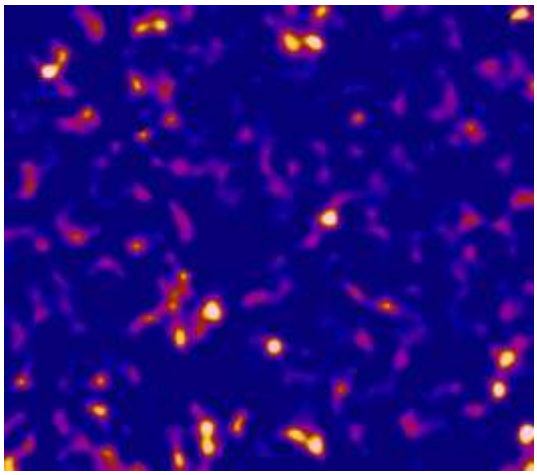
http://www.eurekalert.org/pub_releases/2012-01/uoe-arn010912.php

Astronomers reach new frontiers of dark matter

For the first time, astronomers have mapped dark matter on the largest scale ever observed

For the first time, astronomers have mapped dark matter on the largest scale ever observed. The results, presented by Dr Catherine Heymans of the University of Edinburgh, Scotland, and Associate Professor Ludovic Van Waerbeke of the University of British Columbia, Vancouver, Canada, are being presented today to the American Astronomical Society meeting in Austin, Texas. Their findings reveal a Universe comprised of an intricate cosmic web of dark matter and galaxies spanning more than one billion light years.

An international team of researchers lead by Van Waerbeke and Heymans achieved their results by analysing images of about 10 million galaxies in four different regions of the sky. They studied the distortion of the light emitted from these galaxies, which is bent as it passes massive clumps of dark matter during its journey to Earth.



Their project, known as the Canada-France-Hawaii Telescope Lensing Survey (CFHTLenS), uses data from the Canada-France-Hawaii Telescope Legacy Survey. This accumulated images over five years using the wide field imaging camera MegaCam, a 1 degree by 1 degree field-of-view, 340 Megapixel camera on the CFHT in Hawaii.

Galaxies included in the survey are typically six billion light years away. The light captured by the images used in the study was emitted when the Universe was six billion years old – roughly half the age it is today.

The team's result has been suspected for a long time from studies based on computer simulations, but was difficult to verify owing to the invisible nature of dark matter. This is the first direct glimpse at dark matter on large scales showing the cosmic web in all directions.

The observations show that dark matter in the Universe is distributed as a network of gigantic dense (white) and empty (dark) regions, where the largest white regions are about the size of an Earth moon on the sky. **Credit: Van Waerbeke, Heymans and the CFHTLenS Collaboration**

Professor Ludovic Van Waerbeke, from the University of British Columbia, said: "It is fascinating to be able to 'see' the dark matter using space-time distortion. It gives us privileged access to this mysterious mass in the Universe which cannot be observed otherwise. Knowing how dark matter is distributed is the very first step towards understanding its nature and how it fits within our current knowledge of physics."

Dr Catherine Heymans, a Lecturer in the University of Edinburgh's School of Physics and Astronomy, said: "By analysing light from the distant Universe, we can learn about what it has travelled through on its journey to reach us. We hope that by mapping more dark matter than has been studied before, we are a step closer to understanding this material and its relationship with the galaxies in our Universe."

Dr Christian Veillet, CFHT Executive Director, said "This dark matter study illustrates the strong legacy value of the CFHT Legacy Survey which is now enabling exciting results obtained by teams from many nations which use the images retrieved from the Canadian Astronomy Data Centre where they are archived and publicly available".

Professor Lance Miller, from Oxford University said: "This result has been achieved through advances in our analysis techniques which we are now applying to data from the Very Large Telescope's (VLT) Survey Telescope in Chile."

Professor Koen Kuijken, from Leiden University, said: "Over the next three years we will image more than 10 times the area mapped by CFHTLenS, bringing us ever closer to our goal of understanding the mysterious dark side of the Universe."

http://www.eurekalert.org/pub_releases/2012-01/aaon-ctn010312.php

Clinical trial: Nicotine patch shows benefits in mild cognitive impairment

Using a nicotine patch may help improve mild memory loss in older adults

ST. PAUL, Minn. – Using a nicotine patch may help improve mild memory loss in older adults, according to a study published in the January 10, 2012, print issue of Neurology®, the medical journal of the American Academy of Neurology.

Nicotine has been shown to improve cognitive performance in smokers who have stopped smoking and previous short-term studies with nicotine have shown attention and memory improvement in people with Alzheimer's disease. This study looked at nicotine in people with mild cognitive impairment, which is the stage

between normal aging and dementia when people have mild memory or thinking problems but no significant disability.

The study involved 74 people with an average age of 76 who had mild cognitive impairment and were not smokers. Half of the participants received a nicotine patch of 15 mg per day for six months and half received a placebo. The participants took several tests of memory and thinking skills at the start of the study and again after three and six months.

After six months of treatment, the nicotine-treated group regained 46 percent of normal performance for age on long-term memory, whereas the placebo group worsened by 26 percent over the same time period.

"People with mild memory loss should not start smoking or using nicotine patches by themselves, because there are harmful effects of smoking and a medication such as nicotine should only be used with a doctor's supervision," said study author Paul Newhouse, MD, of Vanderbilt University School of Medicine in Nashville. "But this study provides strong justification for further research into the use of nicotine for people with early signs of memory loss. We do not know whether benefits persist over long periods of time and provide meaningful improvement." There were no serious side effects for the people receiving the nicotine patch.

Nicotine stimulates receptors in the brain that are important for thinking and memory skills. People with Alzheimer's disease lose some of these receptors.

The study was supported by the National Institute on Aging and the National Institute of General Medical Sciences. Pfizer Inc. provided the transdermal nicotine patches.

http://www.eurekalert.org/pub_releases/2012-01/jaaj-sui010612.php

Statin use in postmenopausal women associated with increased diabetes risk

The use of statins in postmenopausal women is associated with increased diabetes risk

CHICAGO – The use of statins in postmenopausal women is associated with increased diabetes risk, according to a study published Online First by the Archives of Internal Medicine, one of the JAMA/Archives journals.

But researchers note statins address the cardiovascular consequences of diabetes and current American Diabetes Association guidelines for primary and secondary prevention should not change. Likewise, researchers write that guidelines for statin use in nondiabetic populations also should not change.

Annie L. Culver, B. Pharm, Rochester Methodist Hospital, Mayo Clinic, Rochester, Minn., and colleagues analyzed data from the national, multiyear Women's Health Initiative in the study. In this study, researchers used WHI data through 2005 and included 153,840 women without diabetes and with a mean (average) age of 63.2 years. Statin use was assessed at enrollment and in year three. At baseline, 7.04 percent of women reported taking statin medication.

The results indicate 10,242 new cases of diabetes and statin use at baseline was associated with an increased risk of diabetes. This association remained after adjusting for other potential variables, including age, race/ethnicity and body mass index, and was observed for all types of statins.

"The results of this study imply that statin use conveys an increased risk of new-onset DM in postmenopausal woman. In keeping with the findings of other studies, our results suggest that statin-induced DM is a medication class effect and not related to potency or to individual statin," the researchers write.

However, the consequences of statin-induced DM (diabetes mellitus) have not been specifically defined and deserve more attention. Given the wide use of statins in the aging population, further studies among women, men, and diverse ethnicities will clarify DM risk and risk management to optimize therapy," researchers conclude.

(Arch Intern Med. Published Online January 9, 2012. doi:10.1001/archinternmed.2011.1246. Available pre-embargo to the media at www.jamamedia.org.)

http://medicalxpress.com/news/2012-01-reveal-darker-side-common-cold.html

Researchers reveal darker side of the common cold

Human rhinovirus (HRV), also known as the common cold, can be uncommonly serious for certain children, a study led by a Vanderbilt University Medical Center pediatrician shows.

Medical Xpress - The study, published in the Dec. 28, 2011 online issue of the journal Pediatrics, shows that not only can HRV lead to hospitalization in very low birth weight (VLBW) babies, but surprisingly, even more babies are hospitalized with HRV than with respiratory syncytial virus (RSV), which is known to be dangerous to tiny babies.

For the study, lead author E. Kathryn Miller, M.D., MPH, assistant professor of Pediatrics, Allergy and Immunology, and senior author, infectious disease specialist Fernando Polack, M.D., the Cesar Milstein Professor of Pediatrics, followed 119 VLBW babies for two years through the INFANT Foundation Network in Buenos Aires, Argentina.

Babies were tested with every respiratory illness during the first year of life to see which viruses they caught and how ill they became. It was the first prospective comparison of RSV and HRV illness in these babies.

"People think HRV really only affects older children and adults and is not a serious disease. We found HRV was linked with 33 percent of the hospitalizations compared with RSV, which caused 25 percent of their hospitalizations over the course of a year," Miller said.

While RSV infection was more likely to lead to hospitalization, it was much less common and had a well-defined peak season. In contrast, HRV infected over half of the babies, and led to hospitalizations throughout the whole year.

Miller said there is also evidence of a link between HRV and childhood asthma. In the second study, Miller, Polack and their colleagues at INFANT in Argentina prospectively examined about 200 asthmatics severely impacted by wheezing during a cold, compared with 200 asthmatic children with a cold who did not wheeze.

This research, published Dec. 1, 2011, in the American Journal of Respiratory Critical Care Medicine, focused on the role of one of the body's natural defenses, an antiviral called Type 3 Interferon (INF) (Lambda) 1 in HRV infections.

"There was clearly an association of acute wheezing with HRV. We looked at several theories about the mechanism including viral load and type, as well as various inflammatory and allergic cytokine mediators, but weren't finding a link to wheezing," Miller said. "Then we found Type 3 INF (Lambda) 1 was high in wheezing asthmatic kids with HRV. This was a bit unexpected because Interferons are antiviral and have been thought to reduce the impact of HRV," Miller said.

Another smaller study showed that certain individuals with asthma may start out with a Type 3 IFN (Lambda) 1 deficiency. In the lab, primary airway epithelial cells from those individuals were introduced to HRV causing a dramatic increase in levels of Type 3 IFN (Lambda) 1. In the population-based study, the higher the levels of this type of interferon in the respiratory tract, the more severe the wheezing.

Miller says there are confounding factors, like environment and population, that need to be explored further. She is already working with investigators at the INFANT Foundation in Argentina to follow the VLBW population from the Pediatrics study further to examine development of asthma.

Romina Libster, M.D., an Argentinean pediatrician, is a co-author on both studies, which were made possible through collaborative initiatives the Vanderbilt Vaccine Center is conducting in Argentina with the INFANT Foundation. *Provided by Vanderbilt Medical Center*

http://www.sciencedaily.com/releases/2012/01/120109115830.htm

Saturn-Like Ring System Eclipses Sun-Like Star

A team of astrophysicists from the University of Rochester and Europe has discovered a ring system in the constellation Centaurus that invites comparisons to Saturn.

ScienceDaily - The scientists, led by Assistant Professor of Physics and Astronomy Eric Mamajek of Rochester and the Cerro Tololo Inter-American Observatory, used data from the international SuperWASP (Wide Angle Search for Planets) and All Sky Automated Survey (ASAS) project to study the light curves of young Sun-like stars in the Scorpius-Centaurus association -- the nearest region of recent massive star formation to the Sun.

The basic concept of the research is straightforward. Imagine yourself sitting in a park on a sunny afternoon and a softball passes between you and the sun. The intensity of light from the sun would appear to weaken for just a moment. Then a bird then flies by, causing the intensity of the sunlight to again weaken -- more or less than it did for the baseball, depending on the size of the bird and how long it took to pass. That's the principle that allowed the researchers to discover a cosmic ring system.

A light curve is a graph of light intensity over time, and one star in particular showed dramatic changes during a 54 day period in early 2007. University of Rochester graduate student Mark Pecaut and Mamajek discovered the unusual eclipse in December 2010. "When I first saw the light curve, I knew we had found a very weird and unique object. After we ruled out the eclipse being due to a spherical star or a circumstellar disk passing in front of the star, I realized that the only plausible explanation was some sort of dust ring system orbiting a smaller companion -- basically a 'Saturn on steroids,'" said Mamajek.

If a spherical object merely passed in front of the star, the intensity of the light would gradually dim and reach a low point before gradually increasing. That was not the case with the star identified as 1SWASP J140747.93-394542.6. The Rochester team discovered a long, deep, and complex eclipse event with significant on-and-off dimming. At the deepest parts of the eclipse, at least 95% of the light from the star was being blocked by dust.

The shape of the light curve was very similar to that of a well-researched star (EE Cephei), suggesting similar traits in the companion objects. However EE Cephei differs in that it appears to be a thick

protoplanetary disk transiting -- or passing -- in front a massive, hot star. "We suspect this new star is being eclipsed by a low-mass object with an orbiting disk that has multiple thin rings of dust debris," said Mamajek. The star is similar in mass to the sun, but is much younger -- about 16 million years old or 1/300th the age of the solar system -- and it lies about 420 light years away.

The research was conducted by Mamajek, Associate Professor Alice Quillen, graduate student Mark Pecaut, graduate student Fred Moolekamp, and graduate student Erin Scott of Rochester; Assistant Professor Matthew Kenworthy of Leiden University in The Netherlands; and Professor Andrew Collier Cameron and postdoctoral research assistant Neil Parley of the University of St. Andrews in Scotland. Their findings will be published in an upcoming issue of the Astronomical Journal.

"This marks the first time astronomers have detected an extrasolar ring system transiting a Sun-like star, and the first system of discrete, thin, dust rings detected around a very low-mass object outside of our solar system," said Mamajek, "But many questions remain about what exactly has been discovered." He says the object at the center of the ring system is either a very low-mass star, brown dwarf, or planet. The answer lies in the object's mass.

In order to be a brown dwarf, the object would have to be between 13 MJ (Jupiter masses) and 75 MJ, insufficient to sustain the thermonuclear fusion reactions during its projected lifetime. If the object's mass is less than 13 MJ, it would likely be a planet, making it similar to Saturn whose rings have a similar optical depth.

Mamajek and colleagues will be proposing to use southern hemisphere telescopes to obtain radial velocity data for the star to detect the gravitational tug of the companion, and conduct non-redundant mask imaging experiments to try to detect light from the faint companion. The observations will help calculate the companion's mass, which, in turn, will help determine its identity.

Along with the central object, Mamajek is interested in what is taking place in the two pronounced gaps located between the rings. Gaps usually indicate the presence of objects with enough mass to gravitationally sculpt the ring edges, and Mamajek thinks his team could be either observing the late stages of planet formation if the transiting object is a star or brown dwarf, or possibly moon formation if the transiting object is a giant planet.

If the dusty rings are similar to Saturn's in terms of their mass per optical depth, then the total mass of the rings is only on the order of the mass of Earth's moon. The orbital radius of the outermost ring is tens of millions of kilometers, so the mass and size of the ring systems is substantially heftier than Saturn's ring system. In the discovery paper, the four rings detected thus far have been dubbed "Rochester," "Sutherland," "Campanas," and "Tololo" after the sites where the eclipsed star was first detected and analyzed.

With several questions still to answer, Mamajek considers the paper to be a progress report. He expects it will take at least a couple more years to piece everything together. However with future all-sky monitoring surveys like the proposed Large Synoptic Survey Telescope being built in Chile, Mamajek expects that rare eclipses of young stars by moon-forming disks and large ring systems around young giant planets will be detectable over many years of searching. "Follow up observations of such eclipses may provide our first observational constraints on the formation and early evolution of moons around gas giant planets."

Journal Reference: *Eric E. Mamajek, Alice C. Quillen, Mark J. Pecaut, Fred Moolekamp, Erin L. Scott, Matthew A. Kenworthy, Andrew Collier Cameron & Neil R. Parley. Planetary Construction Zones in Occultation: Discovery of an Extrasolar Ring System Transiting a Young Sun-Like Star and Future Prospects for Detecting Eclipses by Circumsecondary and Circumplanetary Disks. Astronomical Journal, January 2, 2012*

http://www.wired.com/wiredscience/2012/01/invincible-tb-india/

India Reports Completely Drug-Resistant TB

Well, this is a bad way to start the year.

By Maryn McKenna Email Author

Over the past 48 hours, news has broken in India of the existence of at least 12 patients infected with tuberculosis that has become resistant to all the drugs used against the disease. Physicians in Mumbai are calling the strain TDR, for Totally Drug-Resistant. In other words, it is untreatable as far as they know.

News of some of the cases was published Dec. 21 in an ahead-of-print letter to the journal Clinical Infectious Diseases, which just about everyone missed, including me. (But not, thankfully, the hyper-alert global-health blogger Crawford Kilian, to whom I hat-tip.) That letter describes the discovery and treatment of four cases of TDR-TB since last October.

On Saturday, the Times of India disclosed that there are actually 12 known cases just in one hospital, the P. D. Hinduja National Hospital and Medical Research Centre; in the article, Hinduja's Dr. Amita Athawale admits, "The cases we clinically isolate are just the tip of the iceberg." And as a followup, the Hindustan Times

reported yesterday that most hospitals in the city - by extension, most Indian cities - don't have the facilities to identify the TDR strain, making it more likely that unrecognized cases can go on to infect others.

Why this is bad news: TB is already one of the world's worst killers, up there with malaria and HIV/AIDS, accounting for 9.4 million cases and 1.7 million deaths in 2009, according to the WHO. At the best of times, TB treatment is difficult, requiring at least 6 months of pill combinations that have unpleasant side effects and must be taken long after the patient begins to feel well.

Because of the mismatch between treatment and symptoms, people often don't take their full course of drugs - and from that (and some other factors I'll talk about in a minute) we get multi-drug resistant and extensively drug-resistant, MDR and XDR, TB. MDR is resistant to the first-choice drugs, requiring that patients instead be treated with a larger cocktail of "second-line" agents, which are less effective, have more side effects, and take much longer to effect a cure, sometimes 2 years or more. XDR is resistant to the three first-line drugs and several of the nine or so drugs usually recognized as being second choice.

As of last spring, according to the WHO, there were about 440,000 cases of MDR-TB per year, accounting for 150,000 deaths, and 25,000 cases of XDR. At the time, the WHO predicted there would be 2 million MDR or XDR cases in the word by 2012. That was before TDR-TB.

The first cases, as it turns out, were not these Indian ones, but an equally under-reported cluster of 15 patients in Iran in 2009. They were embedded in a larger outbreak of 146 cases of MDR-TB, and what most worried the physicians who saw them was that the drug resistance was occurring in immigrants and cross-border migrants as well as Iranians: Half of the patients were Iranian, and the rest Afghan, Azerbaijani and Iraqi. The Iranian team raised the possibility at the time that rates of TDR were higher than they knew, especially in border areas where there would be little diagnostic capacity or even basic medical care.

The Indian cases disclosed before Christmas demonstrate what happens when TB patients don't get good medical care. The letter to CID describes the course of four of the 12 patients; all four saw two to four doctors during their illness, and at least three got multiple, partial courses of the wrong antibiotics. The authors say this is not unusual:

The vast majority of these unfortunate patients seek care from private physicians in a desperate attempt to find a cure for their tuberculosis. This sector of private-sector physicians in India is among the largest in the world and these physicians are unregulated both in terms of prescribing practice and qualifications. A study that we conducted in Mumbai showed that only 5 of 106 private practitioners practicing in a crowded area called Dharavi could prescribe a correct prescription for a hypothetical patient with MDR tuberculosis. The majority of prescriptions were inappropriate and would only have served to further amplify resistance, converting MDR tuberculosis to XDR tuberculosis and TDR tuberculosis.

As their comment suggests, the other TB challenge is diagnosis, especially of resistant strains, and here again the news is not good. The WHO said last spring that only two-thirds of countries with resistant TB epidemics have the lab capacity to detect the resistant strains. As a result, only one MDR patient out of every 10 even gets into treatment, and when they do, cure rates range from 82 percent down to 25 percent. That's for MDR. None of the TDR patients have been recorded cured, and at least one of the known Indian patients has died.

Meanwhile, health authorities estimate that one patient with active TB can infect up to 15 others. And thus resistant TB spreads: XDR-TB was first identified just in 2006, and it has since been found in 69 countries around the world.

Cite: *Zarir F et al. Totally Drug-Resistant Tuberculosis in India. Clin Infect Dis. advance access Dec. 21, 2011. doi: 10.1093/cid/cir889.*

http://www.scientificamerican.com/article.cfm?id=pain-relief-india-on-track

PAIN Relief: India on Track to Be Declared Polio-Free Next Month

For the first time, the polio virus has disappeared from the country for 12 months, but it could still be re-imported from neighboring nations that continue to fight the devastating disease

By Helen Branswell | Monday, January 9, 2012 | 3

In the mid-2000s, when scientists questioned whether the campaign to rid the world of polio could succeed, skeptics pointed to a problem that some called PAIN.

That stood for Pakistan, Afghanistan, India and Nigeria - the four countries that were stubbornly standing in the way of success. The four had never managed to stop the spread of polioviruses within their borders and continued to send viruses, like embers off a fire, to re-ignite outbreaks in places that had previously halted transmission.

Now it appears someone's going to need to craft a new mnemonic.

India, which once seemed likely to be the last country on Earth to rid itself of polio, appears to have succeeded ahead of Pakistan, Afghanistan and Nigeria in besting the crippling viruses. The last child paralyzed by polio in India got sick on January 13, 2011, and surveillance for wild polioviruses in sewage has not turned up the pathogen in more than a year.

If India produces 12 straight months of polio-free surveillance data, it will be removed from the list of countries where polio is considered endemic, leaving only the other three. A statement hailing that likely eventuality will be issued by the Global Polio Eradication Initiative on the one-year anniversary of the last case later this week. But with the time it takes to process pending laboratory tests, it may be mid-February before there is official word. Still, there is the sense that India is on the threshold of a momentous achievement, one gained against tremendous odds.

"This is huge for us. It has taken more than a decade and tens of millions of health-workers, managers and a lot of mobilization to get to this point," says Hamid Jafari, project manager for the World Health Organization's National Polio Surveillance Project, based in New Delhi.

After more than a decade battling the virus, and heartbreaking years of seeing the numbers of paralytic cases dip tantalizingly low, only to rebound, some scientists doubted polio could be stopped in India. It was commonly observed that the eradication program had two distinct problems: In Nigeria, where some Muslim parents refused to vaccinate their kids on religious grounds, and in conflict-torn countries like Afghanistan, where safe access is a challenge, the programs were failing to vaccinate all children. In India, however, the failure was on the part of the vaccine.

Where children are well nourished and healthy, three doses of oral polio vaccine will do the trick. But malnourished children who live where sanitation is poor and diarrhea is a fact of daily life cannot mount a protective immune response so easily. In India children who had been vaccinated eight, 10 or more times would sometimes still fall prey to polio.

New vaccines that targeted first one and later two strains of polio, rather than all three, were introduced and began to make real inroads. But the country still faced enormous challenges. In India locating and vaccinating all the vulnerable children is a gargantuan task. In the two poor northern states where polio made its last stand - Uttar Pradesh and Bihar - more than half a million babies are born every month. On the twice-annual national vaccination days, 2.3 million vaccinators visit 209 million households.

"We have to get to these children, these newborns, with vaccine faster than the wild virus can get to them. It's a race against virus," Jafari explains.

In addition to introducing more effective vaccine, India got better at finding high-risk children, homing in on families that move about the country looking for seasonal work. Transit points - train stations, bus depots, busy highway intersections - are used as distribution centers during vaccination campaigns. And special efforts are made to locate and map where migrant families set up camps, to ensure their children are not missed when vaccination teams make their rounds.

Observers heap praise on India for its commitment to the task and the $2 billion it is spending to eliminate polio. "India's success is really the result of visionary determination and dogged persistence," says Liam Donaldson, former head of the U.K.'s Health Protection Agency and chair of an independent expert panel that monitors the polio eradication effort. "This achievement is thanks to the country's leaders and to many talented and dedicated individuals working both for the government and for its partner agencies."

But D. A. Henderson of the Center for Biosecurity at University of Pittsburgh Medical Center, who led the campaign to eradicate smallpox, thinks some credit for the resurgence of the global polio effort should be directed toward the founder of Microsoft. "We've got a guy by the name of Bill Gates who has taken this very seriously," Henderson says. "And I think he has done a lot to get attention at high levels in the different governments, India included, which I think has made a big difference."

Challenges remain. The country that formerly exported polioviruses is now vulnerable to re-infection from its neighbors Pakistan and Afghanistan, or beyond. Jafari says each Indian state has drawn up emergency response plans that will kick into gear should that happen. "Our biggest enemy at this time would be complacency and to think the job is done, because the threat of importation is real."

And whereas the challenges faced by other countries still fighting polio are not identical to those India faced, the nation is in a position to share its expertise. Polio workers from India have already gone to other countries to offer help, and more will probably go this year, Jafari says. India's program has also been sharing planning documents and systems devised to ensure performance accountability.

Will India's PAIN partners stop polio by the end of 2012, the latest deadline set by the global initiative? Observers expect India's success to give the entire program a badly needed boost. But the latest report from

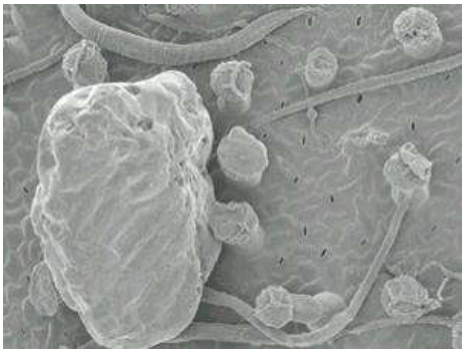
Donaldson's group suggests only India appears to be on track to meet the 2012 deadline. "The focus needs to be on improving their polio eradication programs," he says of the other countries. "If these were working properly, they would not have polio.

http://www.newscientist.com/article/dn21338-first-plant-to-use-buried-leaves-to-catch-worms-found.html

First plant to use buried leaves to catch worms found

A sticky end awaits worms that stray too close to a scrawny-looking plant unique to Brazil.

20:00 09 January 2012 by Andy Coghlan



Philcoxia minensis is the first carnivorous plant discovered to trap and devour prey in the soil with the help of sticky leaves prodded below the surface.

Earlier investigations had shown that P. minensis's tiny subterranean leaves, each just 1.5 millimetres wide, were covered with grains of sand and the corpses of nematode worms.

Now, Rafael Silva Oliveira of the State University of Campinas in Sao Paulo, Brazil and his colleagues say they have proof that the plants qualify as carnivores by digesting the nematodes.

Scanning electron micrograph of nematodes for dinner **(Image: Caio G. Pereira/Rafael S. Oliveira et al/PNAS)**

The team placed P. minensis in soil filled with nematodes containing the rare isotope nitrogen-15. Oliveira's team showed that the leaves that snared the nematodes rapidly absorbed the isotope. Within a day, 5 per cent of the weight of isotope provided had been assimilated into the leaves, with 15 per cent gone after two days.

Oliveira also discovered that the leaves were covered with phosphatases, enzymes that rapidly break down flesh, allowing the plants to digest it.

Nematode traps

"Undoubtedly, the most unique feature about how Philcoxia kills its prey is the underground placement of leaves that function as effective nematode traps," says Oliveira.

Oliveira says that the strategy makes sense in the plant's barren, rocky environment – despite the apparently counterproductive adaption of burying light-harvesting leaves underground in the dark. The team now hope to investigate how other plants in the bleak habitat secure their nutrients.

Philcoxia minensis: pretty but deadly **(Image: Caio G. Pereira/Rafael S. Oliveira et al/PNAS)**

"This is a beautiful discovery," says Walter Federle who studies carnivorous plants at the University of Cambridge. "It would be interesting to find out if the traps capture other soil animals, whether the plant specifically attracts nematodes, and whether the worms are mechanically trapped in the sticky secretion or killed by a toxin." *Journal reference: Proceedings of the National Academy of Sciences, DOI: 10.1073/pnas.1114199109*

http://www.bbc.co.uk/news/health-16468337

Routine aspirin 'may cause harm'

Healthy people who take aspirin to prevent a heart attack or stroke could be doing more harm than good, warn researchers.

By James Gallagher Health reporter, BBC News

An analysis of more than 100,000 patients, published in Archives of Internal Medicine, concluded the risk of internal bleeding was too high. The UK-led study said only people with a history of heart problems or stroke should take the tablets. Experts said any decision should be made with a doctor.

Aspirin helps people who have had a heart attack or stroke. It prevents blood clots from forming by preventing cells, known as platelets, from sticking together. By reducing the number of clots formed, the tablets reduce the risk of another heart attack or stroke. There have also been suggestions that the drug can prevent some cancers, however, the drug is known to increase the chance of internal bleeding, including bleeds on the brain.

The discussion has been whether at-risk or even healthy people should also take aspirin.

Official guidelines were issued in 2005 by the Joint British Societies, which includes the British Cardiac Society, British Hypertension Society and The Stroke Association. It recommended 75 mg of aspirin a day for high risk patients over the age of 50. The Drugs and Therapeutics Bulletin said in 2008 that preventative aspirin should be abandoned unless there was already evidence of cardiovascular disease.

Good or bad?

Researchers analysed data from nine trials, from a total of 102,621 patients. They said that while there was a 20% reduction in non-fatal heart attacks in people taking aspirin, there was no reduction in deaths from heart attack, stroke or cancer. Meanwhile the risk of potentially life threatening internal bleeding increased by 30%.

Lead researcher Prof Kausik Ray, from St George's, University of London, told the BBC: "If you treat 73 people for about six years you will get one of these non-trivial bleeds. "If you treat about 160 people for the same period of time, you're preventing one heart attack that probably wouldn't have been fatal anyway. "It suggests that the net benefit for aspirin is not there, it certainly doesn't prolong life. If you think about it, the net benefit, actually there is net harm.

The study followed patients for an average of six years. An analysis led by Prof Peter Rothwell, from Oxford University, suggested that regularly taking aspirin reduced the risk of a series of cancers, when patients were followed for much longer. Prof Rothwell said the new study was "very nicely done, but I don't think it develops [the argument] much further". He added: "It really just emphasises the need for a more detailed analysis of how risks change over time."

Natasha Stewart, senior cardiac nurse at the British Heart Foundation, said: "Aspirin can help reduce the risk of heart attack or stroke among those with known heart disease, and this group of people should continue to take aspirin as prescribed by their doctor. "Our advice is that people who don't have symptomatic or diagnosed heart disease shouldn't take aspirin because the risk of internal bleeding may outweigh the benefits. "If you're taking prescribed aspirin and have any concerns, don't simply stop taking it. Always talk to your doctor first."

Sotiris Antoniou, from the Royal Pharmaceutical Society, said: "People who buy aspirin should consult with their pharmacist to make sure that it is appropriate for them based on their individual likelihood of having a heart attack or stroke and their likelihood of experiencing a side effect such as stomach ulceration. "If you are already taking aspirin, don't simply stop taking it, speak to the pharmacist about your individual circumstances."

http://www.eurekalert.org/pub_releases/2012-01/f-sf-7oe011012.php

70 percent of Europeans suffer from low vitamin D levels

A group of experts has prepared a report on vitamin D supplementation for menopausal women after it was revealed that Europeans have suffered an alarming decrease in their levels of this vitamin.

In their opinion, the ideal would be to maintain blood levels above 30 ng/ml. Vitamin D is essential to the immune system and processes such as calcium absorption. "We believe that many diseases can be aggravated by a chronic deficiency of vitamin D," states Faustino R. Pérez-López, researcher at the University of Zaragoza. In particular, this is worse during the menopause as low levels of vitamin D in the blood are associated with an increased risk of osteoporosis, loss of motor coordination and bone fractures.

Vitamin D deficiency is a real problem in Europe as levels in the blood are low in 50% to 70% of the population. Pérez-López points out that "healthcare professionals should be aware that this is a common problem which affects a large part of the population in Europe, even those who live in sunny places."

Therefore, a group of experts from the European Menopause and Andropause society (EMAS), led by Pérez-López, have prepared a report about vitamin D supplementation and the health of postmenopausal women. The text has been signed by 11 experts from international institutions like the John Radcliffe Hospital in Oxford.

As Pérez-López explains, "we analysed the conditions and diseases that are associated with vitamin D deficiency and we recommended the intake of supplements in postmenopausal women."

Improvements in bone health

According to these experts, vitamin D supplements improve the mineral density of the bones and neuromuscular function and reduce the risk of fracture. Pérez-López believes that "the World Health Organisation or other relevant bodies belonging to the European Union should establish minimum requirements or recommendations on the fortification of foods with vitamin D." There are recommendations of this type in some European countries but in others there are either no regulations or they are not strictly observed. There is not even a consensus amongst the medical community itself regarding the advantages of supplements.

Pérez-López insists however that "they are effective but its efficacy has not yet been accepted." The researcher outlines that "it is unknown what will happen in the future but we make our recommendations from the EMAS. This is the first statement on the matter in Europe directed towards menopausal women."

As well as stimulating calcium and phosphorus absorption, the vitamin D system has numerous functions. Low vitamin D levels are linked to rickets, osteomalacia, osteoporosis and the risk of bone fracture, cardiovascular disease, diabetes, cancer, infections and degenerative diseases.

"In healthy postmenopausal women, we have seen that a good level of vitamin D is linked to good physical fitness and has an effect on body fat mass as well as muscle strength and balance," state the authors of the article published in the Maturitas journal.

A ray of sunshine

The researchers describe how "a healthy lifestyle should include exposure to the sun for 15 minutes three to four times per week when the weather permits since 90% of vitamin D is synthesized upon the skin having contact with sunlight." Vitamin D is synthesized through sunlight exposure. Therefore, a modern lifestyle that involves little or no sun exposure and few outdoor activities causes deficiency.

Like with everything, we have to strike a balance. Pérez-López adds that "prolonged sun exposure is not recommended as it increases the risk of different types of cancer along with aging of the skin."

Substitutes to sunlight

For the experts the ideal would be to maintain blood levels above 30 ng/ml but there is no agreement as to optimum levels. However, a large number of women are unable to obtain the required quantity of vitamin D through diet and sun exposure. As a way of making up for this deficiency, daily intake of 600 IU (international units) of vitamin D is recommended for women of up to 70 years of age and 800 IU/day for women over 70 years.

The researcher explains that "patients with risk factors associated with hypovitaminosis (obesity, pigmented skin, intestinal malabsorption syndromes and living in regions close to the North and South poles) should increase their intake to up to 4,000 IU per day." There is scientific evidence that a daily dose of 4,000 IU/day is not poisonous in healthy people.

Referencia bibliográfica *Faustino R. Pérez-López, Marc Brincat, C. Tamer Erel, Florence Tremollieres, Marco Gambacciani, Irene Lambrinoudaki, Mette H. Moen, Karin Schenck-Gustafsson, Svetlana Vujovic, Serge Rozenberg, Margaret Rees. "Vitamin D and postmenopausal health". Maturitas, volumen 71, págs. 83-88, enero de 2012.*

http://www.eurekalert.org/pub_releases/2012-01/kp-hli010912.php

Height loss increases risk for fractures and death in older women

Kaiser Permanente study suggests significant height loss may indicate more serious health problems

PORTLAND, Ore.- Older women who have lost more than two inches in height face an increased risk of breaking bones and dying, according to a new study published in the January issue of the Journal of Bone and Mineral Research and funded by the National Institutes of Health.

The study found that women 65 and older who lost more than two inches over 15 years were 50 percent more likely to both fracture a bone and to die in the subsequent five years, compared to women who lost less than two inches in height.

"Most women do lose height as they age, but we found that those who lost more than two inches were at higher risk of breaking a bone and of dying," said lead author Teresa Hillier, MD, MS, an endocrinologist and senior investigator at the Kaiser Permanente Center for Health Research in Portland, Ore. "These women were at higher risk of dying from a fracture, but they were also at higher risk of dying from more common causes, including heart disease."

Height loss may be an indicator of osteoporosis, a weakening of the bone that can lead to fractures of the spine, hip, wrist and other bones. Hip fractures are the most debilitating. Nearly 300,000 people are admitted to the hospital each year with a hip fracture, according to the Centers for Disease Control and Prevention. As many as 20 percent of them will die within a year after the fracture and many others will become disabled, previous research has shown.

"We need to do everything we can to prevent these fractures and our study suggests that clinicians don't need to wait until they have two height measurements before they can be proactive," Hillier said. "Most older women remember how tall they were in their mid 20s, and if they measure two inches shorter than that, clinicians should consider bone density testing, counseling, and possible treatment to help prevent fractures."

Prior studies have reported that significant height loss puts men at higher risk for heart disease and death, but this is the first study to find an association between height loss and death in women. Another study to be published in the same issue of the Journal of Bone and Mineral Research found that men over 70 who lost two inches or more were at greater risk for fracturing a hip, compared with men who lost less height.

The main analysis for the new Kaiser Permanente study involved 3,124 women who were 65 and older during the mid-1980s, when they were recruited for the landmark Study of Osteoporotic Fractures. The study has been going on for more than two decades and includes women from Baltimore, Minneapolis, Portland, Ore., and the Monongahela Valley near Pittsburgh.

Height loss was determined by comparing height measurements taken during an initial clinic visit with measurements taken during a clinic visit 15 years later. A stadiometer was used to measure height. Spine fractures were detected through X-rays, and bone density was measured using a standard bone scan.

In addition to the clinic visits, women filled out health questionnaires every four months and were asked if they'd broken a hip or other bone. Those who didn't fill out the mailed questionnaires were contacted by phone. Public death records were used to confirm mortality.

In addition to the main analysis, researchers also conducted a sensitivity analysis among all 9,704 women in the SOF study and looked at the significance of height loss that had occurred before the women entered the study at age 65 or older. At the beginning of the study, women were asked to recall how tall they were at age 25, and that height was compared to their actual height. Researchers found that women who reported losing more than two inches in the previous 40 years were also at higher risk for fractures and death.

The SOF study was supported by grants from the National Institute of Arthritis and Musculoskeletal and Skin Diseases and the National Institute on Aging.

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http://www.physorg.com/news/2012-01-pelvic-girdles-arose-movable-jaws.html

New study showing pelvic girdles arose before the origin of movable jaws

Researchers offer the first unambiguous evidence for the presence of pelvic girdles in antiarchs

Almost all gnathostomes or jawed vertebrates (including osteichthyans, chondrichthyans, 'acanthodians' and most placoderms) possess paired pectoral and pelvic fins. To date, it has generally been believed that antiarch placoderms (extinct armoured jawed fishes from the Silurian–Devonian periods) lacked pelvic fins. As Parayunnanolepis xitunensis with extensive post-thoracic preservation represents the only example of a primitive antiarch, and its original description has been cited as confirming the primitive lack of pelvic fins in early antiarchs.

Dr. ZHU Min, Institute of Vertebrate Paleontology and Paleoanthropology (IVPP), Chinese Academy of Sciences, and his research team reexamined Parayunnanolepis and offer the first unambiguous evidence for the presence of pelvic girdles in antiarchs, according to a paper published in journal of Biology Letters online 4 January 2012 in advance of the print. As antiarchs are placed at the base of the gnathostome radiation in several recent studies, this finding shows that all jawed vertebrates (including antiarch placoderms) primitively possess both pectoral and pelvic fins and that the pelvic fins did not arise within gnathostomes at a point subsequent to the origin of jaws.

Fig.1. Parayunnanolepis xitunensis, a primitive antiarch with pelvic girdles from the Lower Devonian of China (IVPP V11679.1). (a) Dorsolateral view, (b) right ventrolateral view showing the dermal pelvic girdle immediately behind the trunk armour, and (c) left lateral view. **Credit: ZHU Min**

Traditionally considered as placoderms, the antiarchs from the Silurian and Devonian periods are characterized by a distinct bony form with box-like thoracic exoskeleton and with elongate pectoral fins encased in interlocking dermal plates. Morphological features attributed to antiarchs and their interpretation play a pivotal role in recent analyses of early gnathostome interrelationships. In particular, the putative absence of pelvic fins has been considered (implicitly or explicitly) to be primitive (as in agnathans) rather than due to secondary loss within placoderms. Consequently, antiarchs are often regarded as a highly primitive clade, placed either in an unresolved trichotomy with all other jawed vertebrates (non-antiarch placoderms, chondrichthyans, 'acanthodians' and osteichthyans) and the jawless osteostracans, or as the sister-group to all other jawed vertebrates though crownward to the jawless osteostracans. It is also beleived that paired pelvic appendages (pelvic fins/hind limbs) appeared within the gnathostomes at a point subsequent to the development of movable jaws.

This pelvic girdle discovery shows that all jawed vertebrates (including antiarch placoderms) primitively possess both pectoral and pelvic appendages. While girdle-supported pectoral fins must have arisen before the

origin of movable jaws, girdle-supported pelvic fins should no longer be inferred as having originated at a point subsequent to the origin of jaws. "Together with recent findings of paired appendages and girdles in other gnathostome groups, this discovery highlights the prevalence of parallel loss and/or reduction of pelvic fin and girdle components as a recurring phenomenon in the diversification of gnathostome groups, including placoderms", explained ZHU Min, professor at the IVPP and lead author of the study.

"Parayunnanolepis xitunensis was unearthed from the Early Devonian (Xitun Formation, Lochkovian, about 413Million years ago) of Yunnan, China, and represents the only example of a primitive noneuantiarchan antiarch with extensive post-thoracic preservation. The original description, based in large part on the almost complete holotype (Institute of Vertebrate Paleontology and Paleoanthropology (IVPP) V11679.1), showed no trace of pelvic appendages in the figured and photographed material or in the reconstruction.

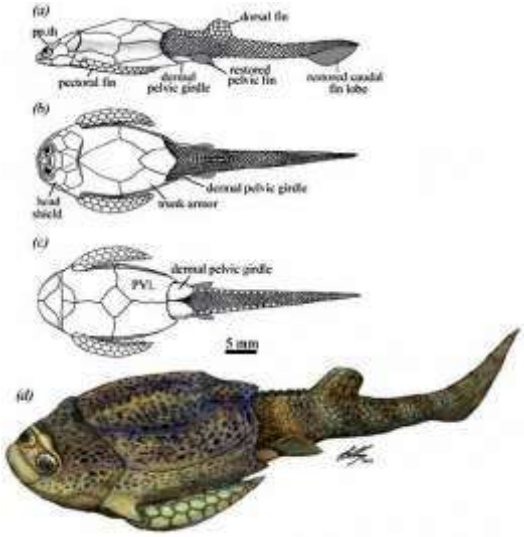


Fig.2: Revised restoration of Parayunnanolepis xitunensis (Lochkovian, Early Devonian) in lateral (a), dorsal (b) and ventral (c) views. (d) Life reconstruction of P. xitunensis. **Credit: Brian Choo**

This specimen has been subsequently cited as confirming the lack of pelvic fins in early antiarchs and thus in all antiarchs in general", said WANG Junqing, emeritus professor at the IVPP and coauthor of the study, "As the post-thoracic anatomy of antiarchs is rarely preserved, the presence or the absence of pelvic fins in most antiarchs has been difficult to ascertain. Fortunately, in our reexamination of this specimen with additional preparation of the ventral surface, we observed the tiny paired pelvic girdles, confirming the unambiguous presence of pelvic fins."

"The presence of pelvic girdles in the primitive antiarch Parayunnanolepis conclusively refutes the prevailing notion that all antiarchs lack pelvic appendages like jawless osteostracans. Viewed in this light, the absence of pelvic fins in derived antiarchs (e.g. Bothriolepis) can be best interpreted as secondary loss (as in some non-antiarch placoderms such as the petalichthyid Lunaspis), rather than as a retained primitive feature", said Xiaobo Yu, professor of Biological Sciences at Kean University, New Jersey, and coauthor of the study, "Absence of pelvic fins can no longer be deemed as an unambiguous character supporting placoderm paraphyly." *Provided by Institute of Vertebrae Paleontology and Paleoanthropology*

http://www.newscientist.com/article/mg21328464.900-siberia-was-a-wildlife-refuge-in-the-last-ice-age.html

Siberia was a wildlife refuge in the last ice age

Fossils and pollen found in these regions suggest they may have acted as a refuge for plants and animals during this time

10 January 2012 by Wendy Zukerman

SIBERIA, a name that conjures up images of snow and ice, may have been an unlikely refuge from the bitter cold of the last ice age. Ancient DNA from the region paints a picture of remarkably stable animal and plant life in the teeth of plunging temperatures. The findings could help predict how ecosystems will adapt to future climate change. The permanently frozen soil of Siberia, Canada and Alaska preserves the DNA of prehistoric plants, fungi and animals. "It's a giant molecular freezer," says James Haile at Murdoch University in Perth, Western Australia.

Glacial ice can also contain ancient DNA but permafrost is much more abundant than ice and so should provide a more complete picture of the effects of prehistoric climate change, says Haile. Last month, at the International Barcode of Life Conference in Adelaide, South Australia, his colleague Eva Bellemain of the University of Oslo in Norway revealed the first fruits of their analysis of Siberian permafrost DNA.

The samples were extracted from 15,000 to 25,000-year-old frozen sediment in southern Chukotka in north-eastern Siberia. Their age is significant: around 20,000 years ago temperatures plummeted and ice sheets blanketed much of the northern hemisphere - but parts of

Siberia, Canada and Alaska apparently stayed ice-free (Quaternary Science Reviews, DOI: 10.1016/j.quascirev.2011.07.020).

Fossils and pollen found in these regions suggest they may have acted as a refuge for plants and animals during this time, but Bellemain turned to fungal DNA to get a complete picture of the environment. Many fungi consume plants, and so indicate the plant life around at the time.

Using 23 permafrost cores, Bellemain identified around 40 fungal taxa that thrived during the last ice age. "We didn't expect to find so much," she says.

The diversity of fungi found suggests that a brimming plant community thrived in northern Siberia to support them. This range of plants should also have sustained a diverse assembly of mammals - and the samples indeed contain DNA from woolly rhinoceros (Coelodonta antiquitatis), woolly mammoths (Mammuthus primigenius), reindeer (Rangifer tarandus) and moose (Alces alces) dating back to between 15,000 and 25,000 years ago (Molecular Ecology, DOI: 10.1111/j.1365-294x.2011.05306.x).

Meanwhile, Haile and Tina Jørgensen at the University of Copenhagen in Denmark have used ancient DNA together with pollen and fossil evidence to reconstruct the plant life surrounding Lake Taymyr, on the Taymyr peninsula in northern Siberia. Using 18 cores from five sites around the lake, the team identified 66 plant taxa that stuck around from 46,000 to 12,000 years ago, even though temperatures in the region fluctuated by some 20 °C during this period. "I was surprised that the [living] environment remained stable for so long," says Jørgensen (Molecular Ecology, DOI: 10.1111/j.1365-294x.2011.05287.x).

The result does not surprise Gregory Retallack at the University of Oregon in Eugene, who studies plant remains in ancient soils that have been fossilised. "A part of this stability is down to the inertia of ecosystems," he says.

Haile and colleagues are now keen to analyse other samples to uncover how the prehistoric flora and fauna in Canada and Alaska were affected by climate change.

Andrew Lowe at the University of Adelaide thinks the results could be used in climate models "to tell us how future communities will change". But Retallack thinks such predictions will not be possible until we know, for example, how the flora and fauna were affected by large pulses of warming 70,000 and 125,000 years ago.

http://nyti.ms/yvzwjB

Haiti: Cholera Epidemic's First Victim Identified as River Bather Who Forsook Clean Water

The first Haitian to get cholera at the onset of the 2010 epidemic was almost undoubtedly a 28-year-old mentally disturbed man from the town of Mirebalais, researchers reported Monday.

By DONALD G. McNEIL Jr.

The man, whose name was not revealed in the report, in The American Journal of Tropical Medicine and Hygiene, was known as the village "moun fou" - Creole for "crazy person" - said the authors, who work for Partners in Health, a Boston group associated with Dr. Paul E. Farmer that has provided free health care in Haiti since 1987.

Although his family had clean drinking water, the man often walked naked through town to bathe and drink from the Latem River just downstream from the Meye River, into which raw sewage drained from an encampment of United Nations peacekeepers from Nepal. Haiti's outbreak was of a Nepali strain, and that encampment is considered the source.

The man developed severe diarrhea on Oct. 12, 2010, and died in less than 24 hours. Two people who washed his body for a wake fell ill 48 hours later. Haiti's first hospitalized cholera case was in Mirebalais on Oct. 17.

The epidemic has since sickened nearly 500,000 people across Haiti and killed nearly 7,000.

The man's habits made him the first known victim, said Dr. Louise C. Ivers, one of the new report's authors. But because of the "infamous living situation" in Mirebalais, which is desperately poor and was swollen with refugees from the devastating earthquake nine months earlier, the epidemic was inevitable.

"Plenty of families drank from that river, and still do despite the risk," she said.

http://www.sciencedaily.com/releases/2012/01/120109211825.htm

Bacteria in the Gut of Autistic Children Different from Non-Autistic Children

The underlying reason autism is often associated with gastrointestinal problems is an unknown, but new results reveal many children with autism harbor a type of bacteria in their guts that non-autistic children do not

ScienceDaily - The underlying reason autism is often associated with gastrointestinal problems is an unknown, but new results to be published in the online journal mBio® on January 10 reveal that the guts of autistic children differ from other children in at least one important way: many children with autism harbor a type of

bacteria in their guts that non-autistic children do not. The study was conducted by Brent Williams and colleagues at the Mailman School of Public Health at Columbia University.

Earlier work has revealed that autistic individuals with gastrointestinal symptoms often exhibit inflammation and other abnormalities in their upper and lower intestinal tracts. However, scientists do not know what causes the inflammation or how the condition relates to the developmental disorders that characterize autism. The research results appearing in mBio® indicate the communities of microorganisms that reside in the gut of autistic children with gastrointestinal problems are different than the communities of non-autistic children. Whether or not these differences are a cause or effect of autism remains to be seen.

"The relationship between different microorganisms and the host and the outcomes for disease and development is an exciting issue," says Christine A. Biron, the Brintzenhoff Professor of Medical Science at Brown University and editor of the study. "This paper is important because it starts to advance the question of how the resident microbes interact with a disorder that is poorly understood."

Bacteria belonging to the group Sutterella represented a relatively large proportion of the microorganisms found in 12 of 23 tissue samples from the guts of autistic children, but these organisms were not detected in any samples from non-autistic children. Why this organism is present only in autistic kids with gastrointestinal problems and not in unaffected kids is unclear.

"Sutterella has been associated with gastrointestinal diseases below the diaphragm, and whether it's a pathogen or not is still not clear," explains Jorge Benach, Chairman of the Department of Microbiology at Stony Brook University and a reviewer of the report. "It is not a very well-known bacterium."

In children with autism, digestive problems can be quite serious and can contribute to behavioral problems, making it difficult for doctors and therapists to help their patients. Autism, itself, is poorly understood, but the frequent linkage between this set of developmental disorders and problems in the gut is even less so.

Benach says the study was uniquely powerful because they used tissue samples from the guts of patients. "Most work that has been done linking the gut microbiome with autism has been done with stool samples," says Benach, but the microorganisms shed in stool don't necessarily represent the microbes that line the intestinal wall. "What may show up in a stool sample may be different from what is directly attached to the tissue," he says.

Tissue biopsy samples require surgery to acquire and represent a difficult process for the patient, facts that underscore the seriousness of the gastrointestinal problems many autistic children and their families must cope with. Benach emphasizes that the study is statistically powerful, but future work is needed to determine what role Sutterella plays, if any, in the problems in the gut. "It is an observation that needs to be followed through," says Benach.

Story Source: *American Society for Microbiology (2012, January 9). Bacteria in the gut of autistic children different from non-autistic children. ScienceDaily. Retrieved January 15, 2012, from http://www.sciencedaily.com-/releases/2012/01/120109211825.htm*

http://www.eurekalert.org/pub_releases/2012-01/uoia-rim010412.php

Researchers identify molecular 'culprit' in rise of planetary oxygen

A turning point in the history of life occurred 2 to 3 billion years ago with the unprecedented appearance and dramatic rise of molecular oxygen.

CHAMPAIGN, Ill. - Now researchers report they have identified an enzyme that was the first – or among the first – to generate molecular oxygen on Earth. The new findings, reported in the journal Structure, build on more than a dozen previous studies that aim to track the molecular evolution of life by looking for evidence of that history in present-day protein structures. These studies, led by University of Illinois crop sciences and Institute for Genomic Biology professor Gustavo Caetano-Anollés, focus on structurally and functionally distinct regions of proteins – called folds – that are part of the universal toolkit of living cells.

Protein folds are much more stable than the sequences of amino acids that compose them, Caetano-Anollés said. Mutations or other changes in sequence often occur without disrupting fold structure or function. This makes folds much more reliable markers of long-term evolutionary patterns, he said.

In the new study, Caetano-Anollés, working with colleagues in China and Korea, tackled an ancient mystery: Why did some of the earliest organisms begin to generate oxygen, and why?

"There is a consensus from earth scientists that about 2.4 billion years ago there was a big spike in oxygen on Earth," Caetano-Anollés said. They generally agree that this rise in oxygen, called the Great Oxygenation Event, was tied to the emergence of photosynthetic organisms.

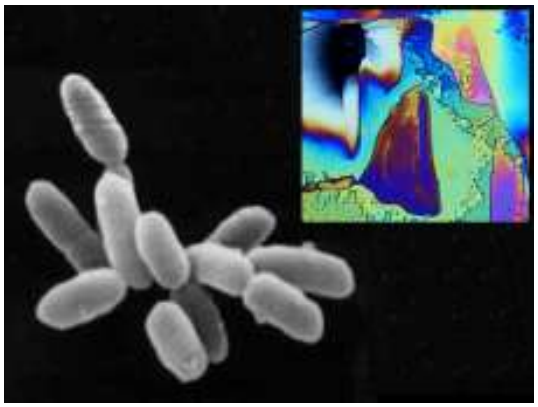
"But the problem now comes with the following question," he said. "Oxygen is toxic, so why would a living organism generate oxygen? Something must have triggered this."

The researchers looked for answers in the "molecular fossils" that still reside in living cells. They analyzed protein folds in nearly a thousand organisms representing every domain of life to assemble a timeline of protein history. Their timeline for this study was limited to single-fold proteins (which the researchers believe are the most ancient), and was calibrated using microbial fossils that appeared in the geologic record at specific dates.

The analysis revealed that the most ancient reaction of aerobic metabolism involved synthesis of pyridoxal (the active form of vitamin B6, which is essential to the activity of many protein enzymes) and occurred about 2.9 billion years ago. An oxygen-generating enzyme, manganese catalase, appeared at the same time.

Other recent studies also suggest that aerobic (oxygen-based) respiration began on Earth 300 to 400 million years before the Great Oxidation Event, Caetano-Anollés said. This would make sense, since oxygen production was probably going on for a while before the spike in oxygen occurred.

Catalases convert hydrogen peroxide to water and oxygen. The researchers hypothesize that primordial organisms "discovered" this enzyme when trying to cope with an abundance of hydrogen peroxide in the environment. Some geochemists believe that hydrogen peroxide was abundant at this time as a result of intensive solar radiation on glaciers that covered much of Earth.



Ancient oxygen. Researchers believe that ancient archaea, similar in shape to this Halobacteria, used aerobic respiration 2.9 billion years ago to produce an active form of the B6 vitamin (crystalline structure, inset).
Credit: NASA, inset; Wikimedia Commons

"In the glacial melt waters you would have a high concentration of hydrogen peroxide and that would be gradually exposing a number of the primitive organisms (alive at that time)," Caetano-Anollés said. The appearance of manganese catalase, an enzyme that degrades hydrogen peroxide and generates oxygen as a byproduct, makes it a likely "molecular culprit for the rise of oxygen on the planet," he said.

http://www.eurekalert.org/pub_releases/2012-01/uoaa-msn010612.php

Marijuana smoke not as damaging to lungs as cigarette smoke

Using marijuana carries legal risks, but a new study shows that the consequences of occasionally lighting up do not include long-term loss of lung function

BIRMINGHAM, Ala. – Using marijuana carries legal risks, but a new study shows that the consequences of occasionally lighting up do not include long-term loss of lung function, according to a new study by University of Alabama at Birmingham researchers published in the January 11, 2012, issue of the Journal of the American Medical Association. Marijuana is the most commonly used illicit drug in the United States, according to the National Survey on Drug Use and Health. In 2009, 16.7 million Americans ages 12 and older reported using marijuana at least once in the month prior to being surveyed. In addition, since 1996, 16 states and Washington, D.C., have legalized the medical use of marijuana to help manage the symptoms of many diseases, including cancer, AIDS and glaucoma.

"With marijuana use increasing and large numbers of people who have been and continue to be exposed, knowing whether it causes lasting damage to lung function is important for public-health messaging and medical use of marijuana," says the study's senior author, Stefan Kertesz, M.D., associate professor in the UAB Division of Preventive Medicine and with the Center for Surgical, Medical and Acute Care Research and Transitions at the Veterans Affairs Medical Center in Birmingham.

Kertesz says it's long been known that marijuana smoke has many irritant chemicals found in tobacco smoke and can cause lung irritation, wheezing and cough immediately after use; however, the research on long-term effects on lung function have inconsistencies.

Using a large national database, the research team compared the lung function of marijuana and tobacco smokers during a 20-year period. The data revealed that tobacco smoke had exactly the effect shown in all prior studies - increasing a person's cumulative exposure to cigarettes results in loss of air flow and lung volumes; the opposite was true for marijuana smoke.

"At levels of marijuana exposure commonly seen in Americans, occasional marijuana use was associated with increases in lung air flow rates and increases in lung capacity," Kertesz says. "Those increases were not large, but they were statistically significant. And the data showed that even up to moderately high-use levels - one joint a day for seven years - there is no evidence of decreased air-flow rates or lung volumes."

Kertesz cautions that smoking marijuana is not an avenue to better lung health. "It's not enough of an increase that would make you feel better," he says "Healthy adults can blow out 3 to 4 liters of air in one second.

The amount of gain, on average, from marijuana is small, 50 ccs or roughly a fifth of a can of coke. So it's not something that would be noticeable."Also, Kertesz says, the increase does not hold steadfast over time.

"The relationship changes for people who get to high levels of lifetime exposure," he says. "At that point, the data suggests there is a decline in lung air-flow rate. There also may be other damaging effects that don't manifest until extremely high levels of exposure; we did not have enough very heavy marijuana smokers in this study to determine this."

To perform their analysis, Kertesz and a research team from other universities looked at data from the Coronary Artery Risk Development in Young Adults Study. CARDIA, funded by the National Heart, Lung and Blood Institute, is a long-term research project involving more than 5,000 black and white men and women from Birmingham, Chicago, Minneapolis and Oakland, designed to examine the development and determinants of cardiovascular disease and its risk factors. Participants were recruited when they were ages 18-30 and followed from 1985 to 2006.

The researchers looked closely at the reported use of both marijuana and tobacco and asked participants repeatedly during years of follow-up about their use of these substances. Marijuana and tobacco use were both commonly reported - 37 percent said they used marijuana at some point during the study. This is similar, the researchers say, to what many Americans have said in other national surveys.

As part of the CARDIA protocol, participants' lung function was measured for air flow and lung volume at years 0, 2, 5, 10 and 20 using standard pulmonary function tests. The air flow measure is the amount of air you can blow out of your lungs in one second after taking the deepest breath possible. The volume measure is the total amount of air you can blow out after taking the deepest breath possible.

Lead author, Mark J. Pletcher, M.D., of the Department of Epidemiology and Biostatistics, and Department of Medicine at the University of California, San Francisco, who led the statistical analysis, says what sets this study apart from any others is both the number of participants and duration of the study. "This is not the first study to show that marijuana has a complicated relationship with lung function. However, the size of the study and the long duration of follow-up help us to paint a clearer picture of the ways in which the relationship changes over time," he says.

As a final note, Kertesz clarified that the study did not examine other ways in which smoking marijuana could affect a person's health and insisted this study does not advocate the use of marijuana. "Marijuana is still an illegal drug, and it has many complicated effects on the human body and its function," he says. "In our findings we see hints of harm in pulmonary function with heavy use, and other studies have shown that marijuana use increases a user's likelihood of a heart attack, according to the American Heart Association, and impairs the immune system's ability to fight disease, according to the National Institute on Drug Abuse."

Study co-authors include Eric Vittinghoff, Ph.D. and Feng Lin, M.S., Department of Epidemiology and Biostatistics, University of California, San Francisco; Ravi Kalhan, M.D., M.S., Asthma-COPD Program, Division of Pulmonary and Critical Care Medicine, Northwestern University Feinberg School of Medicine; Joshua Richman, M.D., Ph.D., UAB Department of Surgery and Center for Surgical, Medical and Acute Care Research and Transitions, Veterans Affairs Medical Center, Birmingham; Monika Safford, M.D., UAB Division of Preventive Medicine; and Stephen Sidney, M.D., Kaiser Permanente Division of Research, Oakland, Calif.

http://www.eurekalert.org/pub_releases/2012-01/nocs-wme010612.php

World's most extreme deep-sea vents revealed

Deeper than any seen before, and teeming with new creatures

Scientists have revealed details of the world's most extreme deep-sea volcanic vents, 5 kilometres down in a rift in the Caribbean seafloor. The undersea hot springs, which lie 0.8 kilometres deeper than any seen before, may be hotter than 450 °C and are shooting a jet of mineral-laden water more than a kilometre into the ocean above. Despite these extreme conditions, the vents are teeming with thousands of a new species of shrimp that has a light-sensing organ on its back. And having found yet more 'black smoker' vents on an undersea mountain nearby, the researchers suggest that deep-sea vents may be more widespread around the world than anyone thought.

Reporting in the scientific journal Nature Communications this week, a team led by marine geochemist Dr Doug Connelly at the National Oceanography Centre in Southampton and marine biologist Dr Jon Copley of the University of Southampton has revealed details of the world's deepest known 'black smoker' vents, so-called for the smoky-looking hot fluids that gush from them.

"Black smoker" vent at the Beebe Vent Field, 5 km deep in the Cayman Trough. **University of Southampton/NOC.**

During an expedition in April 2010 aboard the Royal Research Ship James Cook, the scientists used the National Oceanography Centre's robot submarine called Autosub6000 and a deep-diving vehicle, HyBIS, manufactured by the British firm, Hydro-Lek to locate and study the vents at a depth of five kilometres in the Cayman Trough, an undersea trench south of the Cayman Islands.

The vents, which the team named the Beebe Vent Field after the first scientist to venture into the deep ocean, are gushing hot fluids that are unusually rich in copper, and shooting a jet of mineral-laden water four times higher into the ocean above than other deep-sea vents. Although the scientists were not able to measure the temperature of the vents directly, these two features indicate that the world's deepest known vents may be hotter than 450 ºC, according to the researchers. "These vents may be one of the few places on the planet where we can study reactions between rocks and 'supercritical' fluids at extreme temperatures and pressures," says Connelly.

The team found a new species of pale shrimp congregating in hordes (up to 2,000 shrimp per m2) around the six-metre tall mineral spires of the vents. Lacking normal eyes, the shrimp instead have a light-sensing organ on their backs, which may help them to navigate in the faint glow of deep-sea vents. The researchers have named the shrimp Rimicaris hybisae, after the deep-sea vehicle that they used to collect them.

The Cayman shrimp is related to a species called Rimicaris exoculata, found at other deep-sea vents 4,000 kilometres away on the Mid-Atlantic Ridge. Elsewhere at the Beebe Vent Field, the team saw hundreds of white-tentacled anemones lining cracks where warm water seeps from the sea bed. "Studying the creatures at these vents, and comparing them with species at other vents around the world; will help us to understand how animals disperse and evolve in the deep ocean," says Copley.

Anemones at the world's deepest undersea vents. **Photo by: University of Southampton/NOC.**

The researchers also found black smoker vents on the upper slopes of an undersea mountain called Mount Dent. Mount Dent rises nearly three kilometres above the seafloor of the Cayman Trough, but its peak is still more than three kilometres beneath the waves. The mountain formed when a vast slab of rock was twisted up out of the ocean floor by the forces that pull the plates of the Earth's crust apart.

"Finding black smoker vents on Mount Dent was a complete surprise," says Connelly. "Hot and acidic vents have never been seen in an area like this before, and usually we don't even look for vents in places like this." Because undersea mountains like Mount Dent may be quite common in the oceans, the discovery suggests that deep-sea vents might be more widespread around the world than previously thought.

The vents on Mount Dent, which the team has named the Von Damm Vent Field to commemorate the life of geochemist Karen Von Damm, are also thronged with the new species of shrimp, along with snake-like fish, and previously unseen species of snail and a flea-like crustacean called an amphipod. "One of the big mysteries of deep-sea vents is how animals are able to disperse from vent field to vent field, crossing the apparently large distances between them," says Copley. "But maybe there are more 'stepping stones' like these out there than we realised."

The UK expedition that revealed the vents followed a US expedition in November 2009, which detected the plumes of water from deep-sea vents in the Cayman Trough. A second US expedition is currently using a deep-diving remotely operated vehicle to investigate the vents further and the UK team also plans to return to the Cayman Trough in 2013 with Isis, the National Oceanography Centre's deep-diving remotely operated vehicle, which can work at depths of up to six kilometres.

http://www.newscientist.com/blogs/shortsharpscience/2012/01/earthquake-damaged-particle-sm.html

Earthquake-damaged particle smasher set to restart

A Japanese particle accelerator damaged in the March 2011 earthquake is set to resume operations after extensive repairs.

David Shiga, reporter

A Japanese particle accelerator damaged in the March 2011 earthquake is set to resume operations after extensive repairs.

The accelerator, located in Tokai, about 260 kilometres south of hard-hit Sendai, is part of the Japan Proton Accelerator Research Complex (J-PARC). Prior to the earthquake, it was being used to generate neutrinos as part of an experiment called T2K, among other projects.

In June, T2K researchers announced they had observed a kind of neutrino transformation never seen before, in data collected before the earthquake. Neutrinos are fickle particles known to transform from one type to another spontaneously, but the kind of morphing seen by T2K had not been observed before.
Researchers are interested in finding out whether regular neutrinos and their antimatter counterparts transform at different rates, which could help explain why the universe contains more matter than antimatter. Data collected by T2K in future could help answer this question. T2K also might test the claim made last year that neutrinos had been measured moving faster than light from CERN in Switzerland to an underground lab in Italy.

In addition to damaging roads and causing leaks in the buildings housing the accelerator, the March earthquake knocked the accelerator's magnets out of alignment. The magnets are used to steer the beam of protons and must be very precisely aligned to do this properly.

After re-aligning the magnets, J-PARC researchers successfully sent a proton beam through all parts of the accelerator for the first time on 26 December, according to Symmetry magazine. They are now carrying out more tests with the beam and hope to restart experiments like T2K at the end of January.

http://www.eurekalert.org/pub_releases/2012-01/acs-wcd011112.php

Why coffee drinking reduces the risk of Type 2 diabetes

Why do heavy coffee drinkers have a lower risk of developing Type 2 diabetes, a disease on the increase around the world that can lead to serious health problems?

Scientists are offering a new solution to that long-standing mystery in a report in ACS' Journal of Agricultural & Food Chemistry.

Ling Zheng, Kun Huang and colleagues explain that previous studies show that coffee drinkers are at a lower risk for developing Type 2 diabetes, which accounts for 90-95 percent of diabetes cases in the world. Those studies show that people who drink four or more cups of coffee daily have a 50 percent lower risk of Type 2 diabetes. And every additional cup of coffee brings another decrease in risk of almost 7 percent. Scientists have implicated the misfolding of a substance called human islet amyloid polypeptide (hIAPP) in causing Type 2 diabetes, and some are seeking ways to block that process. Zheng and Huang decided to see if coffee's beneficial effects might be due to substances that block hIAPP.

Indeed, they identified two categories of compounds in coffee that significantly inhibited hIAPP. They suggest that this effect explains why coffee drinkers show a lower risk for developing diabetes. "A beneficial effect may thus be expected for a regular coffee drinker," the researchers conclude.

The authors acknowledge funding from the National Natural Science Foundation of China, the National Basic Research Program of China and the Chinese Ministry of Education.

http://www.eurekalert.org/pub_releases/2012-01/uoc-awo011012.php

A wealth of habitable planets in the Milky Way

Six years of observations of millions of stars now show how common it is for stars to have planets in orbits around them.

Using a method that is highly sensitive to planets that lie in a habitable zone around the host stars, astronomers, including members from the Niels Bohr Institute, have discovered that most of the Milky Way's 100 billion stars have planets that are very similar to the Earth-like planets in our own solar system – Mercury, Venus, Earth and Mars, while planets like Jupiter and Saturn are more rare. The results are published in the prestigious scientific journal, Nature.

"Our results show that planets orbiting around stars are more the rule than the exception. In a typical solar system approximately four planets have their orbits in the terrestrial zone, which is the distance from the star where you can find solid planets. On average, there are 1.6 planets in the area around the stars that corresponds to the area between Venus and Saturn" explains astronomer Uffe Gråe Jørgensen, head of the research group Astrophysics and Planetary Science at the Niels Bohr Institute at the University of Copenhagen.

Searching for exoplanets

Over 1000 exoplanets have been found in our galaxy, the Milky Way, and most have been found using either the radial velocity method or the transit method, both of which are best suited to be able to find planets that are large and relatively close to their host star. With the radial velocity method you can measure that a star rocks in small circular motions due to a revolving planet's gravitational force. With the transit method you measure periodic changes in the brightness of a star. When a planet moves in front of the star, there is a little dip in the star's brightness and if this little dip occurs regularly, further observations can reveal whether there it is a planet. With both methods you most often find large planets in such small orbits around their stars, that they have no equivalents in our own solar system.

Habitable exoplanets

In order to find planets similar to the planets we know from our own solar system, researchers must use a third method – gravitational microlensing observations. But the gravitational microlensing method requires very special conditions concerning the stars location in the galaxy.

Uffe Gråe Jørgensen explains that you need to have two stars that lie on a straight line in relation to us here on Earth. Then the light from the background star is amplified by the gravity of the foreground star, which thus acts as a magnifying glass. When the stars pass close by each other in the sky, astronomers can observe the light from the background star first increase and then decrease again. If there is a planet around the foreground star, there might be a little extra bump on the light curve. But if the planet is very close to the star, the bump 'drowns' on the light curve, and if the planet is very far from star, you do not see it. "Therefore the method is most sensitive to planets that lie at an Earth-like distance from a star," explains Uffe Gråe Jørgensen.

There are 100 billion stars in the Milky Way. Observations show that planets orbiting around stars are more the rule than the exception and approximately one out of every ten stars have a planet roughly the size of the Earth with an orbit that, if there was water and atmosphere, would create a temperature and climate roughly that same as on Earth -- we could live there. **ESO/M. Kornmesser**

It is rare that two planets pass by each other closely enough to create a microlens. We have therefore implemented a strategic search on two levels. Every starry night the research group scans 100 million stars using telescopes in Chile and New Zealand. If the scanning identifies a stellar location with a possible microlensing effect, it is automatically registered and all researchers are notified. Then the best 'lenses' are observed more closely at high resolution and their light curves are analysed. One of the places this is done is at the Danish 1.5 meter telescope at ESO's La Silla Observatory in Chile.

"In a six year period from 2002 to 2007, we observed 500 stars at high resolution. In 10 of the stars we directly see the lens effect of a planet, and for the others we could use statistical arguments to determine how many planets the stars had on average. To be exact, we found that the zone that corresponds to the area between Venus and Saturn in our solar system had and average of 1.6 planets the size of five Earth masses or more," explains Uffe Gråe Jørgensen.

Billions of habitable planets

The microlensing results complement the best existing transit and radial velocity measurements. Using transit measurements, the American Kepler satellite has identified a very large number of relatively small planets in orbits smaller than even the innermost planet in our own solar system, Mercury, while many years of radial velocity measurements have revealed a large number of very large planets in both very small orbits and slightly larger orbits.

"Our microlensing data complements the other two methods by identifying small and large planets in the area midway between the transit and radial velocity measurements. Together, the three methods are, for the first time, able to say something about how common our own solar system is, as well as how many stars appear to have Earth-size planets in the orbital area where liquid what could, in principle, exist as lakes, rivers and oceans – that is to say, where life as we know it from Earth could exist in principle," says Uffe Gråe Jørgensen.

He explains that a statistical analysis of all three methods combined shows that out of the Milky Way's 100 billion stars, there are about 10 billion stars with planets in the habitable zone. This means that there may be billions of habitable planets in the Milky Way. For thousands of years people have been guessing how many planets there might be out there among the stars, where we could, in principle at least, live. Today we know this.

Are we alone in the universe?

But it is one thing, that the planets have the right temperature to be habitable in principle, but quite another thing, whether they are inhabited – whether there is life and perhaps even intelligent life on the planets.

"There are so many unique events in our solar system that have created the basis for the development of life on Earth. Comets brought water to our planet so that life could arise and a series of random events set in motion an evolution that lead to humans and intelligent life. It is very unlikely that the same circumstances would be present in other solar systems," believes Uffe Gråe Jørgensen, "but perhaps other coincidences in other solar

systems have led to entirely different and exciting new forms of life. Recent research of planets around other stars has shown us that there is in any case billions of planets with orbits like Earth and of comparable size to the Earth."

http://www.eurekalert.org/pub_releases/2012-01/rpi-sdt011112.php

Scientists discover the first physical evidence of tobacco in a Mayan container

High technology uncovers an ancient habit

Troy, N.Y. – A scientist at Rensselaer Polytechnic Institute and an anthropologist from the University at Albany teamed up to use ultra-modern chemical analysis technology at Rensselaer to analyze ancient Mayan pottery for proof of tobacco use in the ancient culture. Dmitri Zagorevski, director of the Proteomics Core in the Center for Biotechnology and Interdisciplinary Studies (CBIS) at Rensselaer, and Jennifer Loughmiller-Newman, a doctoral candidate at the University at Albany, have discovered the first physical evidence of tobacco in a Mayan container. Their discovery represents new evidence on the ancient use of tobacco in the Mayan culture and a new method to understand the ancient roots of tobacco use in the Americas.

Their research will appear in the journal Rapid Communications in Mass Spectrometry, in an article titled "The detection of nicotine in a Late Mayan period flask by GCMS and LCMS methods."

In recent years, archaeologists have begun to use chemical analysis of residues from ancient pottery, tools, and even mummies in an attempt to piece together minute clues about ancient civilizations. Among the potential problems with isolating a residue for analysis is preservation and contamination. Many vessels serve multiple purposes during their lives, resulting in muddled chemical data. Once the vessels are discarded, natural processes such as bacteria and water can destroy the surface of materials, erasing important evidence. Additionally, researchers must be attentive to archaeological field handling and laboratory treatment of the artifacts that might lead to cross contamination by modern sources.

To make their discovery, the researchers had a unique research opportunity: a more than 1,300-year-old vessel decorated with hieroglyphics that seemingly indicated the intended contents. Additionally, the interior of the vessel had not been cleaned, leaving the interior unmodified and the residue protected from contamination.

A Mayan vessel holds the first physical evidence of tobacco in the ancient culture. **Credit: Library of Congress**

The approximately two-and-a-half-inch wide and high clay vessel bears Mayan hieroglyphics, reading "the home of his/her tobacco." The vessel, part of the large Kislak Collection housed at the Library of Congress, was made around 700 A.D. in the region of the Mirador Basin, in Southern Campeche, Mexico, during the Classic Mayan period. Tobacco use has long been associated with the Mayans, thanks to previously deciphered hieroglyphics and illustrations showing smoking gods and people, but physical evidence of the activity is exceptionally limited, according to the researchers.

Zagorevski used the technology within CBIS at Rensselaer, usually reserved to study modern diseases and proteins, to analyze the contents of the vessel for the chemical fingerprint of tobacco. The technology included gas chromatography mass spectrometry (GCMS) and high-performance liquid chromatography mass spectrometry (LCMS). Both are analytical chemistry techniques that combine the physical separation capabilities of gas or liquid chromatography with the analysis capabilities of mass spectrometry. The latter is used to determine molecular weights of compounds, their elemental composition, and structural characteristics.

Zagorevski and Loughmiller-Newman's analysis of the vessel found nicotine, an important component of tobacco in residues scrapped from the container. Both techniques confirmed the presence of nicotine. In addition, three oxidation products of nicotine were also discovered. Nicotine oxidation occurs naturally as the nicotine in tobacco is exposed to air and bacteria. None of the nicotine byproducts associated with the smoking of tobacco were found in the vessel, indicating that the vessel housed unsmoked tobacco leaves (possibly powered tobacco) and was not used as an ash tray. No other evidence of nicotine has been found, at this time, in any of the other vessels in the collection.

This discovery "provides rare and unequivocal evidence for agreement between a vessel's actual content and a specific ichnographic or hieroglyphic representation of that content (on the same vessel)," Loughmiller-Newman states in the paper. She is in the anthropology department at the University at Albany, studying ritual food stuff consumed by the Mayans. Both Loughmiller-Newman and Zagorevski would like to see this technique used to analyze a greater variety of vessel types.

http://www.sciencedaily.com/releases/2012/01/120111103856.htm

Omega-3 Fatty Acids Could Prevent and Treat Nerve Damage, Research Suggests

Research from Queen Mary, University of London suggests that omega-3 fatty acids, which are found in fish oil, have the potential to protect nerves from injury and help them to regenerate.

ScienceDaily - When nerves are damaged because of an accident or injury, patients experience pain, weakness and muscle paralysis which can leave them disabled, and recovery rates are poor. The new study, published this week in the Journal of Neuroscience, suggests that omega-3 fatty acids could play a significant role in speeding recovery from nerve injury.

The study focused on peripheral nerve cells. Peripheral nerves are the nerves which transmit signals between the brain and spinal cord, and the rest of the body. These nerves have the ability to regenerate but, despite advances in surgical techniques, patients usually only have good recovery when their injury is minor.

Omega-3 fatty acids are vital for the body's normal growth and development and have been widely researched for their health benefits. Because the body cannot manufacture omega-3 fatty acids, they have to be consumed in foods such as oily fish.

In the new study, researchers first looked at isolated mouse nerve cells. They simulated the type of damage caused by accident or injury, by either stretching the cells or starving them of oxygen. Both types of damage killed a significant number of nerve cells but enrichment with omega-3 fatty acids in cells gave them significant protection and decreased cell death. Next the researchers studied the sciatic nerves of mice. They found that a high level of omega-3 fatty acids helped mice to recover from sciatic nerve injury more quickly and more fully, and that their muscles were less likely to waste following nerve damage.

The research was carried out by a group led by Adina Michael-Titus, Professor of Neuroscience at Barts and The London Medical School and lead of the Neurotrauma and Neurodegeneration group in the Centre for Neuroscience and Trauma, Queen Mary, University of London.

She explained: "Our previous research has shown that these fatty acids could have beneficial effects in a number of neurological conditions. This new study suggests that they could also have a role in treating peripheral nerve injuries. "More work is needed but our research indicates that omega-3 fatty acids can protect damaged nerve cells, which is a critical first step in a successful neurological recovery."

http://medicalxpress.com/news/2012-01-diet-iron-intake-teen-years.html

Diet counts: Iron intake in teen years can impact brain in later life

Researchers at UCLA have found that in addition to causing cognitive problems, a lack of iron early in life can affect the brain's physical structure as well

Medical Xpress - Iron is a popular topic in health news. Doctors prescribe it for medical reasons, and it's available over the counter as a dietary supplement. And while it's known that too little iron can result in cognitive problems, it's also known that too much promotes neurodegenerative diseases. Now, researchers at UCLA have found that in addition to causing cognitive problems, a lack of iron early in life can affect the brain's physical structure as well.

UCLA neurology professor Paul Thompson and his colleagues measured levels of transferrin, a protein that transports iron throughout the body and brain, in adolescents and discovered that these transferrin levels were related to detectable differences in both the brain's macro-structure and micro-structure when the adolescents reached young adulthood. The researchers also identified a common set of genes that influences both transferrin levels and brain structure. The discovery may shed light on the neural mechanisms by which iron affects cognition, neurodevelopment and neurodegeneration, they said. Their findings appear in the current online edition of the journal Proceedings of the National Academy of Sciences.

Iron and the proteins that transport it are critically important for brain function. Iron deficiency is the most common nutritional deficiency worldwide, causing poor cognitive achievement in school-aged children. Yet later in life, iron overload is associated with damage to the brain, and abnormally high iron concentrations have been found in the brains of patients with Alzheimer's, Parkinson's and Huntington diseases.

Since both a deficiency and an excess of iron can negatively impact brain function, the body's regulation of iron transport to the brain is crucial. When iron levels are low, the liver produces more transferrin for increased iron transport. The researchers wanted to know whether brain structure in healthy adults was also dependent on transferrin levels.

"We found that healthy brain wiring in adults depended on having good iron levels in your teenage years," said Thompson, a member of UCLA's Laboratory of Neuro Imaging. "This connection was a lot stronger than

we expected, especially as we were looking at people who were young and healthy - none of them would be considered iron-deficient.

"We also found a connection with a gene that explains why this is so. The gene itself seems to affect brain wiring, which was a big surprise," he said.

To assess brain volume and integrity, Thompson's team collected brain MRI scans on 615 healthy young-adult twins and siblings, who had an average age of 23. Of these subjects, 574 were also scanned with a type of MRI called a "diffusion scan," which maps the brain's myelin connections and their strength, or integrity. Myelin is the fatty sheath that coats the brain's nerve axons, allowing for efficient conduction of nerve impulses, and iron plays a key role in myelin production.

Eight to 12 years before the current imaging study, researchers measured the subjects' blood transferrin levels. They hoped to determine whether iron availability in the developmentally crucial period of adolescence impacted the organization of the brain later in life. "Adolescence is a period of high vulnerability to brain insults, and the brain is still very actively developing," Thompson said.

By averaging the subjects' transferrin levels, which had been assessed repeatedly - at 12, 14 and 16 years of age - the researchers estimated iron availability to the brain during adolescence, he said.

The team discovered that subjects who had elevated transferrin levels - a common sign of poor iron levels in a person's diet - had structural changes in brain regions that are vulnerable to neurodegeneration. And further analyses of the twins in the study revealed that a common set of genes influences both transferrin levels and brain structure. One of the genetic links - a specific variation in a gene called HFE, which is known to influence blood transferrin levels - was associated with reduced brain-fiber integrity, although subjects carrying this gene variant did not yet show any symptoms of disease or cognitive impairment.

"So this is one of the deep secrets of the brain," Thompson said. "You wouldn't think the iron in our diet would affect the brain so much in our teen years. But it turns out that it matters very much. Because myelin speeds your brain's communications, and iron is vital for making myelin, poor iron levels in childhood erode your brain reserves which you need later in life to protect against aging and Alzheimer's. "This is remarkable, as we were not studying iron deficient people, just around 600 normal healthy people. It underscores the need for a balanced diet in the teenage years, when your brain's command center is still actively maturing. "

The findings, he said, may aid future studies of how iron transport affects brain function, development and the risk of neurodegeneration. *Provided by University of California Los Angeles*

http://www.scientificamerican.com/article.cfm?id=vaccine-haiti-cholera

Can a Vaccine Cure Haiti's Cholera?

Two years after the earthquake and thousands of deaths later, the debate about whether to use the cholera vaccine in Haiti continues

By Katherine Harmon | Thursday, January 12, 2012 | 6

The cholera epidemic in Haiti has cast a stark light on deep development holes and disagreements about whether a short-term patch - in the form of a cholera vaccine - can help in the long-term fight for better health.

A developing nation, Haiti has long struggled to maintain modern public-health projects. Even before the January 12, 2010 earthquake the country was already falling behind. In 1990 more than a quarter of the population had access to sanitary facilities, but by 2008 only 17 percent of Haitians did. The earthquake brought further destruction to the country's limited infrastructure. Almost before the dust from the devastation settled, however, the international outpouring of support and aid seemed to signal a new opportunity to bring the most basic of health tools - clean water and decent sanitation - to Haitians.

Now, two years after the earthquake, Haiti is backsliding again. In the first half of 2010 about half of people in settlement camps in Port-au-Prince had clean drinking water, but by the end of the year only 7 percent did. And even as the cholera epidemic subsides to a couple hundred cases a day between rainy seasons, experts anticipate a spike in illness and deaths as soon as the rains return, starting next month.

Since the first cases of cholera appeared in October 2010, some 7,000 people have died from the diarrheal disease (caused by the pathogen Vibrio cholerae, which is transmitted via unclean drinking water) and at least 520,000 have suffered symptoms. Treatment is simple (oral rehydration salts), and prevention is basic (clean drinking water and proper sanitation). But for impoverished Haiti, these solutions are still largely out of reach.

That is why many advocates argue for the distribution of the cholera vaccine, which has passed clinical trials and received approval by the World Health Organization (WHO) for global use. But many groups, such as the Pan-American Health Organization (PAHO), are taking a wait-and-see approach and are not yet ready to back a full rollout of the vaccine.

Prevention imperfect?

The two existing cholera vaccines, Dukoral and Shanchol, are taken orally in two doses two weeks apart, and immunity takes about a week to kick in, lasting for two to three years. They are about 60 to 90 percent effective.

Those at Partners In Health (PIH), a health care organization, say that imperfect efficacy should not matter in Haiti. "If you have a vaccine that was about 80 percent effective compared to 0 percent effective of drinking stool-laden water, which would you choose?" asks Paul Farmer, co-founder of the organization and a professor at Harvard University. "It's not as good as the polio vaccine, but neither is the flu vaccine." Indeed, the cholera vaccines are roughly as effective as flu vaccine, and are "pretty frickin' good," Farmer says. Shanchol has emerged as the favorite, as unlike Dukoral it does not need to be diluted with water.

PIH is collaborating with the Haitian nongovernmental organization Gheskio to start distributing Shanchol in two locations - in the rural area of Bocozel in the Artibonite River Valley and the more urban Port-au-Prince slum Cité de Dieu. They have 200,000 doses of Shanchol on order from the Indian manufacturer, Shantha Biotechnics, and hope to start the pilot program next month - although Farmer says they had hoped it would start last year.

PAHO, WHO and other organizations will be watching the program closely to see if the logistics of distribution pan out. "It needs to be verified in the field," says Andrea Vicari, a vaccination advisor at PAHO, of the vaccine program, explaining that although it has worked well in clinical trials and previous assays in Asia, on the ground in Haiti it might prove less effective because of gaps in distribution and people not taking both doses. Vicari plans to visit Haiti to assess the situation at the end of the month. Success could mean a green light for the rest of the country - and likely the world - to use these vaccines on a larger scale to provide immunity where cholera is endemic.

And PIH is eager to show results. "The most immediate data we will have will be completion-rate data: Can we get two doses to the majority of the population we're targeting," says Jonathan Weigel, a researcher at PIH. "We're not worried about whether it will be a safe or effective vaccine - we know it is. That data on completion rate will convince any skeptics about whether it can be rolled out on a wider scale in Haiti."

Dosage deficiency

The lack of access to clean water and proper sanitation facilities means that "we have to consider nearly everybody at risk in Haiti for developing cholera," David Olson, Doctors Without Borders medical advisor for diarrheal diseases, said in a prepared statement.

Therein lies one of the major reasons why, as Vicari notes, there is not yet "a consensus whether the vaccine can be useful or not." Haiti's population far exceeds the current manufacturing capacity of five million doses combined of Shanchol and Dukoral. To vaccinate the entire country with the required two doses per person, it would either take a five-year effort (with immunity waning in each person after two years) or there would need to be a massive scale-up effort in production. "Regardless of financial issues, that is going to be a little bit of a bottleneck," Vicari says.

As Olson pointed out, a strategic use of the limited quantities of vaccine could be workable: vaccines could first be sent to remote regions, where deliveries of soap, clean water and training are more difficult. "It won't be easy to vaccinate in rural areas with poor access, but it would be even harder to intervene should an outbreak occur," Olson said. But not everyone agrees on an appropriate use of the limited supply. Early on in the epidemic, the then-Haitian health minister even expressed concern that having a limited number of doses could cause unrest.

PIH has eliminated that issue from their program by servicing two areas that each has about 50,000 residents, "so we can vaccinate almost everyone in those areas," Weigel explains, who also notes that unvaccinated individuals in these communities would benefit from herd immunity.

Farmer predicts that if the government decides to support the vaccine's more widespread distribution, supply will follow and thereby render the current debate irrelevant. "There are hundreds of thousands of cases just in Haiti - and millions around the world, so if demand were in any way related to burden of disease," there should be adequate supply, he says.

Excising the endemic

Even if the vaccine demonstration proves successful in Bocozel and Cité de Dieu, the cholera scourge is not going to be rid from Haiti with immunization alone. As Weigel is quick to point out, "it would be foolhardy" to try to eradicate cholera from the area using only a vaccine.

The cholera eradication conversation inevitably turns back to the need for potable water and better sanitation. "Without improving access to clean water and proper sanitation, cholera will undoubtedly keep coming back," Olson said.

And that infrastructure is expensive to build. But as Mirta Roses, director of PAHO, said in a press briefing Wednesday, not improving water and sanitation will be even more costly. "It might take years, but the journey begins today," she said.

At the end of the day, however, the path forward will be for the Hatian government to select and see through. Haiti's President Michel Martelly addressed the PAHO briefing, noting, "the time has come to address these deficiencies," adding that "only a joint, comprehensive and strategic approach can lead us to eliminate cholera."

Martelly, PAHO and others have taken as a model for cholera's eradication the lessons learned from the reemergence of the pathogen in Latin America in the 1990s, which took a decade to vanquish.

But for many Haitians at risk for contracting cholera, 2022 could come too late. Farmer and his colleagues at PIH are hoping that widespread use of the vaccine could bolster other longer-term investments to combat cholera. "We do hope that will be a model for Haiti, and the Ministry of Health has been extremely excited about it," Weigel says of the PIH demonstration.

And like water improvement, the vaccine shakes out to look like a good investment - and one that could draw quicker dividends. The $40 million needed to pay for vaccine doses for the entire country - if they were to be available - seems like just a drop in the bucket of the billions of dollars promised following the disaster two years ago. But, as Vicari points out, "what is pledged is not necessarily what is available." So far, "just 30 to 40 percent was received."

Nevertheless, investing in cholera prevention by procuring more vaccines could also cut down on costs in the future, Weigel notes. In the 14 months since the first cholera cases appeared, the disease has cost some $176 million - many times more expensive than the cost of vaccination, he notes. "This is low-hanging fruit - this is not some complex intervention."

http://n.pr/wIkDq4

Why do cats have an affinity for mushrooms?

Mystery Solved: Why The Cat Craves Mushrooms (And People Do, Too)

by Nancy Shute

Anyone who lives with a cat knows that fruits and vegetables do not top the feline food chart. So it's a surprise to hear that some cats do crave mushrooms.

This tale starts with Ellen Jacobson, an amateur mushroom hunter in Colorado. As she was cooking up a bolete mushroom, her cat Cashew started brushing against her legs. She put some of the mushrooms in a bowl, and Cashew gobbled them up. "He didn't like them raw," she told The Salt. "He only liked them cooked."

She was puzzled as to why a meat-loving cat would love fungi. But she soon found that other peoples' cats wanted mushrooms, too.

That oddity is a clue to how the taste preferences of humans and animals evolved, based on the foods we need to survive.

Mushrooms have a lot of glutamate, an amino acid that gives them their rich, savory flavor. Glutamate is one of the chemicals responsible for the umami flavor; it's one of the five flavors sensed by humans, along with salty, sweet, sour, and bitter. (Check out Robert Krulwich's engaging piece on ***the origins of umami here***.)

The notion that a cat might crave mushrooms isn't a big surprise to Gary Beauchamp, director of the Monell Chemical Senses Center in Philadelphia. For decades, he has been studying how different species sense flavor. Cats have been a big focus of his research.

In 2005, Beauchamp and his colleagues proved that cats, tigers and other felines can't taste sweetness because they lack a functional gene for sweetness taste receptors. But they do have genes for the receptors that detect the umami flavor of wide array of amino acids in protein. So Cashew and any other mushroom-craving cats are really on a hunt for protein, not for fungi, he says.

"One experiment nature made was to have certain species that eat nothing but meat," Beauchamp told The Salt. "How that shapes their sensory world can tell us something about how the sensory world of everyone, including humans, is constrained by biology."

It's a good thing that cats don't crave sweets; they aren't physically able to digest carbohydrates.

When Beauchamp's paper was published in 2005, he says, "We got a ton of mail saying, 'Yes, but my cat likes sweets.'" He thinks that those cats are responding to the fat or protein in cake and ice cream, not the sugar. And he thinks humans are probably deluding themselves if they think they can taste more flavors than animals.

Humans are omnivorous, and have a wide variety of flavor receptors, which help us identify the many foods that we can digest. Dogs have sweet receptors, too.

But veterinarians say that neither dogs nor cats should eat mushrooms, and the North American Mycological Association warns that both dogs and cats are attracted by the odor of wild mushrooms, and can be poisoned as a result.

The Salt cottoned onto this story thanks to Jef Akst, who wrote about Ellen Jacobson and her mushroom-craving cats the current edition of The Scientist. She had found the story thanks to two researchers who had seen Jacobson's article in a mycological newsletter out in Colorado, and wrote about it in a scientific journal. So you never know where you're going to find a story that solves a mystery involving felines, fungi, and taste.

http://www.eurekalert.org/pub_releases/2012-01/uom-rdp011012.php

Researchers discover particle which could 'cool the planet'

In a breakthrough paper published in Science, researchers from The University of Manchester, The University of Bristol and Sandia National Laboratories report the potentially revolutionary effects of Criegee biradicals.

These invisible chemical intermediates are powerful oxidisers of pollutants such as nitrogen dioxide and sulfur dioxide, produced by combustion, and can naturally clean up the atmosphere. Although these chemical intermediates were hypothesised in the 1950s, it is only now that they have been detected. Scientists now believe that, with further research, these species could play a major role in off-setting climate change.

The detection of the Criegee biradical and measurement of how fast it reacts was made possible by a unique apparatus, designed by Sandia researchers, that uses light from a third-generation synchrotron facility, at the Lawrence Berkeley National Laboratory's Advanced Light Source.

The intense, tunable light from the synchrotron allowed researchers to discern the formation and removal of different isomeric species – molecules that contain the same atoms but arranged in different combinations.

The researchers found that the Criegee biradicals react more rapidly than first thought and will accelerate the formation of sulphate and nitrate in the atmosphere. These compounds will lead to aerosol formation and ultimately to cloud formation with the potential to cool the planet.

The formation of Criegee biradicals was first postulated by Rudolf Criegee in the 1950s. However, despite their importance, it has not been possible to directly study these important species in the laboratory.

In the last 100 years, Earth's average surface temperature increased by about 0.8 °C with about two thirds of the increase occurring over just the last three decades.

Most countries have agreed that drastic cuts in greenhouse gas emissions are required, and that future global warming should be limited to below 2.0 °C (3.6 °F).

Dr Carl Percival, Reader in Atmospheric Chemistry at The University of Manchester and one of the authors of the paper, believes there could be significant research possibilities arising from the discovery of the Criegee biradicals. He said: "Criegee radicals have been impossible to measure until this work carried out at the Advanced Light Source. We have been able to quantify how fast Criegee radicals react for the first time.

"Our results will have a significant impact on our understanding of the oxidising capacity of the atmosphere and have wide ranging implications for pollution and climate change. "The main source of these Criegee biradicals does not depend on sunlight and so these processes take place throughout the day and night."

Professor Dudley Shallcross, Professor in Atmospheric Chemistry at The University of Bristol, added: "A significant ingredient required for the production of these Criegee biradicals comes from chemicals released quite naturally by plants, so natural ecosystems could be playing a significant role in off-setting warming.'

http://www.eurekalert.org/pub_releases/2012-01/pu-rhd011212.php

Researchers: Honeybee deaths linked to seed insecticide exposure

Honeybee populations have been in serious decline for years, and Purdue University scientists may have identified one of the factors that cause bee deaths around agricultural fields.

WEST LAFAYETTE, Ind. - Analyses of bees found dead in and around hives from several apiaries over two years in Indiana showed the presence of neonicotinoid insecticides, which are commonly used to coat corn and soybean seeds before planting. The research showed that those insecticides were present at high concentrations in waste talc that is exhausted from farm machinery during planting.

The insecticides clothianidin and thiamethoxam were also consistently found at low levels in soil - up to two years after treated seed was planted - on nearby dandelion flowers and in corn pollen gathered by the bees, according to the findings released in the journal PLoS One this month.

"We know that these insecticides are highly toxic to bees; we found them in each sample of dead and dying bees," said Christian Krupke, associate professor of entomology and a co-author of the findings.

The United States is losing about one-third of its honeybee hives each year, according to Greg Hunt, a Purdue professor of behavioral genetics, honeybee specialist and co-author of the findings. Hunt said no one factor is to blame, though scientists believe that others such as mites and insecticides are all working against the bees, which are important for pollinating food crops and wild plants.

"It ƒs like death by a thousand cuts for these bees," Hunt said.

Krupke and Hunt received reports that bee deaths in 2010 and 2011 were occurring at planting time in hives near agricultural fields. Toxicological screenings performed by Brian Eitzer, a co-author of the study from the Connecticut Agricultural Experiment Station, for an array of pesticides showed that the neonicotinoids used to treat corn and soybean seed were present in each sample of affected bees. Krupke said other bees at those hives exhibited tremors, uncoordinated movement and convulsions, all signs of insecticide poisoning.

Seeds of most annual crops are coated in neonicotinoid insecticides for protection after planting. All corn seed and about half of all soybean seed is treated. The coatings are sticky, and in order to keep seeds flowing freely in the vacuum systems used in planters, they are mixed with talc. Excess talc used in the process is released during planting and routine planter cleaning procedures.

"Given the rates of corn planting and talc usage, we are blowing large amounts of contaminated talc into the environment. The dust is quite light and appears to be quite mobile," Krupke said.

Krupke said the corn pollen that bees were bringing back to hives later in the year tested positive for neonicotinoids at levels roughly below 100 parts per billion. "That's enough to kill bees if sufficient amounts are consumed, but it is not acutely toxic," he said. On the other hand, the exhausted talc showed extremely high levels of the insecticides - up to about 700,000 times the lethal contact dose for a bee.

"Whatever was on the seed was being exhausted into the environment," Krupke said. "This material is so concentrated that even small amounts landing on flowering plants around a field can kill foragers or be transported to the hive in contaminated pollen. This might be why we found these insecticides in pollen that the bees had collected and brought back to their hives."

Krupke suggested that efforts could be made to limit or eliminate talc emissions during planting.

"That's the first target for corrective action," he said. "It stands out as being an enormous source of potential environmental contamination, not just for honeybees, but for any insects living in or near these fields. The fact that these compounds can persist for months or years means that plants growing in these soils can take up these compounds in leaf tissue or pollen."

Although corn and soybean production does not require insect pollinators, that is not the case for most plants that provide food. Krupke said protecting bees benefits agriculture since most fruit, nut and vegetable crop plants depend upon honeybees for pollination. The U.S. Department of Agriculture estimates the value of honeybees to commercial agriculture at $15 billion to $20 billion annually.

Hunt said he would continue to study the sublethal effects of neonicotinoids. He said for bees that do not die from the insecticide there could be other effects, such as loss of homing ability or less resistance to disease or mites. "I think we need to stop and try to understand the risks associated with these insecticides," Hunt said.

The North American Pollinator Protection Campaign and the USDA's Agriculture and Food Research Initiative funded the research.

http://www.wired.com/wiredscience/2012/01/tdr-first-italy/

Totally Resistant TB: Earliest Cases in Italy

ProMED points out that the earliest recorded cases of TDR were not the current 12 known cases in Mumbai or the 15 cases in Iran in 2009, but rather two women from Italy who died in 2003 after being sick for several years.

By Maryn McKenna Email Author

A follow-up to Monday's post on the recognition in India of totally drug-resistant tuberculosis, TDR-TB: The fantastic early-warning list ProMED points out that the earliest recorded cases of TDR were not the current 12 known cases in Mumbai or the 15 cases in Iran in 2009, but rather two women from Italy who died in 2003 after being sick for several years. It's a sad story that was briefly recounted in 2007 in the journal EuroSurveillance, published by the European Centre for Disease Prevention and Control (ECDC).

Both women were middle-aged at most (the journal says only "younger than 50"), born in Italy, from middle class families, and otherwise healthy, with no diseases that would put them at greater risk of TB infection. (Among other things, that means no HIV.) They were both treated at the E. Morelli Hospital, a giant TB sanatorium in the town of Sondalo, north of Milan near the Swiss border. They were both diagnosed by local doctors and treated with repeated rounds of the normal TB drugs - three rounds each - before someone recognized that something unusual was happening. They were separately admitted to the Morelli hospital with

what the paper calls "a very severe clinical picture (extended bilateral cavities)," which means the TB infection had eaten away the tissue of their lungs, leaving empty dead zones. (If you'd like to see what that looks like, here are some pathology images, not from these women.)

The first woman actually caught multi-drug resistant TB from her mother and gave it to her 14-year-old daughter (who is not the second case in the paper - more on her below). She was treated in three different hospitals, with 17 different antibiotics, for 422 days, or 14 months - and took TB drugs for 94 months before her untreatable disease killed her.

The second woman - whether she was related to the first, or lived near her, is not made clear - was in one other hospital before being admitted to the TB specialty institution in Sondalo. Her inpatient treatment took 625 days and also involved 17 different drugs. After she was discharged, she was on a drug regimen for 60 months before untreatable TB killed her also. There are some lessons to pick out from these stories.

The first is that TDR-TB has occurred randomly before. Note, both these women died in 2003, but at that point, one had been under treatment for 5 years and the other for 8 years.

The second is that, as the Indian account from Monday emphasized and this one confirms, these TDR cases are artifacts, created by poorly chosen and insufficient drug treatment. The EuroSurveillance paper says: `In both cases the drug susceptibility tests showed that resistance to new drugs was acquired over time. Case 1 was initially mismanaged, and then admitted at the reference hospital being already resistant to the majority of the available drugs. Case 2 management and adherence to the regimen prescribed was sub-optimal before admission to the reference hospital.

While there may be something molecular going on that makes certain strains more likely to become resistant (or certain patients particularly good hosts for that), the paper emphasizes a second time how much blame should fall on poor health care and bad antibiotic use. Citing a contemporaneous study from Italy and Germany, it says:

All XDR- and about 50% of MDR-TB cases as reported in the study mentioned above were previously treated for TB in the past. This finding, coupled with the unlucky story of the two cases mentioned above, suggests the major role played by mismanagement of TB cases and sub-optimal infection control in determining the emergence of the problem.

Finally, it's important to note both the extraordinary agony that lies behind the dry epidemiological account - imagine living for eight years feeling always starved of oxygen, unable ever to take a deep breath - and the phenomenal amounts of patient care and health expenditure these cases required. And not only them. Case 1's daughter, who caught MDR-TB from her mother before inadequate treatment turned it into TDR, was eventually cured - but only after 3 years of persistent drug treatment, and the surgical removal of part of one lung.

The last thing to say is that, even if TDR-TB emerges from poor treatment, there is no reason to think that it will not spread from person to person - just as drug-susceptible TB does, and MDR-TB and XDR-TB have been demonstrated to do. In other words, the suffering, and spending, contained in the stories above could become much more common, if TDR-TB begins to spread.

Cite: Migliori GB et al. First tuberculosis cases in Italy resistant to all tested drugs. Euro Surveill. 2007;12(20):pii=3194.

http://bit.ly/ADPWMc

Test of 400 options shows we can save money while limiting climate change

Scientists identified 14 emissions reduction measures - that primarily reduce ozone and black carbon and the economic benefits of improved air quality and diminished global warming exceed the typical costs of these 14 approaches

By Kyle Niemeyer | Published 2 days ago

If a group of scientists announced that reducing emissions of some pollutants would prevent global warming, it wouldn't make headlines - we've been hearing that for years when the pollutant is carbon dioxide. However, if they added that those reduced emissions would also prevent millions of premature deaths per year and increase annual crop yields by tens to hundreds of millions of tons, you would probably take notice. But the part that will really blow your mind - and what might make some people reconsider their stance - is that all of this could be done at a profit.

A large group of scientists identified 14 emissions reduction measures - out of around 400 considered - that primarily reduce ozone and black carbon (BC; think soot) using existing technology. The study was authored by Drew Shindell, of NASA Goddard and Columbia University, who had 23 coauthors from a total of 13 different institutions around the world (from countries including the US, UK, Italy, Austria, Thailand, and

Kenya). The group concluded that the economic benefits of improved air quality and diminished global warming exceed the typical costs of these 14 approaches.

Carbon dioxide (CO2) has been the focus of most climate change studies and is one of the most significant greenhouse gasses because of its long lifespan in the atmosphere. Ozone and BC don't stay in the air as long, but they cause both warming and decreased air quality, which directly impacts human health and agriculture productivity. Because they remain in the atmosphere for only a few weeks, control measures that target them would quickly produce noticeable improvements in the climate and air quality.

The authors started out by evaluating existing technologies that improve air quality, and ranked them according to how large an impact they had on climate change. They discovered that the top 14 measures were able to produce about 90 percent of the total possible reductions that could be achieved using all measures combined.

Of the 14 emissions reduction measures, half of them target methane (CH4), an ozone precursor. These targeted areas including coal mining, oil and gas production, long-distance gas transmission, municipal waste and landfills, wastewater, livestock manure, and rice paddies. The remaining seven target BC emissions through technological approaches that reduce incomplete combustion, which can occur when there isn't enough oxygen to burn all the fuel, usually due to inefficient technology. These inefficiencies show up in diesel vehicles, biomass stoves, brick kilns, and coke ovens. BC can also be targeted by regulations banning agricultural waste burning, the elimination of high-emitting vehicles, and adoption modern cooking and heating methods.

By pairing these emissions reduction approaches with a complex climate model, the researchers found that the predicted global warming by 2030 would be reduced by approximately 0.5°C, which would limit the increase to about 1.2°C from the 1890-1910 preindustrial mean temperature. The current international limit for global temperature rise is 2°C, which the authors here say requires both significant CO2 and CH4 + BC emissions reductions - neither alone will prevent us from passing that limit.

In addition to the decreased global warming potential, reduction of ozone and BC in the atmosphere - or more specifically the troposphere, the lowest level of the atmosphere - would have other benefits. It should improve global food crop yields (including wheat, rice, maize, and soy) and prevent premature deaths due to air pollution. The authors' calculations showed that approximately 53 million metric tons of crops could be saved (valued at around $8.2 billion) and 0.7-4.7 million deaths could be avoided each year in 2030 and beyond. These measures would also result in improved indoor air quality, which is a bit harder to calculate due to limited data; the authors estimate an additional 373 thousand lives a year in India and China would be saved.

One important note to these results: there would be further crop yield benefits from the limited climate change, but this study didn't consider these indirect results. The agricultural benefits calculated here resulted directly from reduced levels of ozone and BC in the troposphere.

Now for the cost of all this: they estimated that 2030 emissions could be reduced by 110 teragrams (Tg, 1012 grams) of CH4 with costs below $1500 per metric ton of CH4. Accepting a somewhat lower target, 90 Tg, would cost even less: $250 per metric ton. The economic benefit of reducing these emissions, on the other hand, is conservatively about $1100 per metric ton of CH4 and potentially as high as $5000 per metric ton. Most of the reductions, then, produce benefits outweighing the costs.

The BC improvements, mainly in brick kilns and clean-burning stoves, actually lead to net cost savings through efficiency improvements. Regulations on vehicle emissions and agricultural waste burning would require political capital rather than actual money. The total benefits of BC improvements work out to around $5.4 trillion, mainly health-related, so a significant profit is also likely here.

Finally, the authors identified the regions that would benefit the most from these measures. While the avoided warming is fairly well spread out across the globe, central and northern Asia, southern Africa, and the Mediterranean in particular would be helped. The benefits in these areas come in large part from reduced albedo forcing on snow and desert areas thanks to lower BC levels. Albedo refers to the reflection of light from the earth's surface; bright surfaces reflect more light while darker surfaces (such as those covered in BC particles) absorb more sunlight. With the higher albedo, snow and ice would last longer into the year in these areas.

Developing nations in Asia and Africa would avoid the most premature deaths due to cleaner air. If measuring increased crops by total metric tonnage gains, China, India, and the US would benefit the most here, but the Middle East would see the greatest improvement by percentage (due to large potential ozone reductions).

This study, unlike most climate change studies that emphasize reduction of CO2 emissions, demonstrates that a small number of air-quality improvement measures could also have a large impact on global warming. These techniques, all of which could be implemented with current technology, provide practical benefits for

food crops and human health that outweigh the costs in most cases, and simultaneously slow the rate of climate change. If policy makers know that following this plan makes economic sense, it might have a better chance of being enacted - and we might be able to limit climate change.

Science, 2012. DOI: 10.1126/science.1210026 (About DOIs)

http://www.scientificamerican.com/article.cfm?id=high-dose-opiates-could-crack

High-Dose Opiates Could Crack Chronic Pain

Powerful analgesics can restore normal nerve function.

By Arron Frood of Nature magazine

Has a cheap and effective treatment for chronic pain been lying under clinicians' noses for decades? Researchers have found that a very high dose of an opiate drug that uses the same painkilling pathways as morphine can reset the nerve signals associated with continuous pain--at least in rats.

If confirmed in humans, the procedure could reduce or eliminate the months or years that millions of patients spend on pain-managing prescription drugs. The results of the study were described January 12 in Science.

"We have discovered a new effect of opiates when they are given, not constantly at a low dose, but at a very high dose," says Jürgen Sandkühler, a neurophysiologist at the Center for Brain Research of the Medical University of Vienna, and a co-author of the paper.

Chronic pain is a nerve condition that lingers long after the immediate, or acute, pain-causing stimulus has receded. It can follow surgery or injury, and is also associated with conditions such as rheumatoid arthritis and cancer.

Sandkühler says that the original stimulus changes how the central nervous system deals with pain over time. In a model known as long-term potentiation, nerves carrying pain signals fire repeatedly, turning on a cellular pain amplifier that causes anything from exaggerated pain to outright agony on a long-term basis.

Opiates such as morphine and heroin remain the "gold standard" in pain relief, but they work only temporarily for those with chronic pain. Sandkühler and his colleagues decided to push the boundaries of the opiates' action and measure whether the drugs could have any effect on the underlying problem.

The team induced long-term potentiation in 25 rats by exposing nerve fibers known to carry pain signals to low-frequency electrical stimulation. They subjected some of the rats to high-frequency electrical stimulation, or gave them injections of capsaicin, the pain-causing ingredient in chill peppers, as alternative stimuli.

Rapid relief

After the pain stimulus ceased, the researchers gave the rats a very high intravenous dose of the opiate remifentanil. As expected, the pain signals slumped at once--remifentanil is an extremely fast-acting painkiller, and was chosen because its effects tend to wear off in rats after just 10 minutes.

When the drug's effects did wear off, the chronic pain was significantly reduced in the rats treated with low-frequency stimulation. A second infusion of the drug an hour later abolished the long-term potentiation and restored these rats' pain levels to normal. A high dose of remifentanil was also effective in reducing the pain of the rats treated with capsaicin or high-frequency stimulation.

Treating the rats with half the dose of remifentanil did not produce the same effect. Sandkühler suggests that a threshold level of the drug is needed to disrupt the movement of calcium signaling ions between nerves and neutralize the long-term potentiation.

"The dose of drugs we use is very high, probably 2-4 times higher than used for normal pain control," says Sandkühler. "The animals almost stop breathing, which is probably one reason why this was not discovered before."

But he adds that the equivalent amount of the opiate for a human is well below a fatal dose. He and his colleagues have conducted pre-clinical experiments that have shown that people can tolerate it.

Michael Serpell, a consultant anesthetist and pain doctor at the University of Glasgow School of Medicine, UK, is impressed with the paper's methodology. He says the idea has always been that if you hit acute pain hard enough, then you can reduce the chance of it becoming chronic. "It would be appropriate to try this. It could be rolled out into the clinical arena in high-risk patients first," he says.

However, Serpell cautions that a similar approach, applying a pre-emptive analgesic before surgery that was likely to cause chronic pain, produced promising results in animal studies but later trials in humans were "a complete failure".

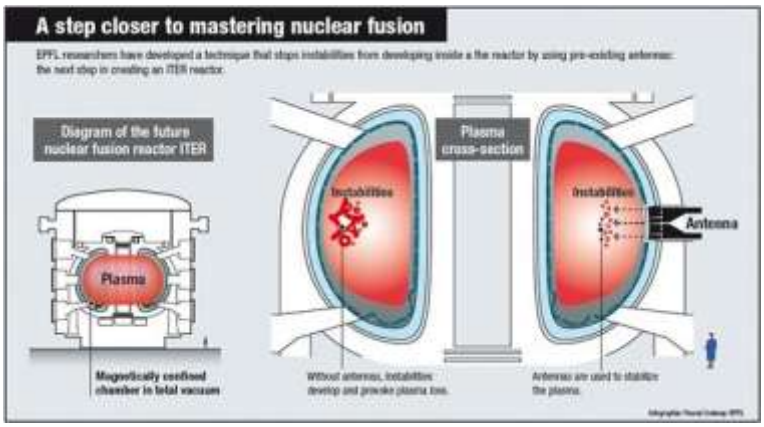
Treatments are certainly needed for chronic pain, which may affect up to one in six adults across the world; Serpell says that 3-5 percent of the adult population in the United Kingdom is prevented from working by pain. The condition is the second most common reason for claiming incapacity benefit.

http://www.physorg.com/news/2012-01-closer-nuclear-fusion.html

One step closer to controlling nuclear fusion

Using a heating system, physicists have succeeded for the first time in preventing the development of instabilities in an efficient alternative way relevant to a future nuclear fusion reactor. It's an important step forward in the effort to build the future ITER reactor.

Scientists have achieved a milestone: they have managed to stop the growth of instabilities inside a nuclear fusion reactor. How? Here's a look at this energy source, which despite being challenging to control, is nevertheless extremely promising.



One step closer to controlling nuclear fusion

Nuclear fusion is an attempt to reproduce the energy of the Sun in an Earth-based reactor system. When gas is heated to several million degrees, it becomes plasma. Sometimes in the plasma, an instability will appear and grow large enough to perturb the plasma, making it vibrate despite the presence of the magnetic field in which it is contained. If the plasma touches the walls of the reactor, it will cool rapidly and create large electromagnetic forces within the structure of the machine.

The challenge is to reduce the instabilities deep within in the interior of the plasma so that they don't amplify, while at the same time allowing the reactor to continue to function normally. Thus it is necessary to work within the specific configuration of these fusion reactors, where the plasma is strongly confined by a magnetic field. By adjusting an antenna that emits electromagnetic radiation, physicists from EPFL's Center for Research in Plasma Physics were able to quench the instabilities when they appear, in the precise region where they are forming, and without perturbing the rest of the installation.

From theory to practice

The physicists first conducted simulations to verify the extent to which specific radiation frequencies and locations of application would suppress the growth of instabilities. Then they carried out tests to confirm their calculations. The beauty of their approach is that they were able to use antennas that are used as part of the system to heat the plasma, and that are already present in the Joint European Torus (JET), the largest reactor currently in use. Surprisingly, the simulations and the tests showed that heating and instability suppression can be combined, by aiming the radiation slightly off-center in the plasma.

The next step will be to add a detector system that will make it possible to neutralize instabilities in real time over longer time periods. These improvements can then be implemented in the ITER fusion reactor, currently in development in Southern France.

*Control of magnetohydrodynamic stability by phase space engineering of energetic ions in tokamak plasmas, J.P. Graves, et al, Nature Commun. *3*, 624 (2012). DOI: 10.1038/ncomms1622 Provided by Ecole Polytechnique Federale de Lausanne*

http://www.scientificamerican.com/article.cfm?id=gas-hydrate-tests-to-begin

Test Will 'Mine' Hydrates for Natural Gas in Alaska

US team will pump waste carbon dioxide into natural-gas well to extract methane.

By Nicola Jones of Nature magazine

This month, scientists will test a new way to extract methane from beneath the frozen soil of Alaska: they will use waste carbon dioxide from conventional wells to force out the desired natural gas.

The pilot experiment will explore the possibility of `mining' from gas hydrates: cages of water ice that hold molecules of methane. Such hydrates exist under the sea floor and in sandstone deep beneath the Arctic tundra, holding potentially vast reserves of natural gas. But getting the gas out is tricky and expensive.

The test is to be run by the US Department of Energy (DOE), in conjunction with ConocoPhillips, an oil company based in Houston, Texas, and the Japan Oil, Gas and Metals National Corporation. The researchers will pump CO2 down a well in Prudhoe Bay, Alaska, into a hydrate deposit. If all goes as planned, the CO2molecules will exchange with the methane in the hydrates, leaving the water crystals intact and freeing the methane to flow up the well.

Conventional wells in the Prudhoe Bay gas fields contain a very high concentration of carbon dioxide--about 12 percent of the gas. "You have to find something to do with it," says Ray Boswell, technology manager for methane hydrates at the DOE's National Energy Technology Laboratory in Morgantown, West Virginia. One way to dispose of it is to bury the gas underground. Excess carbon dioxide is already pumped down some

conventional wells to encourage extraction of the last bits of natural gas; using it to extract methane from hydrates might be a good idea too.

Fuel test

The test will use the Ignik Sikumi well, which was drilled on an ice platform in Prudhoe Bay last winter. Specialized equipment has been installed, including fibre-optic cables to measure the temperature down the well, and injection pipes for the CO2. "None of this is standard equipment; it had to be built to design," says Boswell.

ConocoPhillips helped the team to get access to the site. "That's one of the biggest hurdles--getting industry to let you do an experiment in their field," says Boswell, who has been working to arrange such tests in Alaska since 2001. "There's a lot of inertia to overcome. Prudhoe is where they make their money," he adds.

During the test, the researchers will inject nitrogen gas into the hydrate deposit to try to push away any free water in the system, which would otherwise freeze into hydrates on exposure to CO2 and block up the well. The next phase is to pump in isotopically labeled CO2, and let it `soak' for a week before seeing what comes back up. This will help to test whether the injected carbon is really swapping places with the carbon in the hydrates. Finally, the team will depressurize the well and attempt to suck up all the methane and carbon dioxide. This will also give them a chance to test extraction using depressurization--sucking liquids out of the hydrate deposits to reduce pressure in the well and coax the methane out of the water crystals. "We'll continue to depressurize until we run out of time or money, and see how much methane we can get out that way," says Boswell.

Field of dreams

This is not the first attempt to extract methane from hydrates. In 2002, experiments at the Mallik Field site in northern Canada pumped hot water underground to "melt" hydrates and release the methane. In 2008, further tests at the same site tried depressurization. That scheme seems most likely to be commercially viable, says Boswell. "The tests were very short and the modeling has so many moving parts, no one knows exactly what the production rate will be," he says. "But the test well produced more than the models said it would."

The CO2-methane exchange method to be tested at Prudhoe Bay removes the need to either add water or dispose of extracted fluids, and doesn't risk destabilizing the ground by melting the hydrate. It also has the added bonus of getting rid of unwanted gas, which would offset the price of commercial operations. "It doesn't have to produce methane at a great rate, because you're also disposing of CO2," says Boswell.

"The concept is very alluring," says Scott Dallimore, a hydrate expert with the Geological Survey of Canada in Sidney, British Columbia. "Gas fields in this area have a relatively high CO2 concentration. If this CO2 can be re-injected while at the same time producing methane, it will be a terrific option."

Commercialization is still a long way off. The U.S. has no urgent need to mine methane hydrates, says Boswell, because it will continue to have access to much cheaper natural-gas resources for some time to come. Japan is much closer to commercialization: the country plans to open a short-term production well in the offshore Nankai Trough in 2013, with the aim of running a longer production test in 2015. The country is "quite eager" to explore the potential of hydrates, says Boswell, because it has few other fossil-fuel resources.

"There's a perception out there that this is a wild fantasy. That's not true. I am convinced that the research community has already demonstrated the technical viability of gas-hydrate production," says Dallimore. "When it comes to the question of commercial viability, things become more complex."

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MS damage washed away by stream of young blood

A FOUNTAIN of youthful cells reverses the damage found in diseases like multiple sclerosis, a study in mice reveals.

Nerve cells lose their electrically insulating myelin sheath as MS develops. New myelin-generating cells can be produced from stem cells, but the process loses efficiency with age.

Julia Ruckh at the University of Cambridge, and colleagues, have found a way to reverse the age-related efficiency loss. They linked the bloodstreams of young mice to old mice with myelin damage. Exposure to youthful blood reactivated stem cells in the old mice, boosting myelin generation.

White blood cells called macrophages from the young mice gathered at the sites of myelin damage. Macrophages engulf and destroy pathogens and debris, including destroyed myelin (Cell Stem Cell, DOI: 10.1016/j.stem.2011.11.019) "We know this debris inhibits regeneration, so clearing it up is important," says team member Amy Wagers of Harvard University.

Neil Scolding at the University of Bristol, UK, who was not involved in the new work, says reactivating ageing stem cells may be a more realistic approach for treating MS than transplanting stem cells from a donor.