, doctors will still be able to prescribe the drug "off-label," though some insurers may not pay for it. For the time being, the FDA said the drug will remain available and patient care will not be affected. The FDA's decision is a significant setback for the world's best-selling cancer drug and will likely cost drugmaker Roche hundreds of millions of dollars in lost revenue. Avastin is also approved for various types of colon, lung, kidney and brain cancer.

While vigorously opposed by thousands of cancer patients, the FDA's ruling is in line with the guidance of its outside panel of cancer experts, who voted 12-1 in July to rescind the drug's approval for breast cancer.

Cancer specialists said this week that Avastin never lived up to its initial promise.

"The bottom line is that it doesn't work very well," said Dr. Albert Braverman, chief of oncology at State University of New York Downstate Medical Center. "I've seen the occasional patient have a brief remission, which is nice, but it's certainly not doing anything important. It's not saving anyone's life."
But some patients credit their survival to Avastin and say the FDA's decision could amount to a death sentence.

Christi Turnage of Madison, Miss., said her cancer has been undetectable for more than two years since starting therapy with Avastin. She was diagnosed with breast cancer in June 2006 and began taking the drug in 2008 after the tumors spread, or metastized, to her lungs. Breast cancer that spreads to other parts of the body is generally considered incurable. “It's a miracle drug for me and for several of my friends, and to deny it to women being diagnosed with metastatic disease is wrong," Turnage said. "We know it doesn't work for everybody but it works for a lot of us."

More than 9,500 cancer patients and friends and family signed a petition written by Turnage urging the FDA to keep Avastin approved. Some doctors say the removal of the drug's approval could make it more difficult to study Avastin in some rare forms of breast cancer where it has not yet been tested.

"There is still significant interest among clinicians to determine if Avastin is useful in some subsets of breast cancer patients," said Dr. Elisa Port of Mount Sinai Medical Center in New York.

http://www.eurekalert.org/pub_releases/2010-12/uab-icr121710.php

Ion channel responsible for pain identified by UB neuroscientists

BUFFALO, N.Y. -- ***University at Buffalo neuroscience researchers conducting basic research on ion channels have demonstrated a process that could have a profound therapeutic impact on pain.***

Targeting these ion channels pharmacologically would offer effective pain relief without generating the side effects of typical painkilling drugs, according to their paper, published in a recent issue of The Journal of Neuroscience.

"Pain is the most common symptom of injuries and diseases, and pain remains the primary reason a person visits the doctor," says Arin Bhattacharjee, PhD, UB assistant professor of pharmacology and toxicology in the School of Medicine and Biological Sciences, director of the Program in Neuroscience and senior author on the paper. "Fifty million Americans suffer from chronic pain, costing between $100-200 billion a year in medical expenses, lost wages and other costs," says Bhattacharjee. "The need to understand pain mechanisms remains paramount for human health and for society."

Inflammatory pain can result from penetration wounds, burns, extreme cold, fractures, arthritis, autoimmune conditions, excessive stretching, infections and vasoconstriction.

"There are efficacious treatments for inflammatory pain, such as corticosteroids and non-steroidal anti-inflammatory drugs," says Bhattacharjee, "but the adverse side effects associated with these drugs limit their long-term use and compromise patient compliance. As a result, there is a great need to understand the cellular processes involved in inflammatory pain to create less toxic, less addictive, analgesic drugs."

Pain-responsive nerve cells, known as nociceptors, are electrical cells that normally respond to pain stimuli. Nociceptors then relay information to the central nervous system, indicating the location, nature and intensity of the ensuing pain. Nociceptors are sensitized during inflammation, their ionic properties are altered and their firing characteristics changes. This sensitization causes a state of "hyperalgesia," or increased sensitivity to pain.

"Merely touching the inflamed area can be very painful," notes Bhattacharjee. "The ionic mechanisms that are chiefly responsible for this inflammatory-mediated change in nociceptive firing had not been clearly identified.

"We were able to demonstrate that a certain class of potassium channels is removed from the surface of nociceptive cells during inflammatory signaling. The removal of these ion channels is linked to the hypersensitivity of these nerve cells. We demonstrated that reducing the expression of these channels by gene interference techniques produced a similar nociceptor hyperexcitability. "

Bhattacharjee says his team plans to extend their ion channel "trafficking" studies to in vivo models, using peptide inhibitors to try to prevent the removal of the potassium channels from the surface of nociceptors during inflammation.

"We expect to show that maintaining these channels at the surface during inflammation will be effective for pain relief. Successful completion of our studies will provide the impetus for direct human clinical trials. *Megan O. Nuwer, PhD, and Kelly E. Picchione, PhD, both in the neuroscience program, are co-authors on the paper.*

The study was supported by a Junior Faculty Award from the American Diabetes Association and a John R. Oishei Foundation Grant to Bhattacharjee.

http://www.eurekalert.org/pub_releases/2010-12/uoe-bjc121710.php

Beetroot juice could help people live more active lives

New research into the health benefits of beetroot juice suggests it's not only athletes who can benefit from its performance enhancing properties – its physiological effects could help the elderly or people with heart or lung-conditions enjoy more active lives.

Beetroot juice has been one of the biggest stories in sports science over the past year after researchers at the University of Exeter found it enables people to exercise for up to 16% longer. The startling results have led to a host of athletes – from Premiership footballers to professional cyclists – looking into its potential uses.
A new piece of research by the university in conjunction with the Peninsula College of Medicine and Dentistry has revealed the physiological effects of drinking beetroot juice could help a much wider range of people.

In the latest study, published in the Journal of Applied Physiology, the researchers looked at low intensity exercise and found that test subjects used less oxygen while walking – effectively reducing the effort it took to walk by 12%.

Katie Lansley, a PhD student from the university's Sport and Health Sciences department and lead author of the study, said: "As you get older, or if you have conditions which affect your cardiovascular system, the amount of oxygen you can take in to use during exercise drops considerably. This means that, for some people, even simple tasks like walking may not be manageable. "What we've seen in this study is that beetroot juice can actually reduce the amount of oxygen you need to perform even low-intensity exercise. In principle, this effect could help people do things they wouldn't otherwise be able to do."

When consumed, beetroot juice has two marked physiological effects. Firstly, it widens blood vessels, reducing blood pressure and allowing more blood flow. Secondly, it affects muscle tissue, reducing the amount of oxygen needed by muscles during activity. The combined effects have a significant impact on performing physical tasks, whether it involves low-intensity or high-intensity effort.

So far the research on the impacts of beetroot juice has only been carried out on younger people who are in good health, but the researchers believe there is no reason why the effects of beetroot juice wouldn't help others. "While we haven't yet measured the effects on the elderly or those with heart or lung conditions, there is the potential for a positive impact in these populations which we intend to go on and investigate further," Katie Lansley added.

Beetroot juice contains high levels of nitrate. The latest study has proved that this is the key ingredient which causes the increase in performance, rather than any other component of the beetroot juice.

Professor Andy Jones, the senior scientist on the study and a pioneer of research into beetroot juice, said: "In this study, we were able to use - for the first time - both normal beetroot juice and beetroot juice with the nitrate filtered out. Test subjects didn't know which one they were getting. The drinks both looked and tasted exactly the same. Each time the normal, nitrate-rich juice was used, we saw a marked improvement in performance which wasn't there with the filtered juice – so we know the nitrate is the active ingredient."

The research paper Dietary nitrate supplementation reduces the O_2 cost of walking and running: a placebo controlled study is available to view online as an article in press in the Journal of Applied Physiology here: http://jap.physiology.org/cgi/reprint/japplphysiol.01070.2010v1
James White Drinks provided the beetroot juice for this study, including the nitrate filtered placebo version. You can find out more at http://www.jameswhite.co.uk/

http://www.eurekalert.org/pub_releases/2010-12/babs-5my121710.php

550 million years ago rise in oxygen drove evolution of animal life

Researchers funded by the Biotechnology and Biological Sciences Research Council (BBSRC) at the University of Oxford have uncovered a clue that may help to explain why the earliest evidence of complex multicellular animal life appears around 550 million years ago, when atmospheric oxygen levels on the planet rose sharply from 3% to their modern day level of 21%.

***Trichoplax adhaerens* - Credit: Ana Signorovitch, Yale University**

The team, led by Professor Chris Schofield, has found that humans share a method of sensing oxygen with the world's simplest known living animal - Trichoplax adhaerens - suggesting the method has been around since the first animals emerged around 550 million years ago.

This discovery, published today (17 December) in the January 2011 edition of EMBO Reports, throws light on how humans sense oxygen and how oxygen levels drove the very earliest stages of animal evolution.

Professor Schofield said "It's absolutely necessary for any multicellular organism to have a sufficient supply of oxygen to almost every cell and so the atmospheric rise in oxygen made it possible for multicellular organisms to exist.

"But there was still a very different physiological challenge for these organisms than for the more evolutionarily ancient single-celled organisms such as bacteria. Being multicellular means oxygen has to get to cells not on the surface of the organism. We think this is what drove the ancestors of Trichoplax adhaerens to develop a system to sense a lack of oxygen in any cell and then do something about it.

The oxygen sensing process enables animals to survive better at low oxygen levels, or 'hypoxia'. In humans this system responds to hypoxia, such as is caused by high altitudes or physical exertion, and is very important for the prevention of stroke and heart attacks as well as some types of cancer.

Trichoplax adhaerens is a tiny seawater organism that lacks any organs and has only five types of cells, giving it the appearance of an amoeba. By analysing how Trichoplax reacts to a lack of oxygen, Oxford researcher Dr Christoph Loenarz found that it uses the same mechanism as humans - in fact, when the key enzyme from Trichoplax was put it in a human cell, it worked just as well as the human enzyme usually would.

They also looked at the genomes of several other species and found that this mechanism is present in multi-cellular animals, but not in the single-celled organisms that were the precursors of animals, suggesting that the mechanism evolved at the same time as the earliest multicellular animals

Defects in the most important human oxygen sensing enzyme can cause polycythemia - an increase in red blood cells. The work published today could also open up new approaches to develop therapies for this disorder.

Professor Douglas Kell, Chief Executive, BBSRC said "Understanding how animals - and ultimately humans - evolved is essential to our ability to pick apart the workings of our cells. Knowledge of normal biological processes underpins new developments that can improve quality of life for everyone. The more skilful we become in studying the evolution of some of our most essential cell biology, the better our chances of ensuring long term health and well being to match the increase in average lifespan in the UK and beyond."

Notes To Editors

** A report entitled "The hypoxia-inducible transcription factor pathway regulates oxygen sensing in the simplest animal, Trichoplax adhaerens" will be published in the January edition of EMBO Reports on 17 December 2010.*

** The team was led by Professor Chris Schofield of Oxford University's Department of Chemistry, with Professor Peter Ratcliffe from Oxford's Centre for Cellular and Molecular Physiology, Professor Peter Holland from Oxford's Zoology Department and, at the University of Hannover in Germany, Professor Bernd Schierwater.*

** The article is available online at http://dx.doi.org/10.1038/embor.2010.170, together with an introduction that highlights key aspects of the research, at http://dx.doi.org/10.1038/embor.2010.192*

http://www.newscientist.com/article/mg20827913.600-creativity-vies-with-language-in-brain.html

Creativity vies with language in brain

*** 17 December 2010 by Catherine de Lange**

GREAT ideas can feel like they come out of nowhere. Now we're a step closer to understanding where they do originate.

The thinking is that areas for language and creativity compete in the brain, which might explain why some people with brain damage suddenly become artistic.

Originality - or the ability to think up novel ideas that don't occur to many other people - is a key aspect of creativity. But researchers are struggling to pin down where the gift comes from.

"We were amazed by the conflicting results in the literature," says Simone Shamay-Tsoory, from the University of Haifa, Israel. To better pinpoint the areas involved in creative thinking, Simone Shamay-Tsoory, and her team compared 40 people with damage to one of three distinct areas in the brain, and a group without any damage.

As well as having their brains scanned, the two groups were shown 30 identical circles on a piece of paper and given 5 minutes to draw as many different pictures of meaningful objects as they could, each of which had to include at least one circle (see diagram).

The volunteers were scored on their total number of responses and also on the number of statistically rare responses, deduced from earlier experiments on healthy volunteers. The test measures "divergent thinking" - the ability to generate new ideas that give different solutions to a particular problem.

Although they were unable to check volunteers' levels of creativity before brain damage, the results suggest that levels of originality directly relate to where in the brain the damage has happened. Those who scored significantly higher than healthy volunteers in originality had more damage to the left side of the brain, in areas responsible for processing language. Those with the lowest scores tended to have more damage to the right side of the brain, in an area involved in planning and decision-making (Neuropsychologia, in press).

Shamay-Tsoory says that while creativity is likely generated in the right side of the brain it may be suppressed by language processing on the left. "[Language] regions may compete with the right hemisphere's ability to produce creative ideas," she says. This would explain why, when these language areas are damaged, originality seems to increase.

Rex Jung from the Mind Research Network in Albuquerque, New Mexico, says this is the first time brain injuries have been used to look at the origins of creativity. However, "creativity is not one thing", says Arne Dietrich, at the American University of Beirut, Lebanon, "and is also highly distributed in the brain." He believes pinning creativity to very specific areas is unrealistic.

Shamay-Tsoory is now planning to investigate whether it might be possible to boost creativity in healthy volunteers by inhibiting language areas.

http://www.physorg.com/news/2010-12-drug-early-intervention-cystic-fibrosis.html

Novel drug offers hope for early intervention in cystic fibrosis patients

Cystic fibrosis (CF) patients with normal to mildly impaired lung function may benefit from a new investigational drug designed to help prevent formation of the sticky mucus that is a hallmark of the disease, according to researchers involved in a phase 3 clinical trial of the drug.

Called denufosol, the investigational medication can be given early in the CF disease process, and may help delay the progression of lung disease in these patients, the researchers found.

The findings were published online ahead of the print edition of the American Thoracic Society's American Journal of Respiratory and Critical Care Medicine.

"Although the lungs of children with CF are thought to be normal at birth, studies have demonstrated significant lung damage that occurs early in life in children suffering from cystic fibrosis," said lead investigator Frank Accurso, MD, professor of pediatrics, University of Colorado School of Medicine, Denver. "Many patients continue to suffer progressive loss of lung function despite treatment of complications. Because denufosol can be used early in life, it offers hope for delaying or preventing the progressive changes that lead to irreversible airflow obstruction in CF patients."

Denufosol belongs to a class of drugs known as ion channel regulators. These drugs help balance the flow of ions through cell membranes, helping normalize the airway surface hydration and mucus clearance impairment present in patients who suffer from the disease. In cystic fibrosis, the ion sodium chloride does not flow normally through cell membranes, resulting in thick, sticky mucus which is difficult to cough out of the airways. In addition to causing breathing problems, the mucus becomes a breeding ground for bacteria and can cause serious respiratory infections.

Denufosol works by increasing chloride secretion, inhibiting sodium absorption and increasing the beat frequency of the tiny hairs, or "cilia," lining the airways move to clear mucus. Combined, these effects enhance airway hydration and aid in clearing mucus. The drug is different from other CF medications, which primarily treat the symptoms rather than the underlying causes, said Dr. Accurso, who is also the director of University of Colorado's cystic fibrosis center.

This study is the first large, phase 3 trial of an ion channel regulator in cystic fibrosis patients with little or no baseline pulmonary function impairment.

"Abnormal ion transport and defective mucociliary clearance are fundamental defects that contribute to complications of CF lung disease, including mucus plugging, chronic bacterial infection, inflammation and progressive airway damage," Dr. Accurso noted. "Although currently available drugs target these complications, denufosol was designed to treat the underlying defects that cause the complications, and could potentially modify the course of the disease, particularly when administered early in the disease process."

Researchers enrolled 352 cystic fibrosis patients 5 years of age or older, and enrolled them to receive either inhaled denufosol or placebo three times daily for 24 weeks, followed by a 24-week open-label period when all patients received denufosol. At baseline, most patients enrolled had mild impairment of lung function and were taking multiple medications to control their symptoms. Because the study outcomes were measured using spirometry, a lung function test that can be difficult to accurately use in young children, patients under five years of age were excluded.

Patients' exhalation rates and lung volume were measured throughout the study, and also were monitored for adverse events, such as cough, congestion, fever or sinusitis. At the end of the 24-week period, researchers determined patients who received denufosol had better lung exhalation rates than those in the placebo group, whose exhalation volumes remained relatively unchanged from the start of the study. Both groups had similar numbers and types of adverse events, with the denufosol patients experiencing significantly fewer headaches and lower rates of sinusitis and runny nose.

Although children under five years of age were excluded from this study, Dr. Accurso said future studies likely would address the use of denufosol in this younger population.

"Considering the evidence that early inflammation and infection results in impaired lung function and structural damage in early childhood, future studies of the effects of denufosol during the first 5 years of life is warranted," he said.

A second, similar phase 3 trial incorporating a longer placebo-controlled treatment phase is ongoing to further investigate the effectiveness of denufosol in patients with CF, Dr. Accurso added.

Provided by American Thoracic Society

http://www.physorg.com/news/2010-12-swedish-med-students-teacher-body.html

Swedish med students get teacher's body at first autopsy

It was their first ever autopsy, but students at one of Sweden's top medical schools were faced with a familiar sight in the classroom: the body on the table belonged to their late teacher.

"The first autopsy is really, really emotional, and we autopsied someone we knew!," one of the shocked students told news agency TT Friday.

"I feel something in the routines went a bit wrong," said another.

Chief physician Birgitta Sundelin called the event "extremely unfortunate."

She said that students were normally informed ahead of time of whose body they were to examine and that it was also the case this time.

But according to a student, the class did not find out until they saw their teacher's name on the body's toe tag.

The head of the department, Tina Dalianis, said she regretted the incident, but added the students needed to learn the tricks of the trade.

"It's terrible, but it's part of education sometimes. Unfortunately they have to deal with it," she told TT.

http://www.newscientist.com/article/dn19889-could-we-detect-trees-on-other-planets.html

Could we detect trees on other planets?

*** 20:23 17 December 2010 by Rachel Courtland**

It sounds like a zen koan. If a tree on an alien world falls, would we notice? Christopher Doughty of the University of Oxford and Adam Wolf of Princeton University think we just might.

They say the shadows cast by trees would change the amount of light a planet reflects as it orbits its star. When the planet is behind its star as seen from Earth – as the moon is during its full phase – the trees would cast little visible shadow, while at other points in its orbit the shadows would grow longer from Earth's perspective. Future telescopes should be able to search for these changes in brightness, they say.

Plants and some microbes on Earth reflect a large fraction of the near-infrared light that hits them, apparently because absorbing it would cause them to overheat during photosynthesis. So any exoplanet that showed a spike in the near-infrared light it reflected, called a "red edge", might potentially host plant life.

This new technique could help distinguish between worlds with simple photosynthetic life, such as algae or bacterial mats, and those in which competition for light and the need to distribute water and nutrients drove the evolution of branching, tree-like life-forms.

Nancy Kiang of the NASA Goddard Institute for Space Studies in New York City says the proposal is interesting, but cautions that steep mountains could mimic the effect.

Wolf counters that an Earth-like planet exhibiting erosion and plate tectonics would probably boast few sharp geological features, noting that less than 1 per cent of Earth's surface has a slope of 45 degrees or more.

Journal reference: Astrobiology, DOI: 10.1089/ast.2010.0495

http://www.nytimes.com/2010/12/18/business/energy-environment/18tree.html

How Green Is Your Artificial Christmas Tree? You Might Be Surprised

By JOHN COLLINS RUDOLF

When it comes to Christmas trees, Americans increasingly prefer plastic pines over the real thing.

Sales of fake trees are expected to approach 13 million this year, a record, as quality improves and they get more convenient, with features like built-in lights and easy collapsibility. All told, well over 50 million artificial Christmas trees will grace living rooms and dens this season, according to the industry's main trade group, compared to about 30 million real trees.

Kim Jones, who was shopping for a tree at a Target store in Brooklyn this week, was convinced that she was doing the planet a favor by buying a $200 fake balsam fir made in China instead of buying a carbon-sipping pine that had been cut down for one season's revelry. "'m very environmentally conscious," Ms. Jones said. "I'll keep it for 10 years, and that's 10 trees that won't be cut down."

But Ms. Jones and the millions of others buying fake trees might not be doing the environment any favors.

In the most definitive study of the perennial real vs. fake question, an environmental consulting firm in Montreal found that an artificial tree would have to be reused for more than 20 years to be greener than buying a fresh-cut tree annually. The calculations included greenhouse gas emissions, use of resources and human health impacts.

"The natural tree is a better option," said Jean-Sebastien Trudel, founder of the firm, Ellipsos, that released the independent study last year.

The annual carbon emissions associated with using a real tree every year were just one-third of those created by an artificial tree over a typical six-year lifespan. Most fake trees also contain polyvinyl chloride, or PVC, which produces carcinogens during manufacturing and disposal.

Ellipsos specifically studied the market for Christmas trees bought in Montreal and either grown in Quebec or manufactured in China. Mr. Trudel said the results would most likely differ for other cities and regions. Excessive driving by consumers to purchase real trees could tip the scales back in favor of artificial trees, at least in terms of carbon emissions.

Over all, the study found that the environmental impact of real Christmas trees was quite small, and significantly less than that of artificial trees — a conclusion shared by environmental groups and some scientists.

"You're not doing any harm by cutting down a Christmas tree," said Clint Springer, a botanist and professor of biology at Saint Joseph's University in Philadelphia. "A lot of people think artificial is better because you're preserving the life of a tree. But in this case, you've got a crop that's being raised for that purpose."

Makers of fake trees argue that the environmental evidence isn't quite so clear-cut.

"If you buy an artificial Christmas tree and reuse it for at least five years, it's absolutely a green thing to do," said Thomas Harman, founder and chief executive of Balsam Hill, a maker of premium artificial trees. Mr. Harman said that the average amount of car travel by consumers to buy a real Christmas tree outweighed the added energy and pollution costs of buying an artificial tree from China.

The American Christmas Tree Association, the main trade group for artificial tree makers and retailers, says its own study found that it took 10 years of use before a fake tree became better for the environment than a real one, at least in terms of carbon emissions.

Yet the trade-offs are not immediately apparent to consumers and even some tree growers.

On a bitterly cold afternoon at the Winter Market at New York City's Union Square this week, Lizza Stanley browsed for Christmas trees with her husband, Brian. They wondered if an artificial tree would be better for the environment because it could be reused time and time again.

The tree seller, Rob Rodriguez from Van Houten Farms of Orangeville, Pa., was of little help. "I don't even know for sure," Mr. Rodriguez said. "I would guess natural?"

The balance tilts in favor of natural Christmas trees because of the way they are grown and harvested.

Close to 400 million trees now grow on Christmas tree farms in the United States, according to the National Christmas Tree Association, which represents growers and retailers of real trees. About 30 million trees are harvested annually.

The living trees generate oxygen, help fix carbon in their branches and in the soil and provide habitat for birds and animals, Mr. Springer said.

Christmas tree farms also help preserve farmland and green space, particularly near densely populated urban areas where pressure for development is intense.

"It allows people with land that may not be the best farmland to have a crop that they can actually make a profit on, and not be under pressure to sell out to developers," said Mike Garrett, owner and operator of a Christmas tree farm in Sussex, N.J.

After the holidays, real trees can continue to serve a purpose. New York City, for instance, offers free curbside recycling for trees, which are turned into compost. The city's parks department also provides a free mulching service for trees at several locations after the holidays. In 2009, nearly 150,000 trees were composted or mulched in the city.

Artificial trees, by contrast, are manufactured almost exclusively in Asia from plastic and metal and cannot be recycled by most municipal recycling programs. After six to 10 years of use, most will end up in a landfill.

Melly Garcia, who bought a six-foot fir on the Upper East Side of Manhattan this week, said she was certain that the real tree was the correct environmental choice.

"The trees are coming from a sustainable place, and if you dispose of it properly, it goes back to the earth," she said. "So I'm at peace with that."

Jami Warner, executive director of the American Christmas Tree Association, the group promoting artificial trees, said that neither kind of tree had much of an impact on the environment — "especially when compared to something that most of us do every day, like drive a car," she wrote in an e-mail.

On that point, Mr. Trudel of Ellipsos agrees.

"When you really consider it, if you exchange a couple of days of commuting by car with carpooling or riding a bicycle, you'll completely overcompensate for whatever the impact of the tree is," he said. "It's not such a big deal. Enjoy your tree, whichever one you prefer."

http://news.discovery.com/tech/electronic-pick-pockets-target-credit-cards.html

Electronic Pick-Pockets Target Credit Cards

By David Teeghman

Credit card scams are about as old as credit cards themselves, but electronic pick-pocketing is a relatively new threat to your credit card security.

It's creepier than most credit card scams too, because it lets thieves secretly scan a back pocket or purse to read information off credit card equipped with RFID (Radio Frequency Identification Technology). These cards allow you to tap readers at gas stations pumps or check-out counters. They can also pick up identification information on RFID-embedded passports.

This capability has been around for a while, but it's gotten a lot more attention ever since the Fox affiliate in Memphis aired a story about it a couple weeks ago.

In the report, a man using a card reader and netbook was able to walk up to several people and engage in credit card "skimming," as it's called. He picked up credit card numbers, names and expiration dates for random passersby, none of whom he actually touched.

One piece of information RFID does not transmit is the CVV (Credit Verification Value) security codes on each credit card, according to Snopes. That's the three-digit code on the back of every credit card that most, but not all, e-retailers ask for when making a purchase. And because this credit card scam doesn't steal the actual card, just the information on the card, it's useless if it can't be used at an e-retailer like Amazon.

Even though there are approximately 140 million Americans with RFID-enabled credit cards, there have been no reported instances of credit card numbers being stolen this way. But that could be due to the fact that so many don't know this technology exists. I certainly didn't know this credit card scam existed before today.

Most people don't know this could happen to their credit card, but the government has known about it for years. That's why many government employees have to wear a special "jacket" for their government IDs. And there are security sleeves you can purchase, like these from Identity Strong, which prevents card readers from getting the information encoded in RFID chips.

So, do you think this is a serious threat to your credit card information, or a lot of people getting scared for no reason? Will you do anything more to keep your credit card numbers away from "electronic pick-pocketers"?

http://news.discovery.com/tech/cold-plasma-kills-bacteria-better-than-antibiotics.html

Cold Plasma Kills Bacteria Better Than Antibiotics

By Amy Dusto

Russian and German scientists may have found a better way to treat infections than using antibiotics. The solution is not another drug, but a feat of physics: cold plasma.

Before you ask whether that is an oxymoron, let me explain. Cold here is not cold in the Arctic sense; rather the opposite of scalding hot. Plasma -- an ionized gas sometimes called the fourth state of matter -- typically exists at thousands of degrees Celsius, and hot plasmas are regularly used to sterilizing surgical equipment.

Cold plasmas are closer to room temperatures. And only recently have researchers been able to make plasmas at a steady 35 to 40 degrees Celsius and at atmospheric pressure. This is cold enough to touch safely -- watch this woman on YouTube run her finger beneath a cold plasma flame.

Svetlana Ermolaeva and her research team at the Gamaleya Institute of Epidemiology and Microbiology in Moscow wanted to see how well cold plasma could work against nasty microbes that lead to infections.They used a cold plasma torch in the lab to combat two common bacteria, Pseudomonas aeruginosa and Staphylococcus aureus, which show up frequently in wound infections, but are resistant to antibiotics because they have a protective layer called a biofilm.

After five minutes, the plasma torch killed 99 percent of bacteria grown in a Petri dish, and after ten minutes, it killed 90 percent of bacteria present in the wounds of a rat wounds. And because the torch can be directed at a specific, small area of infection, surrounding tissue is left unharmed.

"Cold plasmas are able to kill bacteria by damaging microbial DNA and surface structures without being harmful to human tissues. Importantly we have shown that plasma is able to kill bacteria growing in biofilms in wounds, although thicker biofilms show some resistance to treatment," Ermolaeva said in a press release.

The researchers published their results in the Journal of Medical Microbiology.

Antibiotics, you may have met your match. Not only does cold plasma treatment avoid the nasty side effects that drugs often bring, but the ionized torch destroys bacteria indiscriminately -- whether it is antibiotic-resistant or not. There is no escaping a plasma attack.

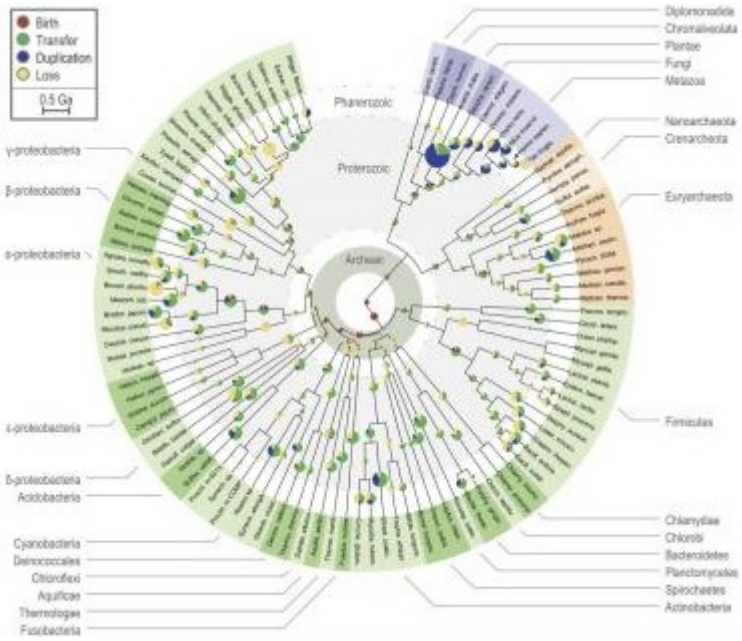
http://www.physorg.com/news/2010-12-scientists-decipher-billion-year-old-genomic-fossils.html

Scientists decipher 3 billion-year-old genomic fossils

(PhysOrg.com) -- *About 580 million years ago, life on Earth began a rapid period of change called the Cambrian Explosion, a period defined by the birth of new life forms over many millions of years that ultimately helped bring about the modern diversity of animals.*

Fossils help palaeontologists chronicle the evolution of life since then, but drawing a picture of life during the 3 billion years that preceded the Cambrian Period is challenging, because the soft-bodied Precambrian cells rarely left fossil imprints. However, those early life forms did leave behind one abundant microscopic fossil: DNA.

Because all living organisms inherit their genomes from ancestral genomes, computational biologists at MIT reasoned that they could use modern-day genomes to reconstruct the evolution of ancient microbes. They combined information from the ever-growing genome library with their own mathematical model that takes into account the ways that genes evolve: new gene families can be born and inherited; genes can be swapped or horizontally transferred between organisms; genes can be duplicated in the same genome; and genes can be lost.



The figure shows the evolution of gene families in ancient genomes across the Tree of Life. The sizes of the little pie charts scale with the number of evolutionary events in lineages, slices indicate event types: gene birth (red), duplication (blue), horizontal gene transfer (green), and loss (yellow). The Archean Expansion period (3.33 to 2.85 billion years ago) is highlighted in green. Graphic: Lawrence David

The scientists traced thousands of genes from 100 modern genomes back to those genes' first appearance on Earth to create a genomic fossil telling not only when genes came into being but also which ancient microbes possessed those genes. The work suggests that the collective genome of all life underwent an expansion between 3.3 and 2.8 billion years ago, during which time 27 percent of all presently existing gene families came into being.

Eric Alm, a professor in the Department of Civil and Environmental Engineering and the Department of Biological Engineering, and Lawrence David, who recently received his Ph.D. from MIT and is now a Junior Fellow in the Harvard Society of Fellows, have named this period the Archean Expansion.

Because so many of the new genes they identified are related to oxygen, Alm and David first thought that the emergence of oxygen might be responsible for the Archean Expansion. Oxygen did not exist in the Earth's atmosphere until about 2.5 billion years ago when it began to accumulate, likely killing off vast numbers of anerobic life forms in the Great Oxidation Event.

"The Great Oxidation Event was probably the most catastrophic event in the history of cellular life, but we don't have any biological record of it," says Alm.

Closer inspection, however, showed that oxygen-utilizing genes didn't appear until the tail end of the Archean Expansion 2.8 billion years ago, which is more consistent with the date geochemists assign to the Great Oxidation Event.

Instead, Alm and David believe they've detected the birth of modern electron transport, the biochemical process responsible for shuttling electrons within cellular membranes. Electron transport is used to breathe oxygen and by plants and some microbes during photosynthesis when they harvest energy directly from the

sun. A form of photosynthesis called oxygenic photosynthesis is believed to be responsible for generating the oxygen associated with the Great Oxidation Event, and is responsible for the oxygen we breathe today.

The evolution of electron transport during the Archean Expansion would have enabled several key stages in the history of life, including photosynthesis and respiration, both of which could lead to much larger amounts of energy being harvested and stored in the biosphere.

"Our results can't say if the development of electron transport directly caused the Archean Expansion," says David. "Nonetheless, we can speculate that having access to a much larger energy budget enabled the biosphere to host larger and more complex microbial ecosystems."

David and Alm also went on to investigate how microbial genomes evolved after the Archean Expansion by looking at the metals and molecules associated with the genes and how those changed in abundance over time. They found an increasing percentage of genes using oxygen, and enzymes associated with copper and molybdenum, which is consistent with the geological record of evolution.

"What is really remarkable about these findings is that they prove that the histories of very ancient events are recorded in the shared DNA of living organisms," says Alm. "And now that we are beginning to understand how to decode that history, I have hope that we can reconstruct some of the earliest events in the evolution of life in great detail."

More information: "Rapid evolutionary innovation during an Archean Genetic Expansion," by Lawrence A. David and Eric J. Alm. Nature online Dec. 19, 2010. Provided by Massachusetts Institute of Technology

http://www.eurekalert.org/pub_releases/2010-12/wtsi-tgb121610.php

The genetic basis of brain diseases

A set of brain proteins is found to play a role in over 100 brain diseases and provides a new insight into evolution of behavior

In research published today, scientists have studied human brain samples to isolate a set of proteins that accounts for over 130 brain diseases. The paper also shows an intriguing link between diseases and the evolution of the human brain.

Brain diseases are the leading cause of medical disability in the developed world according to the World Health Organisation and the economic costs in the USA exceeds $300 billion.

The brain is the most complex organ in the body with millions of nerve cells connected by billions of synapses. Within each synapse is a set of proteins, which, like the components of an engine, bind together to build a molecular machine called the postsynaptic density – also known as the PSD. Although studies of animal synapses have indicated that the PSD could be important in human diseases and behaviour, surprisingly little was known about it in humans.

A team of scientists, led by Professor Seth Grant at the Wellcome Trust Sanger Institute and Edinburgh University, have extracted the PSDs from synapses of patients undergoing brain surgery and discovered their molecular components using a method known as proteomics. This revealed that 1461 proteins, each one encoded by a different gene, are found in human synapses. This has made it possible, for the first time, to systematically identify the diseases that affect human synapses and provides a new way to study the evolution of the brain and behaviour.

"We found that over 130 brain diseases involve the PSD – far more than expected," says Professor Grant. "These diseases include common debilitating diseases such as Alzheimer's disease, Parkinson's disease and other neurodegenerative disorders as well as epilepsies and childhood developmental diseases including forms of autism and learning disability."

"Our findings have shown that the human PSD is at centre stage of a large range of human diseases affecting many millions of people," says Professor Grant.

"Rather than 'rounding up the usual suspects', we now have a comprehensive molecular playlist of 1000 suspects," says Professor Jeffrey L Noebels, Professor of Neurology, Neuroscience and Human Genetics at Baylor College of Medicine. "Every seventh protein in this line-up is involved in a known clinical disorder, and over half of them are repeat offenders. Mining the postsynaptic proteome now gives researchers a strategic entry point, and the rest of us a front row seat to witness neuroscience unravel the complexity of human brain disorders."

The findings open several new paths toward tackling these diseases.

"Since many different diseases involve the same set of proteins we might be able to develop new treatments that could be used on many diseases", says Professor Grant. To aid in this objective the group has created the first molecular network, a roadmap of the molecular organisation of human synapses, which shows how the

many proteins and diseases are interconnected. "We also can see ways to develop new genetic diagnostic tests and ways to help doctors classify the brain diseases".

To accelerate discovery and application of their data, the scientists have released all their data into the public domain on their website – G2Cdb. The team suggests that the data on the proteome of the PSD will be extremely useful for understanding the brain in the same way the genome was useful for understanding DNA.

The scientists were able to use their study of diseases to identify the biological roots of human behaviour. They found that proteins in the PSD are especially important for cognitive behaviours such as learning and memory, emotion and mood, as well as social behaviours and addiction or drug abuse. The findings provide deep insights into how a DNA mutation can impact on fundamental aspects of our behaviour.

The team examined the rate of evolution of the PSD proteins over millions of years of mammalian evolution, expecting the proteins to evolve at the same rate as other proteins. In a fascinating and unexpected twist to the story, the team found that the PSD proteins changed much more slowly than expected, revealing that the PSD has been highly conserved or constrained from changing during evolution.

"The conservation of the structure of these proteins suggests that the behaviours governed by the PSD and the diseases associated with them have not changed much over many millions of years," said Professor Grant. "It also shows that synapses in rodents are much more similar to humans than we expected showing that mice and rats are suitable models for studying human brain disease."

Professor Jonathan R Seckl, Moncrieff-Arnott Professor of Molecular Medicine and Executive Dean, College of Medicine and Veterinary Medicine, The Queen's Medical Research Institute, Edinburgh, says: "This splendid collaborative study is a major step forward which will surely illuminate the causes of many of the major mental health and neurological disorders that are so common in Britain as well as indicating new ways to develop treatments for these most disabling diseases."

This project was conducted as part of the Genes to Cognition Program, which is a research program aimed at understanding the molecular basis of behaviour and brain disease.

Notes to Editors

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Genes to Cognition database (G2Cdb): www.genes2cognition.org/HUMAN-PSD

http://www.edmontonsun.com/news/weird/2010/12/19/16609851.html

Surgeon reconstructs boy's jaw with rib

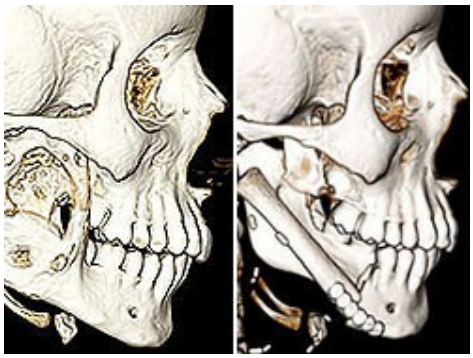
By QMI Agency

For only the second time in recorded medical history, a U.S. plastic surgeon reconstructed a 12-year-old boy's jawbone with some of the child's own rib.

The Grade 7 student suffers from a rare and aggressive bone tumour that, if left untreated, would leave him unable to chew.

Dr. Rohit Khosla, assistant professor of plastic and reconstructive surgery at Stanford School of Medicine in Palo Alto, Calif., helped remove the non-cancerous tumour and replace one-third of the boy's jawbone with a chunk of the child's rib.

"The situation was pretty complicated," Khosla said in a statement. "If he tried to open his mouth, part of the jaw would get stuck. We had to come up with a way to remove all the bone that was involved and reconstruct the mandible."



These CT scans show before (left) and after views of an unusual reconstructive surgery to treat a jaw tumour in a 12-year-old boy. (HO)

The surgery, called the Eve procedure by the Belgium team that first performed it, involved the transplant of a 10-centimetre rib piece, its blood vessels and muscle to allow the boy's face to growinto adulthood.

The new jaw was sculpted to form a joint and fitted with surgical plates and screws.

It has been six months since the surgery, and the chondromyxoid fibroma sufferer is able to chew again without any difficulty and is back on the soccer field.

"I saw that he could eat pretty much whatever he wanted without pain and without restriction in movement of his jaw. It was very reassuring that the reconstructed jaw joint was working well," Khosla said.

http://www.newscientist.com/article/mg20827915.000-is-night-falling-on-classic-solar-panels.html

Is night falling on classic solar panels?

*** 20 December 2010 by Duncan Graham-Rowe**

A new breed of electronic solar cells that harvests power from heat could double the output of conventional panels

SOLAR cells that work at night. It sounds like an oxymoron, but a new breed of nanoscale light-sensitive antennas could soon make this possible, heralding a novel form of renewable energy that avoids many of the problems that beset solar cells.

The key to these new devices is their ability to harvest infrared (IR) radiation, says Steven Novack, one of the pioneers of the technology at the US Department of Energy's Idaho National Laboratory in Idaho Falls. Nearly half of the available energy in the solar spectrum resides in the infrared band, and IR is re-emitted by the Earth's surface after the sun has gone down, meaning that the antennas can even capture some energy during the night.

Lab tests have already shown that, under ideal conditions, the antennas can collect 84 per cent of incoming photons. Novack's team calculates that a complete system would have an overall efficiency of 46 per cent; the most efficient silicon solar cells are stalled at about 25 per cent. What's more, while those ideal conditions are relatively narrowly constrained for silicon solar cells - if the sun is in the wrong position, light reflects off a silicon solar cell instead of being absorbed - the antennas absorb radiation at a variety of angles. If the antennas can be produced cheaply, the technology could prove to be truly disruptive, says Novack.

Solar arrays of billions of the tiny antennas have an efficiency as high as 84 per cent

Unlike photovoltaic cells, which use photons to liberate electrons, the new antennas resonate when hit by light waves, and that generates an alternating current that can be harnessed.

To build an array that could capture both visible and infrared radiation, researchers envision multiple layers of antennas, with each layer tuned to a different optical frequency.

So far, two main challenges have stood in the way of fomenting a revolution in solar power. First, the length of the antennas must be close to the size of the wavelength being captured, which in the case of the solar spectrum can be very small - from millimetres down to a few hundred nanometres.

Second, the currents produced will be alternating at frequencies too high to be of use unless they are first converted into a steady direct current. The problem here is that silicon diodes, which are crucial to the conversion, typically don't operate at the high frequencies required, says Aimin Song, a nanoelectronic engineer at the University of Manchester, UK.

Both of these barriers are now being broken down. Earlier this year, Novack and colleagues perfected a technique for creating arrays of billions of antennas. Although these antennas were only just small enough to harvest energy at the far end of the infrared spectrum, Novack says it should be possible to modify the process and build smaller antennas to work with mid and near-infrared.

Meanwhile Song, and Garret Moddel's team at the University of Colorado in Boulder, have independently taken a significant step in tackling the current-conversion problem by creating novel diodes capable of handling high optical frequencies (see "The devil's in the diodes"). Both groups expect to combine the diodes and antennas into working prototypes within months. "There's a potential for this to be a real game-changer," says Moddel.

The devil's in the diodes

Semiconductor diodes act like valves, converting alternating current into direct current. To work with the novel antennas, they have to operate at the AC frequencies being received and match the conductive properties of the antenna.

Semiconductors are ill-suited for this, as they tend to become less conductive when shrunk to the size of the antennas. Several groups have tackled this problem, creating diodes based on different concepts. One is that at tiny scales, the physical geometry of the device influences current flow: by creating asymmetry in the geometry, electrons can be funnelled to flow one way only.