http://phys.org/news/2012-05-climate-scientists-riddle-sea.html

Climate scientists say they have solved riddle of rising sea

Massive extraction of groundwater can resolve a puzzle over a rise in sea levels in past decades, scientists in Japan said on Sunday. Global sea levels rose by an average of 1.8 millimetres (0.07 inches) per year from 1961-2003, according to data from tide gauges.

Massive extraction of groundwater can resolve a puzzle over a rise in sea levels in past decades, scientists in Japan said on Sunday.

Global sea levels rose by an average of 1.8 millimetres (0.07 inches) per year from 1961-2003, according to data from tide gauges. But the big question is how much of this can be pinned to global warming.

In its landmark 2007 report, the UN's Nobel-winning Intergovernmental Panel on Climate Change (IPCC) ascribed 1.1mm (0.04 inches) per year to thermal expansion of the oceans - water expands when it is heated - and to meltwater from glaciers, icecaps and the Greenland and Antarctica icecaps.

That left 0.7mm (0.03 inches) per year unaccounted for, a mystery that left many scientists wondering if the data were correct or if there were some source that had eluded everyone.

In a study published in the journal Nature Geoscience, a team led by Yadu Pokhrel of the University of Tokyo say the answer lies in water that is extracted from underground aquifers, rivers and lakes for human development but is never replenished.

The water eventually makes it to the ocean through rivers and evaporation in the soil, they note.

Groundwater extraction is the main component of additions that account for the mystery gap, according to their paper, which is based on computer modelling.

"Together, unsustainable groundwater use, artificial reservoir water impoundment, climate-driven change in terrestrial water storage and the loss of water from closed basins have contributed a sea-level rise of 0.77mm (0.031 inches) per year between 1961 and 2003, about 42 percent of the observed sea-level rise," it says.

The probe seeks to fill one of the knowledge gaps in the complex science of climate change.

Researchers admit to many unknowns about how the oceans respond to warming, and one of them is sea-level rise, an important question for hundreds of millions of coastal dwellers. Just a tiny rise, if repeated year on year, can eventually have a dramatic impact in locations that are vulnerable to storm surges or the influx of saltwater into aquifers or coastal fields.In its 2007 Fourth Assessment Report, the IPCC said the oceans would rise by between 18 and 59 centimetres (seven to 23 inches) by the century's end.

But this estimate did not factor in meltwater from the mighty Greenland and Antarctic ice sheets.

A study published last year by the Oslo-based Arctic Monitoring and Assessment Project (AMAP) said sea levels would rise, on current melting trends, by 90 cms to 1.6 metres (3.0 to 5.3 feet) by 2100.

More information: DOI: 10.1038/ngeo1476

http://www.eurekalert.org/pub_releases/2012-05/qsu-tov052112.php

Type of viral infection of eye associated with disease causing blindness in the elderly

A team of researchers, including a scientist from the Viral Immunology Center at Georgia State University, have found that a type of herpesvirus infection of the eye is associated with neovascular age-related macular degeneration (AMD), a disease that causes blindness in the elderly.

ATLANTA – The scientists found that human cytomegalovirus, a type of herpesvirus, causes the production of vascular endothelial growth factor, or VEGF, a signal protein that regulates the formation of new blood vessels. With the formation of new blood vessels, retinal tissue destruction occurs, leading to the development of "wet" AMD and eventually, vision loss and blindness. The results were published in PLoS Pathogens, a journal of the Public Library of Science.

"Prior to this work, cofactors for the development of AMD included genetics, a high fat diet and smoking. Now, we are adding an infections agent as another cofactor," said Richard D. Dix, professor at the Georgia State Viral Immunology Center's Ocular Virology and Immunology Laboratory. The research team includes Dix, Scott W. Cousins, Diego G. Espinosa-Heidmann, Daniel M. Miller, Simone Pereira-Simon, Eleut P. Hernandez, Hsin Chien and Courtney Meier-Jewett.

Affiliated research institutions include the Duke University Eye Center, the Bascom Palmer Eye Institute of the University of Miami Miller School of Medicine, the Viral Immunology Center at Georgia State, and the Department of Ophthalmology at the Emory University School of Medicine.

Human cytomegalovirus is a common herpesvirus, said Dix, who is also an adjunct professor of ophthalmology at the Emory University School of Medicine. About 80 percent of the population is estimated to have antibodies for the virus, and it is often acquired during childhood.

If a person has a normal, healthy immune system, the virus becomes latent in the cells of bone marrow and blood, he said. But in the elderly, the immune system's function is reduced, the virus proliferates, and the production of VEGF increases.

Identifying human cytomegalovirus as a cofactor in the development of AMD opens up new paths for the treatment of AMD, Dix said. One route could include reducing the viral load – the amount of the human cytomegalovirus in the blood stream – by treatment with an antiviral drug known as ganciclovir.

Additional research paths include looking at the genetics involved in the upregulation of VEGF by human cytomegalovirus. "If we can knock down a certain gene or genes of the virus that stimulates VEGF production, we might be able to decrease it production and minimize AMD," Dix said.

The research was supported by the National Institutes of Health grants EY/AI 012218 (SWC), EY 010568 (RDD), core grant NIH P30 EY 06360, as well as Fight for Sight.

The article is Cousins SW, Espinosa-Heidmann DG, Miller DM, Pereira-Simon S, Hernandez EP, Chien H, Meier-Jewett, and Dix RD (2012) Macrophage Activation Associated with Chronic Murine Cytomegalovirus Infection Results in More Severe Experimental Choroidal Neovascularization. PLoS Pathog 8(4): e1002671. doi:10.1371/journal.ppat.1002671.

http://www.eurekalert.org/pub_releases/2012-05/uov-sif051712.php

Squid ink from Jurassic period identical to modern squid ink, U.Va. study shows

Researchers found that ink sacs from 160-million-year-old giant cephalopod fossils contain the pigment melanin that is essentially identical to that found in the ink sac of a modern-day cuttlefish.

An international team of researchers, including a University of Virginia professor, has found that two ink sacs from 160-million-year-old giant cephalopod fossils discovered two years ago in England contain the pigment melanin, and that it is essentially identical to the melanin found in the ink sac of a modern-day cuttlefish. The study is published online in the May 21 edition of the journal Proceedings of the National Academy of Sciences.

The finding - in an extremely rare case of being able to study organic material that is hundreds of millions of years old - suggests that the ink-screen escape mechanism of cephalopods - cuttlefish, squid and octopuses - has not evolved since the Jurassic period, and that melanin could be preserved intact in the fossils of a range of organisms. "Though the other organic components of the cephalopod we studied are long gone, we've discovered through a variety of research methods that the melanin has remained in a condition that could be studied in exquisite detail," said John Simon, one of the study authors, a chemistry professor and the executive vice president and provost at U.Va. One of the ink sacs studied is the only intact ink sac ever discovered.

Phillip Wilby of the British Geological Survey found it in Christian Malford, Wiltshire, England, west of London near Bristol. He sent samples to Simon and Japanese chemist Shoskue Ito, both experts on melanin, who then engaged research colleagues in the United States, the United Kingdom, Japan and India to investigate the samples using a combination of direct, high-resolution chemical techniques to determine whether or not the melanin had been preserved. It had.

The investigators then compared the chemical composition of the fossil melanin to the melanin in the ink of the modern cuttlefish, Sepia officinalis, common to the Mediterranean, North and Baltic seas. They found a match.

"It's close enough that I would argue that the pigmentation in this class of animals has not evolved in 160 million years," Simon said. "The whole machinery apparently has been locked in time and passed down through succeeding generations of cuttlefish. It's a very optimized system for this animal and has been optimized for a long time."

Generally animal tissue, made up mostly of protein, degrades quickly. Over the course of millions of years all that is likely to be found from an animal is skeletal remains or an impression of the shape of the animal in surrounding rock. Scientists can learn much about an animal by its bones and impressions, but without organic matter they are left with many unanswered questions. But melanin is an exception. Though organic, it is highly resilient to degradation over the course of vast amounts of time.

"Out of all of the organic pigments in living systems, melanin has the highest odds of being found in the fossil record," Simon said. "That attribute also makes it a challenge to study. We had to use innovative methods from chemistry, biology and physics to isolate the melanin from the inorganic material."

The researchers cross-checked their work using separate complementary experiments designed to capitalize on various molecular features unique to melanin and determined the morphology and chemical composition of the material. This combination of in-depth, multidisciplinary techniques is not normally used by paleontologists to study fossil samples.

"I think the strength of this paper is that it is not tied to a single method," Simon said. "Any one technique would have brought some insights, but potentially more questions than insights. It was really the more holistic

approach that fully characterized it and allowed us to actually do a real comparison between what existed during the Jurassic period and what exists now. "It's also given us a handle on ways of identifying organic components in fossils that might have been missed using standard methods."

http://www.eurekalert.org/pub_releases/2012-05/du-mdb051812.php

Modern dog breeds genetically disconnected from ancient ancestors

Cross-breeding of dogs over thousands of years has made it extremely difficult to trace the ancient genetic roots of today's pets, according to a new study led by Durham University.

An international team of scientists analysed data of the genetic make-up of modern-day dogs, alongside an assessment of the global archaeological record of dog remains, and found that modern breeds genetically have little in common with their ancient ancestors.

Dogs were the first domesticated animals and the researchers say their findings will ultimately lead to greater understanding of dogs' origins and the development of early human civilisation. Although many modern breeds look like those depicted in ancient texts or in Egyptian pyramids, cross-breeding across thousands of years has meant that it is not accurate to label any modern breeds as "ancient", the researchers said.

Breeds such as the Akita, Afghan Hound and Chinese Shar-Pei, which have been classed as "ancient", are no closer to the first domestic dogs than other breeds due to the effects of lots of cross-breeding, the study found.

Other effects on the genetic diversity of domestic dogs include patterns of human movement and the impact on dog population sizes caused by major events, such as the two World Wars, the researchers added.

The findings are published today (Monday May 21) in the scientific journal Proceedings of the National Academy of Sciences USA (PNAS). The Durham-led research team was made up of scientists from a number of universities including Uppsala University, Sweden, and the Broad Institute, in the USA.

In total the researchers analysed genetic data from 1,375 dogs representing 35 breeds. They also looked at data showing genetic samples of wolves, with recent genetic studies suggesting that dogs are exclusively descended from the grey wolf.

Lead author Dr Greger Larson, an evolutionary biologist in Durham University's Department of Archaeology, said the study demonstrated that there is still a lot we do not know about the early history of dog domestication including where, when, and how many times it took place. Dr Larson added: "We really love our dogs and they have accompanied us across every continent. "Ironically, the ubiquity of dogs combined with their deep history has obscured their origins and made it difficult for us to know how dogs became man's best friend.

"All dogs have undergone significant amounts of cross-breeding to the point that we have not yet been able to trace all the way back to their very first ancestors."

Several breeds, including Basenjis, Salukis and Dingoes, possess a differing genetic signature, which previous studies have claimed to be evidence for their ancient heritage, the research found.

However the study said that the unique genetic signatures in these dogs was not present because of a direct heritage with ancient dogs. Instead these animals appeared genetically different because they were geographically isolated and were not part of the 19th Century Victorian-initiated Kennel Clubs that blended lineages to create most of the breeds we keep as pets today.

The study also suggested that within the 15,000 year history of dog domestication, keeping dogs as pets only began 2,000 years ago and that until very recently, the vast majority of dogs were used to do specific jobs.

Dr Larson said: "Both the appearance and behaviour of modern breeds would be deeply strange to our ancestors who lived just a few hundred years ago. "And so far, anyway, studying modern breeds hasn't yet allowed us to understand how, where and when dogs and humans first started this wonderful relationship."

The researchers added that DNA sequencing technology is faster and cheaper than ever and could soon lead to further insights into the domestication and subsequent evolution of dogs.

http://phys.org/news/2012-05-supercharged-safflower.html

Supercharged safflower

CSIRO researchers have produced Super-High Oleic (SHO) safflower, it's oil contains over 90% oleic acid, the highest level of purity of an individual fatty acid present in any currently available plant oil.

This scientific achievement has produced safflower seed oil that contains more than 90 per cent of this valuable fatty acid, the highest level of purity of an individual fatty acid currently available in any plant oil. The new safflower type will provide Australian grain growers with a unique opportunity to produce and supply renewable, sustainable plant oils that will replace petroleum-based feedstocks in the manufacture of industrial products.

The future global demand for high purity oleic acid oil could require over 100,000 hectares of this 'super-high' oleic safflower, which is comparable to the size of the cotton industry in Australia.
Dr Allan Green, Deputy Chief of CSIRO Plant Industry, said this breakthrough safflower oil combines high-purity for industrial chemical production with tremendous stability for direct use in industrial lubricants and fluids, creating a versatile, valuable industrial raw material. "Plant oils contain a range of fatty acids including both monounsaturates and polyunsaturates," Dr Green said.
"For food use it's important to have a healthy balance of these. However, the polyunsaturates cause problems for industrial use because they are unstable and difficult to remove during oil processing," he said.
Dr Green said the team used CSIRO gene silencing technology to boost the level of desirable oleic acid in the seed by switching off its conversion to the undesirable polyunsaturates. "We have succeeded in dramatically lowering the polyunsaturates to below three per cent, thereby raising the monounsaturate oleic acid to over 90 per cent purity," Dr Green said. This new 'super-high' oleic safflower was developed by the Crop Biofactories Initiative, a strategic research and product development partnership between CSIRO and the Grains Research and Development Corporation (GRDC).
Dr Jody Higgins, Senior Manager Commercial Grain Technologies at the GRDC, said the breakthrough development could create a new crop industry in Australia, initially suitable for farmers in northern NSW and southern Queensland. "Safflower is an old crop known from ancient times, but it is very minor crop in Australia today because of the low local demand for its current oil quality type," Dr Higgins said. "Interestingly, safflower was originally grown in Australia as an industrial crop where the oil was used to make paints and resins," she said. Safflower is ideal for Australian biofactories as it is a very hardy and adaptable crop that does well in warm-season conditions and should cope well with the expected stresses of climate change.
"Our market intelligence has shown that global demand for high purity oleic acid oil could require over 100,000 hectares of 'super-high' oleic safflower, which is comparable to the size of the cotton industry in Australia," Dr Higgins said. "The Crop Biofactories Initiative will engage in further discussions with a number of local and international companies to develop production of this high value safflower crop in Australia," she said.
'Super-high' oleic safflower will also provide a core technology platform for the future development of a range of oils with high contents of industrially-important derivatives of oleic acid. *Provided by CSIRO*

http://www.sciencedaily.com/releases/2012/05/120521104026.htm

Stressed Men Are More Social

Freiburg researchers have refuted the common belief that stress always causes aggressive behavior.

ScienceDaily - A team of researchers led by the psychologists and neuroscientists Prof. Markus Heinrichs and Dr. Bernadette von Dawans at the University of Freiburg, Germany, examined in a study how men react in stressful situations - and have refuted a nearly 100-year-old doctrine with their results. According to this doctrine, humans and most animal species show the "fight-or-flight" response to stress. Only since the late 1990s have some scientists begun to argue that women show an alternate "tend-and-befriend" response to stress - in other words, a protective ("tend") and friendship-offering ("befriend") reaction. Men, in contrast, were still assumed to become aggressive under stress. Von Dawans refuted this assumption, saying: "Apparently men also show social approach behavior as a direct consequence of stress."
With this study, the research team experimentally investigated male social behavior under stress for the first time. The results are published in the journal Psychological Science. The economists Prof. Ernst Fehr of the University of Zurich, Switzerland, and Prof. Urs Fischbacher of the University of Konstanz, Germany, as well as the psychologist Prof. Clemens Kirschbaum from the Technical University of Dresden, Germany, also participated in the study. Last year, Heinrichs and von Dawans already developed a standardized procedure for inducing stress in groups using a public speaking task. The researchers examined the implications of this stressor for social behavior using specially designed social interaction games.. These games allowed them to measure positive social behavior - for example, trust or sharing - and negative social behavior - for example, punishment.
In the study, subjects who were under stress showed significantly more positive social behavior than control subjects who were not in a stressful situation. Negative social behavior, on the other hand, was not affected by stress. For Markus Heinrichs, this has far-reaching consequences for our understanding of the social significance of stress: "From previous studies in our laboratory, we already knew that positive social contact with a trusted individual before a stressful situation reduces the stress response. Apparently, this coping strategy is anchored so strongly that people can also change their stress responses during or immediately after the stress through positive social behavior."

http://www.sciencedaily.com/releases/2012/05/120521115351.htm

Tea Could Aid Olympic Cheating

Researchers from Kingston University in London have found that green and white teas could hide abnormal levels of testosterone in athletes.

ScienceDaily - Researchers from Kingston University in London have found that green and white teas could hide abnormal levels of testosterone in athletes.

Research carried out at London's Kingston University has revealed that athletes could mask illegal doping with testosterone by drinking green and white tea. A team headed by Professor Declan Naughton, from the University's School of Life Sciences, found drinking the beverages had the potential to reduce the amount of the performance-enhancing hormone present in urine testing.

Professor Naughton said the findings could have significant implications for major sporting events such as the 2012 Olympics. "We've spent the past four years researching this and, as far as we're aware, it's the first study that has found food and diet can alter the metabolism of testosterone," Professor Naughton said. "We looked at how a particular enzyme reacts to various foodstuffs to see if it affects the amount of time certain substances such as cancer drugs stay in the body." The enzyme in question excretes testosterone through urine and the potential to mask doping occurs when compounds called catechins - present in green and white tea but not in black - inhibit this. This means athletes attempting to enhance their performance illegally with testosterone could potentially mask a boost in the hormone by drinking a certain amount of the tea.

"The catechins stop enzymes tagging molecules for excretion so the kidneys don't recognise them as needing to be removed and leave them circulating in the body," Professor Naughton explained. "We found that green and white tea could inhibit the enzyme by about 30 per cent. The levels of catechins in a strong cup of green tea matched those we used in our experiments."

While the team's findings were lab-based, if the same effect occurs in human bodies the World Anti-Doping Agency (WADA) may rethink its approach to drug testing. "WADA is aiming to add regular checks of blood steroids to its biological passports which monitor athletes for suspicious changes in their physiology," Olivier Rabin, WADA's science director, said. "That should foil any attempt to fool the urine test."

However Professor Naughton feels blood testing is probably not enough. "Our Kingston University research shows testing hair is a key way to pinpoint doping. Substances stay in the hair for longer and, more importantly, are not dependant on the enzyme affected by the teas," he said.

For athletes who don't resort to doping, the increased levels of testosterone from drinking green and white teas may provide a legal boost. "It's like having extra testosterone without actually taking any," Professor Naughton said. "By not excreting it from the body, athletes could potentially increase their testosterone levels for improved performance. Unless, of course, the body compensates for this and finds other ways of removing it, but we won't find out about that until the tests go to human studies. This research is just one part of the story."

Carl Jenkinson, Andrea Petroczi, James Barker, Declan P. Naughton. Dietary green and white teas suppress UDP-glucuronosyltransferase UGT2B17 mediated testosterone glucuronidation. Steroids, 2012; 77 (6): 691 DOI: 10.1016/j.steroids.2012.02.023

http://phys.org/news/2012-05-aim-tree-life-million-species.html

Researchers aim to assemble the tree of life for all 2 million named species

A new initiative aims to build a grand tree of life that brings together everything scientists know about how all living things are related, from the tiniest bacteria to the tallest tree.

Scientists have been building evolutionary trees for more than 150 years, ever since Charles Darwin drew the first sketches in his notebook. But despite significant progress in fleshing out the major branches of the tree of life, today there is still no central place where researchers can go to browse and download the entire tree.

"Where can you go to see their collective results in one resource? The surprising thing is you can't - at least not yet," said Dr. Karen Cranston of the National Evolutionary Synthesis Center.

But now, thanks to a three-year, $5.76 million grant from the U.S. National Science Foundation, a team of scientists and developers from ten universities aims to make that a reality.

Figuring out how the millions of species on Earth are related to one another isn't just important for pinpointing an aardvark's closest cousins, or determining if hagfish are more closely related to sand dollars or sea squirts. Information about evolutionary relationships has helped scientists identify promising new medicines, develop hardier, higher-yielding crops, and fight infectious diseases such as HIV, anthrax and influenza.

If evolutionary trees are so widely used, why has assembling them across all of life been so hard to achieve? It's not for lack of research, or data. Thanks in large part to advances in DNA sequencing, thousands of new

phylogenetic trees are published in scientific journals each year - most of them focused on isolated branches of the tree of life, for everything from birds to botflies.
"There's a firehose of data," said Cranston, principal investigator of the project. "[Over the years] scientists have published tens of thousands of evolutionary trees, but there's been very little work to connect the dots and put them all together into a single resource."
Part of the difficulty lies in the sheer enormity of the task. The largest evolutionary trees built to-date contain roughly 100,000 taxa. Assembling the branches for all two million named species of animals, plants, fungi and microbes - not to mention the countless more still being named or discovered - will require new tools for analyzing large data sets and stitching together vast numbers of published trees.
Another difficulty lies in how scientists typically disseminate their results. A tiny fraction of all evolutionary trees that have been published - researchers estimate a mere 4% - end up in a database in a digital form. Instead, most of that knowledge is locked up in figures in journal articles, as PDFs or other file formats that are impossible for other researchers to download, reanalyze, or merge with new information.
This new initiative - dubbed Open Tree of Life (http://opentreeoflife.org) - aims to change all that.
What makes this project different from previous efforts, the researchers say, is its scope. "This is the first real attempt to put together the entire tree of life," Cranston said.
The team hopes to have a first draft of the complete evolutionary tree - compiled from the evolutionary trees that are already available in existing databases - by August 2013. The first draft that emerges will be far from finished. "There will always be new studies that come out," Cranston said. "There will also be places in the tree where we don't have enough data, or where the data lead to conflicting hypotheses, or where groups of researchers simply disagree."
But with a first draft in hand, scientists will be able to go online and compare their trees to others that have already been published, or download it for further study. They'll also be able to expand the tree, filling in the missing branches and placing newly named or discovered species among their relatives. Eventually, the team's goal is to be able to detect when new trees are published and incorporate them automatically, so that the complete tree can be continuously updated.
If the project is to succeed, one of the biggest challenges will be encouraging more scientists to publish their results in digital form. Growing numbers of scientific journals now require authors to deposit phylogenetic data in a digital database, but many published trees never make it. "We hope to provide infrastructure and tools that will make it easier to do that, such as a more user-friendly interface for submitting data," Cranston said.
"In the long run, we hope this will become the central resource for synthesized phylogenetic data," she added.
Provided by National Evolutionary Synthesis Center (NESCent)

http://www.eurekalert.org/pub_releases/2012-05/ohri-fsd051812.php

Flu shot during pregnancy shows unexpected benefits in large study

Getting a flu shot during pregnancy provides unanticipated benefits to the baby, according to the authors of a large population-based study examining the issue.

Ottawa – Specifically, the study showed that H1N1 vaccination during the pandemic was associated with a significantly reduced risk of stillbirth, preterm birth and extremely small babies at birth.
Researchers at the Ottawa Hospital Research Institute (OHRI), the CHEO Research Institute and the University of Ottawa (uOttawa) used data from Ontario's birth record database, BORN, to examine 55,570 single-child births that took place in Ontario during the H1N1 pandemic. The resulting paper, "H1N1 Influenza Vaccination during Pregnancy and Fetal and Neonatal Outcomes," was recently published by the American Journal of Public Health.
The study shows that, compared to pregnant women who were not immunized against H1N1, mothers who received the H1N1 vaccination were:

34% less likely to have a stillbirth,
28% less likely to deliver before 32 weeks, and
19% less likely to give birth to a child with a birth weight for gestational age in the bottom third percentile.

"These are all significant results, but especially interesting is the finding that the vaccinated mothers were one-third less likely to have a stillborn child," says lead author Deshayne Fell, an epidemiologist for BORN Ontario. "This is one of the only studies large enough to evaluate the association between maternal flu vaccination and stillbirth - a very rare event."
"What surprised me and the research team was the strength of the protective benefits we found," says co-author Dr. Ann Sprague, the Scientific Manager of BORN Ontario at the Children's Hospital of Eastern Ontario (CHEO) Research Institute.

The study also found no increase in adverse outcomes for H1N1-vaccinated mothers and their babies during the weeks before and just after birth, also referred to as the perinatal period.
"The findings of this study are very helpful," says co-author Dr. Mark Walker, a Senior Scientist at OHRI, a High-Risk Obstetrician at The Ottawa Hospital, and a Professor and Tier One Research Chair in Perinatal Research at the University of Ottawa.
"Pregnant women are generally very, very careful about what they put into their bodies. For health-care providers like me, such a large-scale study that shows no adverse perinatal outcomes resulting from the H1N1 flu vaccine will be extremely helpful when discussing maternal vaccination."
Of all the single-child births recorded from November 2009 to April 2010, 42% of the women received the H1N1 vaccination, which makes the findings robust. BORN - the Better Outcomes Registry & Network - collects data from all births in Ontario. In order to conduct the research for this study, questions about H1N1 vaccination were added to the database in advance of the H1N1 vaccine becoming available. BORN includes demographic data that allowed the research team to correct for smoking, education and income; however, as with any population-based study, it may not be possible to account for all influencing factors.
This study was funded by the Canadian Institutes of Health Research (CIHR). The Public Health Agency of Canada provided support to add the H1N1 questions to the BORN database. BORN is funded by Ontario's Ministry of Health and Long-Term Care, with its main offices based at the CHEO Research Institute.
Thanks to additional CIHR funding, the researchers are now following this cohort of children through their first year of life to assess possible longer term benefits of the vaccine.
The authors of "H1N1 Influenza Vaccination during Pregnancy and Fetal and Neonatal Outcomes" are: Deshayne B. Fell, Ann E. Sprague, Ning Liu, Abdool S. Yasseen, Shi-Wu Wen, Graeme Smith and Mark C. Walker.

http://phys.org/news/2012-05-garlic-constituent-blocks-biofilm-formation.html

Garlic constituent blocks biofilm formation, could benefit CF patients and others

E Pluribus Unum, the motto of the United States, could just as well apply to biofilm-forming bacteria.

Bacterial biofilms are far more resistant than individual bacteria to the armories of antibiotics we have devised to combat them. Now Tim Holm Jakobsen and Michael Givskov of the University of Copenhagen, and their many collaborators have pinpointed a constituent of garlic that attacks a key step in the development of biofilms, in an effort they hope may offer help in particular for patients with cystic fibrosis. The research is published in the May 2012 issue of Antimicrobial Agents and Chemotherapy.
In earlier work, Givskov and his colleagues showed that "crude extracts of garlic inhibit the expression of a large number of genes that are controlled by bacterial quorum sensing [communication among bacterial cells involved in biofilm development], and that extracts promote a rapid clearing of pulmonary Pseudomonas aeruginosa infection in mice," he says. "These findings encouraged us to identify and assess the efficacy of the pure active compound."
That compound turned out to be ajoene, the major constituent of a multitude of sulfur-containing compounds produced when garlic is crushed, says Jakobsen. The team then showed in P. aeruginosa that ajoene inhibits expression of 11 genes that are controlled by quorum sensing. "These key genes are regarded as crucial for the ability of P. aeruginosa to cause disease," he says.
"We also found ajoene to reduce the production of rhamnolipid, a compound that shields the biofilm bacteria from the white blood cells that otherwise would destroy bacteria, and that by combining ajoene with the antibiotic tobramycin, it was possible to kill over 90 percent of bacteria living in a biofilm," says Jakobsen.
"Our study is part of a series of comprehensive investigations of natural compounds targeting bacterial quorum sensing systems, and it further strengthens previous proof of concept research we conducted on the potential of compounds which block communication among pathogen cells in contrast to simply killing bacteria, as conventional antibiotics do," says Jakobsen. Such alternative approaches "may postpone or minimize development of antibiotic resistance," he adds.
Jakobsen says the garlic project grew out of a major donation from the German Cystic Fibrosis Association. "In CF patients, P. aeruginosa infection leads to bronchieciasis, pulmonary fibrosis, respiratory failure, and death," he says. "Despite intensive antibiotic treatment, CF patients have a life expectancy of about 40 years, and the main cause of death in CF patients remains complications associated with [this infection]." Jakobsen's team and the German CF Association have patented the action of ajoene against biofilms, and are seeking a pharmaceutical partner to develop antimicrobial drugs based on ajoene.
Jakobsen notes that garlic has been used medicinally "for thousands of years." Garlic not only has antibacterial properties; it has anti-viral, anti-fungal, and anti-protozoal properties as well, and it has beneficial effects on the cardiovascular and immune systems, as well, he says.

More information: T.H. Jakobsen, M. van Gennip, M. Givskov, et al. Ajoene, a sulfur-rich molecule from garlic, inhibits genes controlled by quorum sensing. Antim. Agents Chemother. 56:2314-2325. Provided by American Society for Microbiology

http://www.bbc.co.uk/news/science-environment-18158131

Rewritable DNA memory shown off

Researchers in the US have demonstrated a means to use short sections of DNA as rewritable data "bits" in living cells.

The technique uses two proteins adapted from viruses to "flip" the DNA bits. Though it is at an early stage, the advance could help pave the way for computing and memory storage within biological systems.

A team reporting in Proceedings of the National Academy of Sciences say the tiny information storehouses may also be used to study cancer and aging. The team, from Stanford University's bioengineering department, has been trying for three years to fine-tune the biological recipe they use to change the bits' value.

The bits comprise short sections of DNA that can, under the influence of two different proteins, be made to point in one of two directions within the chromosomes of the bacterium E. coli. The data are then "read out" as the sections were designed to glow green or red when under illumination, depending on their orientation.

The two proteins, integrase and excisionase, were taken from a bacteriophage - a virus that infects bacteria. They are involved in the DNA modification process by which the DNA from a virus is incorporated into that of its host.

The trick was striking a balance between the two counteracting proteins in order to reliably switch the direction of the DNA section that acted as a bit. After some 750 trials, the team struck on the right recipe of proteins, and now have their sights set on creating a full "byte" - eight bits - of DNA information that can be similarly manipulated.

The work is at the frontier of biological engineering, and senior author of the research Drew Endy said that applications of the approach are yet to come. "I'm not even really concerned with the ways genetic data storage might be useful down the road, only in creating scalable and reliable biological bits as soon as possible," Dr Endy said. "Then we'll put them in the hands of other scientists to show the world how they might be used."

As the DNA sections maintained their logical value even as the bacteria doubled 90 times, one clear application would be in using the DNA bits as "reporter" bits on the proliferation of cells, for example in cancerous tissue. But longer-term integrations of these computational components to achieve computing within biological systems are also on the researchers' minds.

"One of the coolest places for computing is within biological systems," Dr Endy said.

http://bit.ly/KyXd78

Hot trend in computing: Chips that sometimes get it wrong

At first blush it appears a daft notion: increasing the speed and efficiency of computer processors at the cost of a few computational errors.

By Eric Berger

Nevertheless, as a Houston computer scientist has developed his ideas over nearly a decade, he has found increasing acclaim for his "inexact" computer chips. This week, at a major computing conference in Italy, Rice University's Krishna Palem unveiled his newest chips that trade a bit of accuracy for better efficiency.

"When we first started working on this there was a large part of the world that was skeptical about what we were doing," said Palem, who holds a joint appointment at Singapore's Nanyang Technological University. "But I can very confidently say that we are past that now." That does not seem to be an idle boast.

After Palem and his colleagues demonstrated their prototype chips at the ACM International Conference on Computing Frontiers in Cagliari, Italy, this week it earned "best paper" honors from attendees.

"This work opens the door to interesting energy-efficiency opportunities of using inexact hardware together with traditional processing elements," said Paolo Faraboschi, the program co-chair of the conference and a distinguished technologist at Hewlett-Packard Laboratories. Palem's approach, known as probabilistic computing, involves taking existing computer chips and modifying them.

Within a basic computer chip there are "blocks" of hardware that do computational work. But some of these blocks do more, or more important work than other blocks, Palem said. For example, the block that calculates a higher-order number in a bank balance, the "5" in $5,300.61, is more critical than the block that calculates the 1 cent at the end.

A snip boosts speed

By studying chips Palem's research group, which also included members from Switzerland's Center for Electronics and Microtechnology and the University of California, Berkeley, identified the blocks that did the most important work.

They then selectively snipped out the blocks that did less work, or the least important computations.
"When we pruned the chips this way we dramatically increased their efficiency and speed," Palem said.
The group's testing showed that pruning could cut energy demands 3.5 times with chips that deviated from the correct value by an average of 0.25 percent. Factoring in size and speed, the pruned chips were 7.5 times more efficient than regular computer chips.
But isn't the whole point of computers to deliver the right calculation, every time?
For some applications such as bank balances, of course, absolute accuracy is critical, Palem said.

Inexact chips

However there are a large number of applications where minor errors go unnoticed by consumers: audio, video, large-scale simulations, search engine results and more. The chips are already being incorporated into some hardware.
Inexact chips are a key component of the low-cost I-slate educational tablet designed for Indian classrooms with no electricity and too few teachers. Officials in India's Mahabubnagar District announced plans in March to adopt 50,000 I-slates in middle and high school classrooms over the next three years. And Palem says that's just the beginning. It could be used in a wide variety of devices, from mobile phones to hearing aids.
"This idea has really spread in recent years," he said. "I think this is the beginning of a big expansion."

http://bit.ly/KwLB55

A Petition for Free Online Access of Taxpayer-funded Research

Science is cumulative. But to be truly cumulative, we need to be able to read and understand what has come before us. And this comes down to an issue of access.

By Samuel Arbesman

Many scientific papers are locked away behind paywalls. But the federal government pays for nearly all of this research! So not only should we have access to it in order to allow science to build upon itself, but as a citizenry we have paid for this research and should be able to access it.
Access2Research is a movement to "Require free access over the Internet to journal articles arising from taxpayer-funded research." And it has recently begun a petition over at Whitehouse.gov for the following:

Require free, timely access over the Internet to journal articles arising from taxpayer-funded research.

We believe in the power of the Internet to foster innovation, research, and education. Requiring the published results of taxpayer-funded research to be posted on the Internet in human and machine readable form would provide access to patients and caregivers, students and their teachers, researchers, entrepreneurs, and other taxpayers who paid for the research. Expanding access would speed the research process and increase the return on our investment in scientific research.

The highly successful Public Access Policy of the National Institutes of Health proves that this can be done without disrupting the research process, and we urge President Obama to act now to implement open access policies for all federal agencies that fund scientific research.

http://www.scientificamerican.com/citizen-science/project.cfm?id=transit-of-venus

Transit of Venus

The next transit of Venus occurs June 5 or 6, 2012, depending on your location.

Observers in North America see it the evening of June 5. This will be the last transit of Venus to occur in your lifetime. The next transit of Venus occurs in December 2117.
Mercury and Venus are the only planets closer to the Sun than Earth, both moving faster in their orbits and passing us regularly. But rather than crossing directly between us and the Sun, these planets are usually slightly above or below the Sun as we see them. When they line up just right we see the round, black silhouette of the planet slowly crossing the Sun, an even referred to as a "transit." Mercury transits the Sun 13 or 14 times each century. But Venus transits happen in pairs - two transits eight years apart - with more than 100 years between each pair.
When Venus passes directly between earth and the sun, we see the distant planet as a small dot gliding slowly across the face of the sun. Historically, this rare alignment is how we measured the size of our solar system.
Astronomers Without Borders has some special plans for this rare event, which will be seen by most of the world's population. The coming Venus transit offers a chance for modern-day stargazers to repeat the experiments conducted by expeditions around the world in the 18th and 19th centuries - with a modern twist.
The free phone app created by the Transit of Venus Project allows every observer with a telescope to record timings of this rare event. Available for Apple and Android devices.

http://www.eurekalert.org/pub_releases/2012-05/uoe-wbm052312.php

Well-connected brains make you smarter in older age

Brains that maintain healthy nerve connections as we age help keep us sharp in later life, new research funded by the charity Age UK has found

Brains that maintain healthy nerve connections as we age help keep us sharp in later life, new research funded by the charity Age UK has found. Older people with robust brain 'wiring' – that is, the nerve fibres that connect different, distant brain areas – can process information quickly and that this makes them generally smarter, the study suggests.

According to the findings, joining distant parts of the brain together with better wiring improves mental performance, suggesting that intelligence is not found in a single part of the brain. However a loss of condition of this wiring or 'white matter' – the billions of nerve fibres that transmit signals around the brain – can negatively affect our intelligence by altering these networks and slowing down our processing speed.

The research by the University of Edinburgh shows for the first time that the deterioration of white matter with age is likely to be a significant cause of age-related cognitive decline.

The research team used three different brain imaging techniques in compiling the results, including two that have never been used before in the study of intelligence. These techniques measure the amount of water in brain tissue, indicate structural loss in the brain, and show how well the nerve fibres are insulated.

The researchers examined scans and results of thinking and reaction time tests from 420 people in the Lothian Birth Cohort of 1936, a group of nearly 1100 people whose intelligence & general health have been tracked since they were 11 The research was part of the Disconnected Mind Project, a large study of the causes of people's differences in cognitive ageing, led by Professor Ian Deary.

Study author Doctor Lars Penke said "Our results suggest a first plausible way how brain structure differences lead to higher intelligence. The results are exciting for our understanding of human intelligence differences at all ages." "They also suggest a clear target for seeking treatment for mental difficulties, be they pathological or age-related. That the brain's nerve connections tend to stay the same throughout the brain means we can now look at factors that affect the overall condition of the brain, like its bloody supply."

Professor Deary said that uncovering the secrets of good thinking skills in old age is a high priority. "The research team is now looking at what keeps the brain's connections healthy. We value our thinking skills, and research should address how we might retain them or slow their decline with age."

Doctor Mark Bastin, who co-authored the study, said "These findings are exciting as they show how quantitative brain imaging can provide novel insights into the links between brain structure and cognitive ability. This is a key research area given the importance of identifying strategies for retaining good mental ability into older age."

Professor James Goodwin, Head of Research at Age UK, said: "This research is very exciting as it could have a real impact on tackling mental decline in later life, including dementia. With new understanding on how the brain functions we can work out why mental faculties decline with age in some people and not others and look at what can be done to improve our minds' chances of ageing better."

http://bit.ly/KScpwi

When Continental Drift Was Considered Pseudoscience

One hundred years ago, a German scientist was ridiculed for advancing the shocking idea that the continents were adrift

By Richard Conniff

In a courtroom in Italy, six seismologists and a civil servant are facing charges of manslaughter after failing to predict a 2009 earthquake that killed 308 people in the Apennine Mountain city of L'Aquila. The charge is remarkable partly because it assumes that scientists can now see not merely beneath the surface of the earth, but also into the future. What's even more extraordinary, though, is that the prosecutors based their case on a scientific insight that was, not long ago, the object of open ridicule.

It was a century ago this spring that a little-known German meteorologist named Alfred Wegener proposed that the continents had once been massed together in a single supercontinent and then gradually drifted apart. He was, of course, right. Continental drift and the more recent science of plate tectonics are now the bedrock of modern geology, helping to answer vital questions like where to find precious oil and mineral deposits, and how to keep San Francisco upright. But in Wegener's day, geological thinking stood firmly on a solid earth where continents and oceans were permanent features.

We like to imagine that knowledge advances fact upon dispassionate fact to reveal precise and irrefutable truths. But there is hardly a better example of just how messy and emotional science can be than Wegener's discovery

of the vast, turbulent forces moving within the earth's crust. As often happens when confronted with difficult new ideas, the establishment joined ranks and tore holes in his theories, mocked his evidence and maligned his character. It might have been the end of a lesser man, but as with the vicious battles over topics ranging from Darwinian evolution to climate change, the conflict ultimately worked to the benefit of scientific truth.

The idea that smashed the old orthodoxy got its start on Christmas 1910, as Wegener (the W is pronounced like a V) browsed through a friend's new atlas. Others before him had noticed that the Atlantic coast of Brazil looked as if it might once have been tucked up against West Africa, like a couple spooning in bed. But no one had made much of it, and Wegener was hardly the logical choice to show what they had been missing. He was a lecturer at Marburg University, not merely untenured but unsalaried, and his specialties were meteorology and astronomy, not geology.

But Wegener was not timid about disciplinary boundaries, or much else. He was an Arctic explorer and a record-setting balloonist, and when his scientific mentor and future father-in-law advised him to be cautious in his theorizing, Wegener replied, "Why should we hesitate to toss the old views overboard?"

He cut out maps of the continents, stretching them to show how they might have looked before the landscape crumpled up into mountain ridges. Then he fit them together on a globe, like jigsaw-puzzle pieces, to form the supercontinent he called Pangaea (joining the Greek words for "all" and "earth"). Next he assembled the evidence that plants and animals on opposite sides of the oceans were often strikingly similar: It wasn't just that the marsupials in Australia and South America looked alike; so did the flatworms that parasitized them. Finally, he pointed out how layered geological formations often dropped off on one side of an ocean and picked up again on the other, as if someone had torn a newspaper page in two and yet you could read across the tear.

Wegener called his idea "continental displacement" and presented it in a lecture to Frankfurt's Geological Association early in 1912. The minutes of the meeting noted that there was "no discussion due to the advanced hour," much as when Darwinian evolution made its debut. Wegener published his idea in an article that April to no great notice. Later, recovering from wounds he suffered while fighting for Germany during World War I, he developed his idea in a book, The Origin of Continents and Oceans, published in German in 1915. When it was published in English, in 1922, the intellectual fireworks exploded.

Lingering anti-German sentiment no doubt intensified the attacks, but German geologists piled on, too, scorning what they called Wegener's "delirious ravings" and other symptoms of "moving crust disease and wandering pole plague." The British ridiculed him for distorting the continents to make them fit and, more damningly, for not describing a credible mechanism powerful enough to move continents. At a Royal Geographical Society meeting, an audience member thanked the speaker for having blown Wegener's theory to bits - then thanked the absent "Professor Wegener for offering himself for the explosion."

But it was the Americans who came down hardest against continental drift. A paleontologist called it "Germanic pseudo--science" and accused Wegener of toying with the evidence to spin himself into "a state of auto-intoxication." Wegener's lack of geological credentials troubled another critic, who declared that it was "wrong for a stranger to the facts he handles to generalize from them." He then produced his own cutout continents to demonstrate how awkwardly they fit together. It was geology's equivalent of O.J. Simpson's glove.

The most poignant attack came from a father-son duo. Like Wegener, University of Chicago geologist Thomas C. Chamberlin had launched his career with an iconoclastic attack on establishment thinking. He went on to define a distinctly democratic and American way of doing science, according to historian Naomi Oreskes. Making the evidence fit grandiose theories was the fatal flaw in Old World science, Chamberlin said; the true scientist's role was to lay out the facts and let all theories compete on equal terms. Like a parent with his children, he was "morally forbidden to fasten his affection unduly upon any one of them."

By the 1920s, Chamberlin was the dean of American science and his colleagues fawned that his originality put him on a par with Newton and Galileo. But he had also become besotted with his own theory of earth's origins, which treated the oceans and continents as fixed features. This "great love affair" with his own work was characterized, historian Robert Dott writes, "by elaborate, rhetorical pirouetting with old and new evidence." Chamberlin's democratic ideals - or perhaps some more personal motivation - required grinding Wegener's grandiose theorizing underfoot.

Rollin T. Chamberlin, who was also a University of Chicago geologist, did his father's dirty work: The drift theory "takes considerable liberties with our globe," he wrote. It ignores "awkward, ugly facts" and "plays a game in which there are few restrictive rules." Young Chamberlin also quoted an unnamed geologist's remark that inadvertently revealed the heart of the problem: "If we are to believe Wegener's hypothesis we must forget everything which has been learned in the last 70 years and start all over again."

Instead, geologists largely chose to forget Alfred Wegener, except to launch another flurry of attacks on his "fairy tale" theory in the middle of World War II. For decades afterward, older geologists warned newcomers that any hint of an interest in continental drift would doom their careers.
Wegener took the assault as an opportunity to refine his ideas and address valid criticisms. When critics said he had not presented a plausible mechanism for the drift, he provided six of them (including one that foreshadowed the idea of plate tectonics). When they pointed out mistakes - his timeline for continental drift was far too short - he corrected himself in subsequent editions of his work. But he "never retracted anything," says historian Mott Greene, author of an upcoming biography, Alfred Wegener's Life and Scientific Work. "That was always his response: Just assert it again, even more strongly." By the time Wegener published the final version of his theory, in 1929, he was certain it would sweep other theories aside and pull together all the accumulating evidence into a unifying vision of the earth's history. (But even he would have been astonished by the charges against the Italians for failing to turn continental drift into a predictive device; that trial is expected to continue for months.)
The turnabout on his theory came relatively quickly, in the mid-1960s, as older geologists died off and younger ones began to accumulate proof of seafloor spreading and vast tectonic plates grinding across one another deep within the earth.
Wegener didn't live to see it. Because of a subordinate's failure, he and a colleague had to make a lifesaving delivery of food to two of his weather researchers spending the winter of 1930 deep in Greenland's ice pack. The 250-mile return trip to the coast that November turned desperate. Wegener, at 50, yearned to be home with his wife and three daughters. He dreamed of "vacation trips with no mountain climbing or other semi-polar adventures" and of the day when "the obligation to be a hero ends, too." But a quotation in his notes reminded him that no one accomplished anything worthwhile "except under one condition: I will accomplish it or die." Somewhere along the way the two men vanished in the endless snow. Searchers later found Wegener's body and reported that "his eyes were open, and the expression on his face was calm and peaceful, almost smiling." It was as if he had foreseen his ultimate vindication.

http://www.eurekalert.org/pub_releases/2012-05/pp-aib052312.php

An introduced bird competitor tips the balance against Hawaiian species

The once-rare white-eye colonized the restoration area, grew rapidly in it, but then surged into the old-growth forest below.

Japanese White-eye

Biologists Leonard Freed and Rebecca Cann from the University of Hawaii at Manoa have been studying birds at Hakalau Forest National Wildlife Refuge for 20 years. Located on an old cattle ranch on the windward slope of Mauna Kea on the Island of Hawaii, it was established in 1985 to protect 8 species of rare and endangered perching birds. The refuge and its volunteers planted over 400,000 seedlings of native koa trees in an abandoned pasture to restore high elevation forest. The once-rare white-eye colonized the restoration area, grew rapidly in it, but then surged into the old-growth forest below. Freed and Cann estimated that tens of thousands of native birds were lost. Their study was recently published in the open access journal NeoBiota.

The researchers had previously shown competition between white-eyes and native birds on their study sites. With increased numbers of white-eyes, young of all native species measured had stunted growth, indicating that food was becoming a problem. They also documented that birds of all ages had difficulty replacing their feathers. Each problem, both unprecedented in nature, occurred at the same time. In contrast to the forest adjacent to the restoration area, native birds deeper within the forest had normal growth and feather replacement where white-eyes were still rare.
Freed and Cann then used the refuge's own survey data collected over 3,373 ha of open forest and 1,998 ha of closed forest to determine if changes observed on their study sites were a general problem on the entire refuge. They documented a stepwise increase in density of white-eyes in the open forest area that had been sustained for 8 years between 2000 and 2007, and a more gradual increase in the closed forest area below that.
Loss of native birds followed the refuge-wide surge of white-eyes. Greater declines occurred in the open forest area where white-eyes increased first, amounting to a drop of one-third of native birds. About 10% of birds disappeared from the closed forest area, but there was strong correlation among losses of native species in the two areas. The researchers expect that losses in the more pristine closed forest area will continue, because the white-eye is still increasing there. Ironically, only an alien species is increasing on a refuge set aside to protect

native Hawaiian birds. Forest restoration has precipitated a problem that requires additional action in the forest below. Hawaiian birds are considered to be "conservation reliant" species from other threats. Now the future of native birds on the refuge requires control of an introduced bird.

Freed LA, Cann RL (2012) Increase of an introduced bird competitor in old-growth forest associated with restoration. NeoBiota 13: 43-60. doi: 10.3897/neobiota.13.2946

http://www.eurekalert.org/pub_releases/2012-05/bmj-csl052212.php

Calcium supplements linked to significantly increased heart attack risk

And boosting overall dietary calcium confers no significant heart health benefit

Calcium supplements might increase the risk of having a heart attack, and should be "taken with caution," concludes research published in the online issue of the journal Heart. Furthermore, boosting overall calcium intake from dietary sources confers no significant advantage in terms of staving off heart disease and stroke, the findings indicate.

Previous research has linked higher calcium intake with a lowered risk of high blood pressure, obesity, and type 2 diabetes, all of which are risk factors for heart disease and stroke. And calcium supplements are commonly recommended to elderly people and women who have gone through the menopause to prevent bone thinning.

The authors base their findings on almost 24,000 participants of one of the German arms of the European Prospective Investigation into Cancer and Nutrition (EPIC) study in Heidelberg.

All the participants were aged between 35 and 64 when they joined the study in 1994-8.

Normal diet for the preceding 12 months was assessed using food frequency questionnaires and they were quizzed about whether they regularly took vitamin or mineral supplements.

Their health was tracked for an average of 11 years, during which time 354 heart attacks, 260 strokes, and 267 associated deaths occurred.

After taking account of factors likely to influence the results, those whose diets included a moderate amount (820 mg daily) of calcium from all sources, including supplements, had a 31% lower risk of having a heart attack than those in the bottom 25% of calcium intake.

But those with an intake of more than 1100 mg daily did not have a significantly lower risk. There was no evidence that any level of calcium intake either protected against or increased the risk of stroke, which backs up the findings of other research, say the authors.

But when the analysis looked at vitamin/mineral supplements, it found that those who took calcium supplements regularly were 86% more likely to have a heart attack than those who didn't use any supplements. And this risk increased further among those who used only calcium supplements. They were more than twice as likely to have a heart attack as those who didn't take any supplements.

The authors conclude: "This study suggests that increasing calcium intake from diet might not confer significant cardiovascular benefits, while calcium supplements, which might raise [heart attack] risk, should be taken with caution."

In an accompanying editorial, Professors Ian Reid and Mark Bolland from the Faculty of Medical and Health Science at the University of Auckland in New Zealand, say that the safety of calcium supplements "is now coming under increasing scrutiny."

They point to previous research, showing a link between these supplements and kidney stones, and gut and abdominal symptoms, and note that while trial evidence suggests that calcium supplements cut levels of cardiovascular risk factors, this doesn't actually translate into fewer heart attacks and strokes.

They also suggest that many women taking calcium supplements to ward off brittle bones are already healthier than those who don't, and that the overall protective effect is modest - in the order of just 10%.

The evidence that dietary calcium is helpful while calcium supplements are not can be explained by the fact that dietary calcium is taken in small amounts, spread throughout the day, so is absorbed slowly, they say.

Supplements, on the other hand, cause calcium levels in the blood to soar above the normal range, and it is this flooding effect which might ultimately be harmful, they suggest. "Calcium supplements have been widely embraced by doctors and the public, on the grounds that they are a natural and therefore safe way of preventing osteoporotic fractures," they write. "It is now becoming clear that taking this micronutrient in one or two daily [doses] is not natural, in that it does not reproduce the same metabolic effects as calcium in food," they say.

Given that it is neither safe nor effective, boosting calcium intake from supplements should be discouraged, they contend.

And they conclude: "We should return to seeing calcium as an important component of a balanced diet, and not as a low cost panacea to the universal problem of postmenopausal bone loss."

http://www.eurekalert.org/pub_releases/2012-05/uoc--sst052312.php

UC Davis MIND Institute study shows that fever during pregnancy more than doubles the risk of autism or developmental delay in children

Outcome leads authors to recommend further studies of inflammation and neurodevelopment

Sacramento, Calif. - A team of UC Davis researchers has found that mothers who had fevers during their pregnancies were more than twice as likely to have a child with autism or developmental delay than were mothers who did not have a fever or who took medication to counter its effect.

"Our study provides strong evidence that controlling fevers while pregnant may be effective in modifying the risk of having a child with autism or developmental delay," said Ousseny Zerbo, lead author of the study, who was a Ph.D. candidate with UC Davis when the study was conducted and is now a postdoctoral researcher with the Kaiser Permanente Northern California Division of Research. "We recommend that pregnant women who develop fever take anti-pyretic medications and seek medical attention if their fever persists."

Published online in the Journal of Autism and Developmental Disorders, the study is believed to be the first to consider how fever from any cause, including the flu, and its treatment during pregnancy could affect the likelihood of having a child with autism or developmental delay.

The results are based on data from a large, case-control investigation known as the Childhood Autism Risk from Genetics and the Environment (CHARGE) Study. Another recent study based on CHARGE data found that mothers who were obese or diabetic had a higher likelihood of having children with autism.

Irva Hertz-Picciotto, a professor of public health sciences at UC Davis and principal investigator of CHARGE, pointed out that fever is produced by acute inflammation - the short-term, natural immune system reaction to infection or injury - and that chronic inflammation, which no longer serves a beneficial purpose and can damage healthy tissue, may be present in mothers with metabolic abnormalities like diabetes and obesity.

"Since an inflammatory state in the body accompanies obesity and diabetes as well as fever," said Hertz-Picciotto, "the natural question is: Could inflammatory factors play a role in autism?"

She explained that when people are infected by bacteria or viruses, the body generally reacts by mounting a healing response that involves the release of pro-inflammatory cytokines from white blood cells into the bloodstream. Some cytokines are able to cross the placenta, and therefore could reach the fetal central nervous system, potentially altering levels of neurotransmitters and brain development.

"We definitely think more research is necessary to pinpoint the ways that inflammation could alter brain development," said Hertz-Picciotto.

CHARGE includes an ethnically diverse population of children aged 2 to 5 years born in California and living in Northern California. The current study included 538 children with autism, 163 children with developmental delay but not autism, and 421 typically developing children whose mothers answered standardized questionnaires about whether they had the flu and/or fever during pregnancy and if they took medications to treat their illnesses.

The results showed that flu during pregnancy was not associated with greater risks of having a child with autism or developmental delay. Fever from any cause during pregnancy, however, was far more likely to be reported by mothers of children with autism (2.12 times higher odds) or developmental delay (2.5 times higher odds), as compared with mothers of children who were developing typically. For children of mothers who took anti-fever medication, the risk of autism was not different from the risk in children whose mothers reported no fever.

According to Irva Hertz-Picciotto, results based on CHARGE data are noteworthy because of the study's large population-based sample and detailed information on participants. Other CHARGE evaluations have found that taking prenatal vitamins prior to and during the first month of pregnancy may help prevent autism and that living near a freeway or in areas with high regional air pollution is associated with higher risk of autism in children.

"CHARGE has obtained a wealth of environmental, demographic and medical information on young children and their parents and provides a solid basis for a variety of epidemiologic studies," said Hertz-Picciotto. "Those studies are helping us find ways to protect childhood neurodevelopment."

The study, "Is maternal influenza or fever during pregnancy associated with autism or developmental delays? Results from the CHARGE (Childhood Autism Risks from Genetics and Environment) Study," was funded by the National Institute of Environmental Health Sciences (grants R01-ES015359 and P01-ES11269), the U.S. Environmental Protection Agency's STAR program (grants R-829388 and R-833292) and the UC Davis MIND Institute. The study is available at www.springerlink.com/content/x7602q07w228t313/?MUD=MP.

In addition to Zerbo and Hertz-Picciotto, other UC Davis authors were Robin Hansen of the Department of Pediatrics, Sally Ozonoff of the Department of Psychiatry and Behavioral Sciences, Cheryl Walker of the Department of Obstetrics and Gynecology and Ana-Maria Iosif of the Department of Public Health Sciences. Hertz-Picciotto, Hansen, Ozonoff and Walker are also affiliated with the UC Davis MIND (Medical Investigation of Neurodevelopmental Disorders) Institute.

http://www.eurekalert.org/pub_releases/2012-05/pu-grs052212.php

Geological record shows air up there came from below

The influence of the ground beneath us on the air around us could be greater than scientists had previously thought, according to new research that links the long-ago proliferation of oxygen in Earth's atmosphere to a sudden change in the inner workings of our planet.

Princeton University researchers report in the journal Nature that rocks preserved in the Earth's crust reveal that a steep decline in the intensity of melting within the planet's mantle - the hot, heat-transferring rock layer between the crust and molten outer core - brought about ideal conditions for the period known as the Great Oxygenation Event (GOE) that occurred roughly 2.5 billion years ago.

During the GOE - which may have lasted up to 900 million years - oxygen levels in the atmosphere exploded and eventually gave rise to our present atmosphere.

Blair Schoene, a Princeton assistant professor of geosciences, and lead author C. Brenhin Keller, a Princeton geosciences doctoral student, compiled a database of more than 70,000 geological samples to construct a 4-billion-year geochemical timeline. Their analysis uncovered a sharp drop in mantle melting 2.5 billion years ago that coincides with existing rock evidence of atmospheric changes related to the GOE.

Based on this correlation, the researchers suggest in Nature that diminished melting in the mantle decreased the depth of melting in the Earth's crust, which in turn reduced the output of reactive, iron oxide-based volcanic gases into the atmosphere. A lower concentration of these gases - which react with and remove oxygen from the atmosphere - allowed free oxygen molecules to proliferate.

The Princeton research offers the strongest data-driven correlation yet between deep Earth processes and the GOE, Schoene said. Previous hypotheses are largely based on qualitative observations of the rock record and computational models that simulate how this rapid oxygenation might have occurred. The Princeton research, however, is based on a statistical analysis of the geologic record and the chemical traces of deep-Earth activity it has preserved, Schoene said.

"The perspective behind past efforts to connect geologic processes to the Great Oxygenation Event has been hypothetical, saying that 'If the Earth had been X, there would have been reaction Y,'" Schoene said. "But these ideas cannot be tested experimentally because they are largely notional. In our paper, we have the evidence to say, 'The Earth was like this,' and then propose a hypothesis that can be tested by examining the same rich database of mantle and deep-crust changes we used in our work."

A change in subsurface activity around the time of the GOE has been noted before, Keller explained. But evidence of that shift is geochemically subtle, especially after billions of years. The database he and Schoene created allowed them to show more precisely how the geochemical makeup of the crust changed through time, resulting in a more detailed hypotheses about how this would affect the atmosphere, Keller said.

"Research in this area has been largely qualitative, but with this much data, we can pick up finer features in the geologic record, particularly a level of detail related to this sudden change 2.5 billion years ago that people had not seen with such clarity before," Keller said.

A missing piece of the GOE puzzle?

Woodward Fischer, an assistant professor of geobiology at the California Institute of Technology who specializes in the GOE, said that the Princeton research could help shed more light on an important factor in Earth's oxygenation that is not well understood. Fischer is familiar with the paper but had no role in it.

The dominant theory of oxygenation is that an abundance of photosynthetic life emerged some hundreds of millions of years before the GOE and began producing oxygen via photosynthesis, Fischer said. The problem is that this output would not have been enough to overcome "sinks" that were absorbing more oxygen from the atmosphere than was being put into it. So, a lingering question is what happened to those sinks to bring about oxygenation.

Keller and Schoene show how one of the primary sinks - volcanic gases - might have suddenly been neutralized, Fischer said. The exact effect this would have had on atmospheric oxygen levels is difficult to know - even recent fluctuations are hard to gauge, he said. Nonetheless, the clear and objective data the researchers use strongly suggests that a quick reduction in volcanic gases brought about by a drop in mantle-melt intensity was an important precursor to oxygenation, Fischer said.

"This paper offers a really striking assessment of changes occurring in the solid Earth that greatly helped set the stage for one of the most marked environmental transitions in Earth history," Fischer said.
"And their methodology precludes a strong tendency that researchers, as humans invested in our work, have to look for anecdotal geological evidence and conclude based on coincidence that events co-occurring in time must have been related," Fischer said. "The statistical approach taken by the authors in this paper really lets the data shine and reveals that there were important secular changes in the way the Earth made igneous rocks, and that these changes were possibly part of an interplay between life and deep-Earth processes."
Keller and Schoene fashioned their expansive database from previously reported rock and trace element analyses, which are increasingly available through online databases. They focused on changes in the chemical composition of basalt, a byproduct of melting in the Earth's mantle.
When melting in the mantle is high, Keller said, basalt contains greater concentrations of "compatible" elements such as chromium and magnesium that are ordinarily found in the mantle. Less intense melting, on the other hand, results in basalt with a higher content of incompatible elements such as sodium and potassium that are found closer to the Earth's surface.
From their examination, Keller and Schoene saw that the Earth's mantle has undergone a gradual cooling since the planet's early history, which is consistent with scientists' expectations based on heat loss at the Earth's surface. Around 2.5 billion years ago, however, the levels of compatible elements in the sampled basalt plummeted, indicating that the magnitude of melting deep in the mantle dropped off suddenly.
Keller and Schoene confirmed their findings by checking them against existing analyses of crust-level "felsic" rocks such as granite, which form when hot basalt merges with other minerals. Heightened melt activity in the mantle leads to deeper melting in the Earth's crust, and felsic rocks can indicate the intensity of mantle melting, Keller said.
The researchers conclude that when melting happens at a great depth in the crust then the concentration of the iron-oxide gases in magma increases. When emitted into the air by volcanoes, these gases bond with free oxygen and essentially remove it from the air. On the other hand, when crust melting becomes shallower, as they observed, atmospheric levels of those volcanic gases drop and free oxygen molecules can flourish.

Connecting the Earth's systems

In a broader sense, said Schoene, his and Keller's research depicts a close interaction between the Earth's geologic and biological systems that is becoming more apparent. "In science, it is becoming increasingly obvious that seemingly different systems act together and the question is how," Schoene said.
"Overall, this analysis strengthens emerging arguments that interaction between the solid Earth and biosphere are very intimate and important," he said. "This is strong evidence of how biological and geological systems might work together, and it suggests that important planetary change is not simply the result of life dragging the rest of the planet along."
Fischer of Caltech added that this interplay of systems applies to various events in the planet's history - such as mass extinctions - that are the result of multiple factors both above and below the Earth's surface. Decidedly more difficult is tracing how these events influenced one another and ultimately led to a greater planetary change, he said.
"Because of the complicated questions of how solid Earth changes lead to biological innovations, scientists now have to start thinking deeply and working across the boundaries of what have traditionally been pretty rigid subdisciplines in the Earth sciences," Fischer said.
"It's clear from research like this," he said, "that there is hay to be made by interdisciplinary efforts to connect processes and mechanisms from the solid to the fluid Earth, and to understand that interplay with an ever-evolving biology."

http://news.discovery.com/space/planex-x-20-gravitational-perturbations-120523.html

Is 'Planet X 2.0' Lurking Beyond Pluto's Orbit?

There is enduring evidence for the existence of a substantial planet gravitationally shaping the population of minor bodies in the Kuiper belt and beyond. The only problem is, we can't see it.

Analysis by Ian O'Neill

Before the doomsayers hijacked "Planet X" and used it as a phantom (a.k.a. "Nibiru") to scare people into believing the 2012 doomsday hype, the hunt for Planet X was an exciting astronomical quest to find a hypothetical world in the outermost reaches of the solar system in the early 20th century.
Although dwarf planet Pluto was discovered during the search for Planet X in 1930, apparently ending the quest, there is enduring evidence for the existence of a substantial planet gravitationally shaping the population of minor bodies in the Kuiper belt and beyond. The only problem is, we can't see it.

Earlier this month, at a meeting of the American Astronomical Society in Timberline Lodge, Ore., Rodney Gomes, an astronomer from the National Observatory of Brazil in Rio de Janeiro, announced the results of his simulation of a region beyond Pluto known as the "scattered disk," suggesting the presence of an as yet to be discovered massive world.

The scattered disk is a sparsely populated region that overlaps with the Kuiper belt at around 30 AU (Neptune's orbit), and some scattered disk objects (or SDOs) have extreme orbits that extend to 100 AU.

One such small world is Sedna, a dwarf planet with a highly elongated orbit. "Sedna's orbit is truly peculiar," said Caltech planetary scientist Mike Brown, who led the team that discovered Sedna in 2003.

These extreme orbits, argues Gomes, could be due to the presence of an unknown massive planet. By his reckoning, a planet four times the size of Earth may be out there beyond the orbit of Pluto. In his simulation, he placed the gravitational field of a large planet and watched the effect it had on the SDO's orbits.

"Rodney Gomes is actively seeking further evidence, and I await his findings with interest!" Douglas Hamilton, an astronomer at the University of Maryland, told Life's Little Mysteries. "He has taken on a difficult task, but is taking the right approach. It is definitely a high-risk, high-reward, situation -- a discovery of a new planet would be spectacular!"

Although the presence of a massive planet may explain the extreme orbits, there is little else that suggests Planet X 2.0 really is out there. But the method of seeking out other worlds while looking for their gravitational influence on the orbits of other celestial bodies has been done before, with historic success.

In 1781, British astronomer Sir William Herschel noticed a perturbation in Uranus' orbit. By 1821, French astronomer Alexis Bouvard surmised that Uranus was being slightly "tugged" by the gravity of another, as yet to be discovered, massive planet in the outer solar system. In the 1840s, English and French astronomers John Couch Adams and Urbain Le Verrier independently went on to calculate where this mystery planet should be in the night sky by purely measuring these little deviations in Uranus' path.

Fifty-five years after Herschel noticed Uranus' perturbations, the distant planet was officially discovered by German astronomer Johann Galle in the location predicted by Couch Adams and Le Verrier. It was named Neptune.

Following the discovery of Neptune through studying perturbations in the orbit of Uranus, astronomers in the late 19th century still believed there must be another massive planet in the outer solar system causing additional perturbations to Uranus. By 1906, Percival Lowell - founder of the Lowell Observatory in Flagstaff, Ariz. - was inspired by these hints of another world and started a search for what he dubbed "Planet X."

It wasn't until 1930 that Clyde Tombaugh, an astronomer at Lowell Observatory, discovered Pluto. At the time, it was thought the search for Planet X had come to an end, but after follow-up observations in the decades after Pluto's discovery, the tiny world was found to have a minuscule gravitational field -- it wasn't the "Planet X" astronomers were looking for.

As it turned out, many of the perturbation measurements were eventually put down to observational error, but that didn't negate the potential for more large planets beyond our observational capabilities existing beyond the Kuiper belt -- the scenario that Gomes is currently investigating.

This new search for a hypothetical world is interesting, and reminiscent of Lowell's hunt for Planet X, but just because extreme SDO orbits hint at the presence of another body doesn't mean there has to be a Planet X 2.0.

"You can go back 100 years to claims of planets in the outer solar system and (their orbital anomalies) have all eventually gone away," said Hal Levison, a planetary scientist at the Southwest Research Institute in Boulder, Colo. "That should give you pause for thought. Just because there's not a good explanation for (the orbits of the scattered disc objects) besides another planet doesn't mean there won't be a good explanation in the future."

One leading alternative theory as to how SDOs got flung around is that during the sun's formative years, it grew up in a cluster of tightly packed stars -- perhaps the gravitational instabilities caused by neighboring stars affected the objects in the outer solar system.

"Back at the time of the birth of the sun, the sun probably formed in a cluster of other stars. If true, they would have been close enough together to influence each other's outer planet systems, like where Sedna is," said Brown. So for now, we'll just have to wait and see if more evidence presents itself -- at the moment, evidence for Planet X 2.0 seems a little too thin. *Source: SPACE.com*

http://news.discovery.com/animals/terrestrial-animals-walking-120523.html

First Terrestrial Animals Shuffled Onto Land

When creatures made their way onto land for the first time, it wasn't pretty.

By Jennifer Viegas

The transition from swimming to walking involved some awkward first steps, according to a new study that recreated how one of the first animals, which left the sea for land, moved.

The study found that that the fishy four-limbed animal Ichthyostega used its front limbs like crutches, pushing its body up and forward onto land while its legs and tail trailed behind. It lived in water near the shoreline when not on land. This was one small step for sea creatures but one big step for animal kind, because those early movements on land around 374-359 million years ago likely later evolved into walking, including human locomotion.

A fleshed-out reconstruction of the early tetrapod Ichthyostega. The flesh is semi-transparent so the skeleton is visible underneath. **Julia Molnar**

"Ichthyostega's muscular and mobile elbows would have also assisted in station holding (staying in one spot) while in the water and in lifting its head out of the water to breathe and process food," Stephanie Pierce of the Royal Veterinary College's Structure and Motion Laboratory told Discovery News. "Ichthyostega probably used its paddle-like legs and tail to swim while in the water," she added. "The hind legs probably were not of much use on land, especially compared to the forelimbs."

Pierce and her colleagues Jennifer Clack and John Hutchinson reconstructed the first ever 3-D computer model of the tetrapod's skeleton. Ichthyostega, in addition to having big muscles, possessed huge fang-like teeth and probably ambushed its prey.

The model, which put together the fossils like a jigsaw puzzle in animation software, revealed that most books and museum displays showing Ichthyostega are incorrect. They usually represent this beast marching around like a large salamander with stocky legs. Instead, the reconstruction determined that the shoulder and hip joint of this species prevented a conventional walking step, since its limbs were incapable of rotating along its long-axis. This motion is critical to locomotion for us and other modern land animals.

Earlier fish relatives of Ichthyostega and other tetrapods, called tetrapodomorphs, had the ability to rotate their fins. This allowed later animals to move well on land. The research was published in this week's issue of Nature.

A separate study, published in the Proceedings of the Royal Society B, looked at a 345-million-year-old eel called Tarrasius problematicus. Lauren Sallan of the University of Chicago discovered that this eel had a spine with multiple segments, similar to that of today's land-dwelling animals. Together, the two new studies offer strong evidence that some of the basic anatomical features needed for land life first evolved in sea dwellers. These features initially were used to improve swimming, but were later applied to moving around on land.

Sallan told Discovery News that the Nature paper is in agreement with her findings, "where axial regionalization is also suggested to be an adaptation for swimming." In water, the hind limbs and tail would have worked similar to those of today's tadpoles.

It remains a mystery as to why some marine species left the water for land in the first place, but Pierce thinks the food and other offerings were likely too good to pass up. Since these animals were possibly the first to even go on to land, the competition for the food -- at least from other bony species -- would have essentially been non-existent. Pierce and her team next plan to study the mobility of the spine of Ichthyostega. This may better determine how the not-so-smooth early locomotion on land evolved into walking and running.

http://www.sciencedaily.com/releases/2012/05/120523200301.htm

Turtles More Closely Related to Birds Than Lizards and Snakes, Genetic Evidence Shows

The evolutionary origin of turtles is one of the last unanswered questions in vertebrate evolution.

ScienceDaily - Paleontological and morphological studies place turtles as either evolving from the ancestor of all reptiles or as evolving from the ancestor of snakes, lizards, and tuataras. Conflictingly, genetic studies place turtles as evolving from the ancestor of crocodilians and birds.

Having recently looked at more than a thousand of the least-changed regions in the genomes of turtles and their closest relatives, a team of Boston University researchers has confirmed that turtles are most closely related to crocodilians and birds rather than to lizards, snakes, and tuataras.

The researchers published their findings in the Royal Society journal Biology Letters. By showing that turtles are closer relatives to crocodiles and birds (archosaurs) than lizards, snakes and tuatara (lepidosaurs), the study

challenges previous anatomical and paleontological assessments. Nick Crawford, a post-graduate researcher in biology in BU's Graduate School of Arts & Sciences and lead author of the study, achieved these findings by using computational analysis to examine regions of the different animals' genomes.
"Turtles have been an enigmatic vertebrate group for a long time and morphological studies placed them as either most closely related to the ancestral reptiles, that diverged early in the reptile evolutionary tree, or as closer to lizards, snakes, and tuataras," says Crawford.
The study is the first genomic-scale analysis addressing the phylogenetic position of turtles, using over 1000 loci from representatives of all major reptile lineages including tuatara (lizard-like reptiles found only in New Zealand). Earlier studies of morphological traits positioned turtles at the base of the reptile tree with lizards, snakes and tuatara (lepidosaurs), whereas molecular analyses typically allied turtles with crocodiles and birds (archosaurs).
The BU researchers challenged a recent analysis of shared microRNA families that suggested turtles are more closely related to lepidosaurs. They did this with data from many single-copy nuclear loci dispersed throughout the genome, using sequence capture, high-throughput sequencing and published genomes to obtain sequences from 1145 ultraconserved elements (UCEs) and their variable flanking DNA. The resulting phylogeny provides overwhelming support for the hypothesis that turtles evolved from a common ancestor of birds and crocodilians, rejecting the hypothesized relationship between turtles and lepidosaurs.
The researchers used UCEs because they are easily aligned portions of extremely divergent genomes, allowing many loci to be interrogated across evolutionary timescales, and because sequence variability within UCEs increases with distance from the core of the targeted UCE, suggesting that phylogenetically informative content in flanking regions can inform hypotheses spanning different evolutionary timescales. The combination of taxonomic sampling, the genome-wide scale of the sampling and the robust results obtained, regardless of analytical method, indicates that the turtle-archosaur relationship is unlikely to be caused by long-branch attraction or other analytical artefacts.
The BU study is the first to produce a well-resolved reptile tree that includes the tuatara and multiple loci, and also is the first to investigate the placement of turtles within reptiles using a genomic-scale analysis of single-copy DNA sequences and a complete sampling of the major relevant evolutionary lineages. Because UCEs are conserved across most vertebrate groups and found in groups including yeast and insects, this framework is generalizable beyond this study and relevant to resolving ancient phylogenetic enigmas throughout the tree of life. This approach to high throughput phylogenomics -- based on thousands of loci -- is likely to fundamentally change the way that systematists gather and analyse data.

N. G. Crawford, B. C. Faircloth, J. E. McCormack, R. T. Brumfield, K. Winker, T. C. Glenn. More than 1000 ultraconserved elements provide evidence that turtles are the sister group of archosaurs. Biology Letters, 2012; DOI: 10.1098/rsbl.2012.0331

http://www.bbc.co.uk/news/health-18186393

'Emergency plan' to eradicate polio launched

Tackling polio has entered "emergency mode" according to the Global Polio Eradication Initiative after "explosive" outbreaks in countries previously free of the disease.

It has launched a plan to boost vaccination in Nigeria, Pakistan and Afghanistan, the only countries where the disease is still endemic. Experts fear the disease could "come back with a vengeance". The World Health Organization says polio is "at a tipping point". There have been large outbreaks of the virus in Africa, Tajikistan and China has had its first cases for more than a decade.

'Relentless'

Bruce Aylward, head of the WHO's polio eradication campaign, said: "Over the last 24 months on three continents - in Europe, in Africa and in Asia - we have seen horrific explosive outbreaks of the disease that affected adults, and in some cases 50% of them died.
"What it reminded people is that, if eradication fails, we are going to see an huge and vicious upsurge of this disease with consequences that it is very difficult even to foresee right now." He said the initiative was "now on an emergency footing" which would result in a "big shift" in the way the virus is tackled.
The strategy has been summarised as the "relentless pursuit of the unvaccinated child".
However, Dr Aylward also cautioned that there was a $950m shortfall in funding and admitted they had been forced into "cutting corners" with vaccination campaigns being stopped in some countries.

'Will'

India, once regarded as one of the most challenging countries, was declared free of the disease in February. Kalyan Banerjee, the president of Rotary International, said: "We know polio can be eradicated, and our success in India proves it. "It is now a question of political and societal will.

"Do we choose to deliver a polio-free world to future generations, or do we choose to allow 55 cases this year to turn into 200,000 children paralyzed for life, every single year?"
The Global Polio Eradication Initiative is a partnership between governments, the World Health Organization (WHO), Rotary International, the US Centers for Disease Control and Prevention and the United Nations Children's Fund. Members of the WHO, meeting in Geneva, will vote this week on whether to declare polio eradication an "emergency for public health" in the three countries where it is still endemic.
The WHO estimates that failure to act could lead to as many as 200,000 paralyzed children a year worldwide within a decade. The WHO originally set the year 2000 as its target for polio eradication. Dr Margaret Chan, director-general of the WHO, said the organisation was now working "in emergency mode".
The BBC's Imogen Foulkes in Geneva says the programme has claimed some remarkable successes, most notably India, which was declared polio-free in February.
She says the WHO hopes to shake donor countries out of their complacency and support one last effort at eradication. The WHO believes that with one last push, the disease could be eradicated globally, she says.
It is thought conflict and a lack of trust in vaccinations mean fewer children are being immunized.
Polio is a highly infectious disease caused by a virus. It invades the nervous system, and can cause total paralysis in a matter of hours. One in 200 infections leads to irreversible paralysis, usually in the legs. Among those paralysed, 5% to 10% die when their breathing muscles become immobilized.
Unicef executive director Anthony Lake said: "All our efforts are at risk until all children are fully immunized against polio - and that means fully funding the global eradication effort and reaching the children we have not yet reached "We have come so far in the battle against this crippling disease. We can now make history - or later be condemned by history for failing."

http://phys.org/news/2012-05-fungi-shifted-power.html

Fungi shifted plant balance of power

Cooperating with fungi didn't just help the earliest plants spread across a barren, rocky landscape; it also played a decisive role in the rise of more complex plants with roots and leaves that make up most of today's flora.

That's the conclusion of a recent study, which used experiments on closely-related plants that are still around today to investigate how major environmental changes around 400 million years ago gave more complex new 'vascular' arrivals the edge over older, simpler 'non-vascular' plants like liverworts.
A sudden plunge in atmospheric CO2 made these simpler plants' cooperative fungal networks far less capable of supplying them with enough nutrients to grow, compared to a corresponding improvement for their vascular rivals. Adding to the problem, the upstarts were starting to outcompete them for light.
Also known as 'higher plants', vascular plants are far more anatomically complex than non-vascular ones, and their appearance saw the birth of innovations like leaves, stems and roots. The new conditions didn't just reward such novelties; they pushed evolutionary lineages further down the path towards complexity, helping shape the rich plant life we see today.
"The liverworts and other non-vascular plants were getting shaded out by plants with roots, leaves and stems, and they were faced with a huge drop in CO2 levels that made their fungal networks far less effective," says Dr. Katie Field, a plant scientist at the University of Sheffield and lead author of the paper, which appears in Nature Communications. "They really were up against it." They quickly lost the top spot; and have never regained it since, though their relations are still around today.
Most plants work with specialised fungi in a mutually-beneficial relationship. Networks of fine fungal filaments attach themselves to plant roots and work to free scarce nutrients like phosphorus from the soil. They pass these to the plant, and in return get carbon-rich sugars that the plant has made through photosynthesis.
This cooperative relationship, known as a 'symbiosis', dramatically improves plants' ability to grow and flourish. Scientists think it may well have been essential in letting them start to spread across the land surface in the first place around 450 million years ago.
Back then in the Devonian era, there was no soil as we know it today; most areas were little more than bare rock. Especially for rootless non-vascular plants, getting nutrients from this unpromising growing medium might have been impossible without the services of fungi.
"It's an ancient partnership, and one hypothesis is that the liverworts would never have been able to access the minerals they needed from the ground without it," explains Field.
Fossils show that early vascular plants like club mosses and lycophytes appeared around 385 to 400 million years ago. Around the same time there was a dramatic 90 per cent drop in the concentration of CO2 in the air, perhaps caused in part by the rapid spread of plant life, which absorbs the gas to photosynthesize. Scientists

have long understood that such a sudden change in atmospheric conditions would have seriously affected the terrestrial flora, but until now they had no experimental evidence about the effect on different kinds of plant.
The team grew plant types under controlled conditions - liverworts very similar to the earliest fossil non-vascular plants, ferns that are very close to the earliest vascular plants, and a vascular plant that evolved relatively recently, the ribwort plantain.
These plants grew in special compartments with a fine mesh that prevented the plants' roots from getting out beyond the central core but allowed the passage of fungal filaments. So if the plants managed to get at the nutrients beyond, they must have done so through the fungal partnership.
Some of each kind of plant were kept in CO2-rich conditions akin to those in the early Devonian, while others faced a CO2-poor environment like the modern one. At the end of the growing period, the scientists ground up each plant and analyzed its chemical composition. This let them work out how much carbon it had absorbed, how much phosphorus it had been able to get from the soil, and therefore how much phosphorus it got back from the fungi per unit of carbon invested - the efficiency of its fungal network.
They found that in the early high-CO2 conditions, the liverworts held their own, but that when levels of the gas dropped their fungal efficiency plummeted - probably because they had smaller fungal networks to start with.
Vascular plants, in contrast, saw a slight increase to their fungal efficiency. Combined with their ability to grow above the ground on stems to get closer to the sun, this gave them a decisive evolutionary advantage.
These days non-vascular plants are generally confined to wet, shady or otherwise difficult environments. They're often found playing a similar role as early colonizers of disturbed or bare habitats that their distant forebears did when they first took to the land hundreds of millions of years ago, but in most areas vascular plants like grasses and trees have taken over.
Contrasting arbuscular mycorrhizal responses of vascular and non-vascular plants to a simulated Palaeozoic CO2 decline. Katie J. Field, et al. Beerling. Nature Communications 3, Article number: 835. doi:10.1038/ncomms1831
Provided by PlanetEarth Online

http://phys.org/news/2012-05-ancient-mars-runaway-greenhouse.html

Did ancient Mars have a runaway greenhouse?

Cosmic impacts that once bombed Mars might have sent temperatures skyrocketing upward on the Red Planet in ancient times, enough to set warming of the surface on a runaway course, researchers say.

According to scientists, these findings could potentially help explain how this cold, dry world might have once sustained liquid water, conditions potentially friendly for life.
The largest craters still visible on Mars were created about 3.7 billion to 4.1 billion years ago. For instance, the Argyre basin is thought to be 3.8 billion to 3.9 billion years old, a crater about 710 miles (1,140 kilometers) wide potentially generated by a comet or asteroid 60 to 120 miles (100 to 200 kilometers) in diameter.
The origin of these immense craters roughly coincides with when many branching Martian river valley networks apparently formed. The impact that created Argyre basin would have released an extraordinary amount of energy, far more than any bomb made by humanity, or even the meteor suspected of ending the Age of Dinosaurs - it would have been an explosion with an energy on the order of 10^{26} joules, or 100 billion megatons of TNT. Altogether, scientists had calculated these giant collisions would have raised surface temperatures on Mars by hundreds of degrees.
Now these researchers find this heating might not have been fleeting. Instead, this warming might have gone on a runaway course, pushing Mars into a long-term stable warm state.
The idea of runaway warming is most commonly associated with Venus. Scientists think that planet's close proximity to the Sun heated its water, causing it to build up in its atmosphere as steam. Water is a greenhouse gas, trapping heat from the Sun that would have vaporized still more water, leading to a runaway greenhouse effect that apparently boiled all the oceans off Venus. Ultraviolet light would have then eventually split this atmospheric water into hydrogen and oxygen — the hydrogen escaped into space, the oxygen became trapped in the rocks of the planet, and the end-result was a bone-dry Venus.
The researchers note the many giant impacts Mars experienced might have heated the planet enough to send vast amounts of the the greenhouse gases water and carbon dioxide into the air. Their computer models suggest that there might have been enough of these gas in the Martian atmosphere to trigger a long-lasting runaway greenhouse effect. The impact that created the Argyre basin might have by itself been large enough to trigger such a chain reaction. Other impacts that might have pushed Mars toward a runaway greenhouse include the ones that created the Isidis and Hellas basins.

"Any terrestrial planet, including Venus, the Earth, or even exoplanets, may have experienced a temporary or permanent runaway greenhouse climate caused by impacts," researcher Teresa Segura, a planetary scientist at the commercial satellite firm Space Systems/Loral in Palo Alto, Calif., told Astrobiology Magazine.
It is possible that any impacting comets might have delivered even more greenhouses gases into the atmosphere once they vaporized. Still, "the kinetic energy is of most importance," Segura said.
The researchers do note that during the runaway greenhouse phase, Mars would actually have been too warm for liquid water to last on its surface. Still, this heat would eventually subside - ultraviolet light would have caused the Martian atmosphere to lose its water just as Venus did, forcing the Red Planet to cool.
After runaway greenhouse conditions collapsed but before Mars became too cold for liquid water on its surface, the planet might have remained wet for a long time, possessing "a prolonged hydrological cycle with rainfall and valley networks as well as surface lakes," Segura said. It remains uncertain just how long either this runaway state or any wet period afterward might have lasted, but previous research suggests the warm climate may have lasted for at least centuries, she noted.
Future research could analyze the effects cosmic impacts might have on the climates of Venus, exoplanets and even Earth. Although impacts might very well be capable of causing a runaway greenhouse effect now, "the size of the impact required is much larger than that we need to worry about today," Segura said. That is to say, if our planet was hit by an impact large enough to create the Argyre basin, there probably wouldn't be anyone on Earth left to worry about any of the collision's potential effects on climate. Segura and her colleagues Christopher McKay and Owen Toon detailed their findings online May 2 in the journal Icarus.
Provided by Astrobio.net

http://www.eurekalert.org/pub_releases/2012-05/aha-lvd052112.php

Low vitamin D in diet increases stroke risk in Japanese-Americans

Japanese-American men who did not eat foods rich in vitamin D had a higher risk of stroke later in life, according to results of a 34-year study reported in Stroke, an American Heart Association journal.

"Our study confirms that eating foods rich in vitamin D might be beneficial for stroke prevention," said Gotaro Kojima, M.D., lead author of the study and geriatric medicine fellow at the John A. Burns School of Medicine at the University of Hawaii in Honolulu.
Vitamin D is an essential nutrient that helps prevent rickets in children and severe bone loss in adults, and researchers believe it has the potential to lower the risk of a host of diseases including cancer and diabetes. Sunlight is generally the greatest source, but synthesizing vitamin D from the sun gets more difficult as we age, Kojima said, so older people are advised to eat more foods rich in vitamin D or take supplements. Good sources include fortified milk and breakfast cereals, fatty fish and egg yolks.
Study participants included 7,385 Japanese-American men living on Oahu, Hawaii. All were participants of the Kuakini Honolulu Heart Program, a study of stroke and coronary heart disease in Japanese-American men that began in 1965 which was conducted at the Kuakini Medical Center. Participants were 45 to 68 years old in the mid- to late-1960s when they were first examined and interviewed about what they had eaten in the previous 24 hours. Food models and serving utensils were used to help participants determine their portions accurately.
Researchers separated the participants into four groups of approximately 1,845 each depending on how much vitamin D they had consumed. They then analyzed their records through 1999, roughly 34 years after the initial exams, to determine the incidence of stroke. New strokes occurred in 960 men during the follow up period.
Researchers calculated risk while adjusting for age, total calorie intake, body-mass index, hypertension, diabetes, cigarette smoking, physical activity, cholesterol levels and alcohol intake. Men who consumed the least dietary vitamin D had a 22 percent higher risk of stroke and a 27 percent increase risk of ischemic (blood-clot related) stroke compared to those consuming the highest levels of vitamin D. There was no difference for hemorrhagic stroke.
Stroke ranks fourth among the leading causes of death in the United States. New or recurrent strokes strike about 795,000 Americans annually. Ischemic strokes account for 87 percent of all strokes, and 10 percent are from an intracranial hemorrhage (bleeding in the brain). The remaining 3 percent result from bleeding in the subarachnoid space between the brain and the tissues covering it.
Kojima said it is unclear whether the study results could be applied to different ethnic groups or to women. While previous studies focused on blood concentrations of vitamin D, this investigation used dietary intake.
Co-authors are Christina Bell, M.D.; Robert D. Abbott, Ph.D.; Lenore J. Launer, Ph.D.; Randi Chen, M.S.; Heather Motonaga, M.D.; G. Webster Ross, M.D.; J. David Curb, M.D.; and Kamal Masaki, M.D. Author disclosures are on the manuscript.
The National Heart, Lung, and Blood Institute and the National Institute on Aging funded the study.

http://www.eurekalert.org/pub_releases/2012-05/cp-adp051812.php

Anti-psychotic drug pushes cancer stem cells over the edge

An anti-psychotic drug used to treat schizophrenia appears to get rid of cancer stem cells by helping them differentiate into less threatening cell types.

The discovery reported in the Cell Press journal Cell on May 24th comes after researchers screened hundreds of compounds in search of those that would selectively inhibit human cancer stem cells, and it may lead rather swiftly to a clinical trial.

"You have to find something that's truly selective for cancer stem cells," said Mickie Bhatia, lead author of the study from McMaster University. "We've been working for some time and it's hard to find that exact formula."

The survival of cancer patients is largely unchanged from 30 years ago, and many suspect that greater success will come by addressing the rare and chemotherapy-resistant cancer stem cells.

Unlike normal stem cells, cancer stem cells resist differentiating into stable, non-dividing cell types. Bhatia's team exploited this difference to simultaneously screen compounds for their activity against human cancer stem cells versus normal human stem cells.

By testing hundreds of compounds, they identified nearly 20 potential cancer stem cell specific drugs. The one that appeared most promising is an antipsychotic drug, thioridazine, which is known to work against schizophrenia by targeting dopamine receptors in the brain. The drug doesn't appear to kill cancer stem cells, but rather encourages them to differentiate, thus exhausting the pool of self-renewing cells.

The researchers showed that thioridazine kills leukemia stem cells without affecting normal blood stem cells. Comparing the proteins in leukemia versus normal blood cells helped to explain this specificity. The leukemia cells, but not normal blood stem cells, express a dopamine receptor on their surfaces. Dopamine receptors also appear on some breast cancer stem cells, they found. "This gives us some explanation," Bhatia said. It also suggests that dopamine receptors might serve as a biomarker for rare, tumor-initiating cells.

In light of the findings, Bhatia's team is already planning for a clinical trial of the FDA-approved thioridazine in combination with standard anti-cancer drugs for adult acute myeloid leukemia.

"We're excited about bringing this drug to patients," Bhatia said. "We also hope our platform can now be a pipeline for other cancer stem cells drugs."

http://www.sciencedaily.com/releases/2012/05/120524143446.htm

New Clues About Cancer Cell Metabolism: Smallest Amino Acid, Glycine, Implicated in Cancer Cell

Research yields the first large-scale atlas of cancer metabolism and points to a key role for the smallest amino acid, glycine, in cancer cell proliferation

ScienceDaily - For almost a century, researchers have known that cancer cells have peculiar appetites, devouring glucose in ways that normal cells do not. But glucose uptake may tell only part of cancer's metabolic story. Researchers from the Broad Institute and Massachusetts General Hospital looked across 60 well-studied cancer cell lines, analyzing which of more than 200 metabolites were consumed or released by the fastest dividing cells. Their research yields the first large-scale atlas of cancer metabolism and points to a key role for the smallest amino acid, glycine, in cancer cell proliferation. Their results appear in the May 25 issue of the journal Science.

"There's growing interest in the role of metabolism in cancer, but studies to date have focused on one or two very specific pathways," said senior author Vamsi Mootha, co-director of the Broad Institute's Metabolism Program and a professor at Harvard Medical School and Massachusetts General Hospital. "We took an unbiased approach, looking at all of metabolism, and the glycine pathway emerged."

Mootha and his colleagues developed a technique known as CORE (COnsumption and RElease) profiling, which allowed them to measure the flux of metabolites -- the precursors and products of chemical reactions taking place in the body. Most of the time, when researchers measure metabolites, they are taking a snapshot of metabolite levels at a certain point in time. But, just as taking a photo of a highway will not reveal how fast traffic is moving, such measurements do not show which metabolites cells are rapidly consuming or expelling.

"Using CORE, we can quantitatively determine exactly how much of every metabolite is being consumed or released on a per-cell, per-hour basis," said co-first author Mohit Jain, a postdoctoral fellow in the Mootha laboratory. "We can now start to derive flux or transport of nutrients into or out of the cell."

The team applied CORE profiling to the NCI-60, a collection of 60 cancer cell lines that have been studied by the scientific community for many decades. Data about drug sensitivity, the activity of genes and proteins, rates of cell division, and much more are publicly available for these cell lines, which represent nine tumor types. The team's compendium of information about metabolites has also been made publicly available.

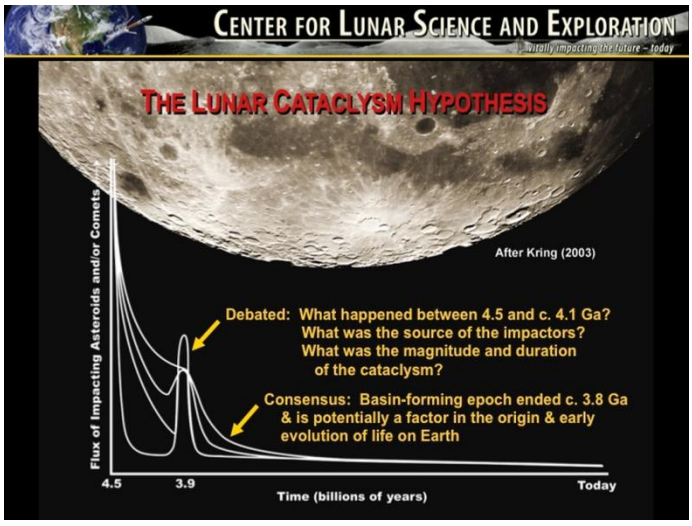
One of the most striking results of the new data is how the pattern of glycine consumption relates to the speed of cancer-cell division. In the slowest dividing cells, small amounts of glyine are released into the culture media. But in cancer cells that are rapidly dividing, glycine is rapaciously consumed. The researchers note that very few metabolites have this unusual pattern of "crossing the zero line," meaning that rapidly dividing cancer cells consume the metabolite while slowly dividing cells actually release it. "The metabolic activities that enable cancer cells to proliferate quickly or slowly are poorly understood," said Jain. "But across these 60 cell lines, we clearly see this association between how fast cells are dividing and how much glycine they are taking up."
"The CORE method is a kind of screening effort," said co-first author Roland Nilsson, who completed his postdoctoral work in the Mootha laboratory and is now at the Karolinska Institute. "It's a way of searching for metabolic activities that might be interesting. You can take those and proceed to other experiments to validate."
In addition to looking for metabolites that correlated with rates of cell division, the team also looked at the expression of almost 1,500 metabolic enzymes. Enzymes required for biosynthesis of glycine within the mitochondria were among the most highly correlated.
"We have two independent methods - metabolite profiling as well as gene expression profiling - both of which point to glycine metabolism as being important for rate of proliferation," said Mootha. To further validate and understand these results, the team observed what happened when the cancer cells were deprived of glycine, both by removing it from the media and by blocking the enzymes involved in glycine metabolism. In both cases, the fast dividing cancer cells slowed down, but the slower growing cancer cells were unaffected.
A limitation of observing such effects in cancer cells grown in the laboratory is that such cells may behave differently in the human body. One way the researchers followed up this work was to look at data available from studies of breast cancer patients over the last 25 years, searching for potential patterns between survival and the levels of enzymes involved in glycine metabolism. They found that higher levels of these enzymes predicted poorer outcomes for patients. The researchers envision many future directions for this work, including applying CORE profiling more broadly.
"This method offers a way of getting a quick overview of a particular cell type or tissue, allowing you to see what a cell requires to survive or grow," said Nilsson. "We're interested in applying this in other settings, to liver cells and muscle tissue and to study conditions such as diabetes. There are lots of potential applications."
M. Jain, R. Nilsson, S. Sharma, N. Madhusudhan, T. Kitami, A. L. Souza, R. Kafri, M. W. Kirschner, C. B. Clish, V. K. Mootha. Metabolite Profiling Identifies a Key Role for Glycine in Rapid Cancer Cell Proliferation. Science, 2012; 336 (6084): 1040 DOI: 10.1126/science.1218595

http://phys.org/news/2012-05-apollo-samples-ancient-impact-theory.html

A new look at Apollo samples supports ancient impact theory

New investigations of lunar samples collected during the Apollo missions have revealed origins from beyond the Earth-Moon system, supporting a hypothesis of ancient cataclysmic bombardment for both worlds.

Using scanning electron microscopes, researchers at the Lunar-Planetary Institute and Johnson Space Center have re-examined breccia regolith samples returned from the Moon, chemically mapping the lunar rocks to discern more compositional detail than ever before. What they discovered was that many of the rocks contain bits of material that is chondritic in origin — that is, it came from asteroids, and not from elsewhere on the Moon or Earth.
Chondrites are meteorites that originate from the oldest asteroids, formed during the development of the Solar System. They are composed of the initial material that made up the stellar disk, compressed into spherical chondrules. Chondrites are some of the rarest types of meteorites found on Earth today but it's thought that at one time they rained down onto our planet… as well as our moon.



Timeline for the Lunar Cataclysm Hypothesis (LPI)

The Lunar Cataclysm Hypothesis suggests that there was a period of extremely active bombardment of the Moon's surface by meteorite impacts around 3.9 billion years ago. Because very few large impact events — based on melt rock samples — seem to have taken place more than 3.85 billion years ago, scientists suspect

such an event heated the Moon's surface enough prior to that period to eradicate any older impact features - a literal resurfacing of the young Moon.
There's also evidence that there was a common source for the impactors, based on composition of the chondrites. What event took place in the Solar System that sent so much material hurtling our way? Was there a massive collision between asteroids? Did a slew of comets come streaking into the inner solar system? Were we paid a brief, gravitationally-disruptive visit by some other rogue interstellar object? Whatever it was that occurred, it changed the face of our Moon forever.
Curiously enough, it was at just about that time that we find the first fossil evidence of life on Earth. If there's indeed a correlation, then whatever happened to wipe out the Moon's oldest craters may also have cleared the slate for life here — either by removing any initial biological development that may have occurred or by delivering organic materials necessary for life in large amounts… or perhaps a combination of both.
The new findings from the Apollo samples provide unambiguous evidence that a large-scale impact event was taking place during this period on the Moon -- and most likely on Earth too. Since the Moon lacks atmospheric weathering or water erosion processes it serves as a sort of "time capsule", recording the evidence of cosmic events that take place around the Earth-Moon neighborhood. While evidence for any such impacts would have long been erased from Earth's surface, on the Moon it's just a matter of locating it.
In fact, due to the difference in surface area, Earth may have received up to ten times more impacts than the Moon during such a cosmic cataclysm. With over 1,700 craters over 20 km identified on the Moon dating to a period around 3.9 billion years ago, Earth should have 17,000 craters over 20 km… with some ranging over 1,000 km! Of course, that's if the craters could had survived 3.9 billion years of erosion and tectonic activity, which they didn't. Still, it would have been a major event for our planet and anything that may have managed to start eking out an existence on it. We might never know if life had gained a foothold on Earth prior to such a cataclysmic bombardment, but thanks to the Moon (and the Apollo missions!) we do have some evidence of the events that took place.
The LPI-JSC team's paper was submitted to the journal Science and accepted for publication on May 2. See the abstract here, and read more on the Lunar Science Institute's website here. And if you want to browse through the Apollo lunar samples you can do so in depth on the JSC Lunar Sample Compendum site.
Source: Universe Today

http://www.eurekalert.org/pub_releases/2012-05/uoe-fst052512.php

First study to suggest that the immune system may protect against Alzheimer's changes in humans

Recent work in mice suggested that the immune system is involved in removing beta-amyloid, the main Alzheimer's-causing substance in the brain.

Researchers have now shown for the first time that this may apply in humans.
Researchers at the Peninsula College of Medicine and Dentistry, University of Exeter with colleagues in the National Institute on Aging in the USA and in Italy screened the expression levels of thousands of genes in blood samples from nearly 700 people. The telltale marker of immune system activity against beta-amyloid, a gene called CCR2, emerged as the top marker associated with memory in people. The team used a common clinical measure called the Mini Mental State Examination to measure memory and other cognitive functions.
The previous work in mice showed that augmenting the CCR2-activated part of the immune system in the blood stream resulted in improved memory and functioning in mice susceptible to Alzheimer's disease.
Professor David Melzer, who led the work, commented: "This is a very exciting result. It may be that CCR2-associated immunity could be strengthened in humans to slow Alzheimer's disease, but much more work will be needed to ensure that this approach is safe and effective".
Dr Lorna Harries, co-author, commented: "Identification of a key player in the interface between immune function and cognitive ability may help us to gain a better understanding of the disease processes involved in Alzheimer's disease and related disorders."
Alzheimer's disease is the most common form of dementia and affects around 496,000 people in the UK.
Lorna W. Harries, Rachel M. Bradley-Smith, David J. Llewellyn, Luke C. Pilling, Alexander Fellows, William Henley, Dena Hernandez, Jack M. Guralnik, Stefania Bandinelli, Andrew Singleton, Luigi Ferrucci and David Melzer. LEUKOCYTE CCR2 EXPRESSION IS ASSOCIATED WITH MINI-MENTAL STATE EXAMINATION (MMSE) SCORE IN OLDER ADULTS. Rejuvenation Research 2012 http://online.liebertpub.com/doi/abs/10.1089/rej.2011.1302
The previously published research in mice from a team in Canada is:
Naert G, Rivest S. Hematopoietic CC-chemokine receptor 2-(CCR2) competent cells are protective for the cognitive impairments and amyloid pathology in a transgenic mouse model of Alzheimer's disease. Mol Med. 2011 Nov 29. doi: 10.2119/molmed.2011.00306.

http://www.eurekalert.org/pub_releases/2012-05/uom-tas052512.php

Tongue analysis software uses ancient Chinese medicine to warn of disease

Researchers have developed computer software that combines the ancient practices and modern medicine by providing an automated system for analyzing images of the tongue.

COLUMBIA, Mo. - For 5,000 years, the Chinese have used a system of medicine based on the flow and balance of positive and negative energies in the body. In this system, the appearance of the tongue is one of the measures used to classify the overall physical status of the body, or zheng. Now, University of Missouri researchers have developed computer software that combines the ancient practices and modern medicine by providing an automated system for analyzing images of the tongue.

"Knowing your zheng classification can serve as a pre-screening tool and help with preventive medicine," said Dong Xu, chair of MU's computer science department in the College of Engineering and study co-author. "Our software helps bridge Eastern and Western medicine, since an imbalance in zheng could serve as a warning to go see a doctor. Within a year, our ultimate goal is to create an application for smartphones that will allow anyone to take a photo of their tongue and learn the status of their zheng."

The software analyzes images based on the tongue's color and coating to distinguish between tongues showing signs of "hot" or "cold" zheng. Shades of red and yellow are associated with hot zheng, whereas a white coating on the tongue is a sign of cold zheng.

"Hot and cold zheng doesn't refer directly to body temperature," said Xu, who is also on the faculty of the Bond Life Sciences Center. "Rather, it refers to a suite of symptoms associated with the state of the body as a whole." For example, a person with cold zheng may feel chills and coolness in the limbs and show a pale flushing of face. Their voice may have a high pitch. Other symptoms of cold sheng are clear urine and loose stool. They also may prefer hot foods and drinks and desire warm environments.

In Chinese traditional medicine both hot and cold zheng can be symptoms of gastritis, an inflammation of the stomach lining frequently caused by bacterial infection.

For the study, 263 gastritis patients and 48 healthy volunteers had their tongues analyzed. The gastritis patients were classified by whether they showed infection by a certain bacteria, known as Helicobacter pylori, as well as the intensity of their gastritis symptoms. In addition, most of the gastritis patients had been previously classified with either hot or cold zheng. This allowed the researchers to verify the accuracy of the software's analysis.

"Our software was able to classify people based on their zheng status," said study co-author Ye Duan, associate professor of computer science at MU.

"As we continue to work on the software we hope to improve its ability," Duan said. "Eventually everyone will be able to use this tool at home using webcams or smartphone applications. That will allow them to monitor their zheng and get an early warning about possible ailments."

The study "Automated Tongue Feature Extraction for ZHENG Classification in Traditional Chinese Medicine" was accepted for publication in the journal Evidence Based Complementary and Alternative Medicine. The study's first author was doctoral student Ratchadaporn Kanawong and the second author was post-doctoral researcher Tayo Obafemi-Ajayi.

http://www.sciencedaily.com/releases/2012/05/120525103354.htm

Irritable Bowel Syndrome Clearly Linked to Gut Bacteria

An overgrowth of bacteria in the gut has been definitively linked to Irritable Bowel Syndrome in the results of a new Cedars-Sinai study which used cultures from the small intestine.

ScienceDaily - This is the first study to use this "gold standard" method of connecting bacteria to the cause of the disease that affects an estimated 30 million people in the United States. Previous studies have indicated that bacteria play a role in the disease, including breath tests detecting methane - a byproduct of bacterial fermentation in the gut. This study was the first to make the link using bacterial cultures.

The study, in the current issue of Digestive Diseases and Sciences, examined samples of patients' small bowel cultures to confirm the presence of small intestinal bacterial overgrowth -- or SIBO -- in more than 320 subjects. In patients with IBS, more than a third also were diagnosed with small intestine bacterial overgrowth, compared to fewer than 10 percent of those without the disorder. Of those with diarrhea-predominant IBS, 60 percent also had bacterial overgrowth.

"While we found compelling evidence in the past that bacterial overgrowth is a contributing cause of IBS, making this link through bacterial cultures is the gold standard of diagnosis," said Mark Pimentel, MD, director of the Cedars-Sinai GI Motility Program and an author of the study. "This clear evidence of the role bacteria play in the disease underscores our clinical trial findings, which show that antibiotics are a successful treatment for IBS."

IBS is the most common gastrointestinal disorder in the U.S., affecting an estimated 30 million people. Patients with this condition suffer symptoms that can include painful bloating, constipation, diarrhea or an alternating pattern of both. Many patients try to avoid social interactions because they are embarrassed by their symptoms. Pimentel has led clinical trials that have shown rifaximin, a targeted antibiotic absorbed only in the gut, is an effective treatment for patients with IBS.

"In the past, treatments for IBS have always focused on trying to alleviate the symptoms," said Pimentel, who first bucked standard medical thought more than a decade ago when he suggested bacteria played a significant role in the disease. "Patients who take rifaximin experience relief of their symptoms even after they stop taking the medication. This new study confirms what our findings with the antibiotic and our previous studies always led us to believe: Bacteria are key contributors to the cause of IBS."

The study is a collaboration with researchers at Sismanogleion General Hospital in Athens, Greece, and at the University of Athens.

Gene Kim, Fnu Deepinder, Walter Morales, Laura Hwang, Stacy Weitsman, Christopher Chang, Robert Gunsalus, Mark Pimentel. Methanobrevibacter smithii Is the Predominant Methanogen in Patients with Constipation-Predominant IBS and Methane on Breath. Digestive Diseases and Sciences, 2012; DOI: 10.1007/s10620-012-2197-1

http://nyti.ms/MILiFT

Spent Fuel Rods Drive Growing Fear Over Plant in Japan

What passes for normal at the Fukushima Daiichi plant today would have caused shudders among even the most sanguine of experts before an earthquake and tsunami set off the world's second most serious nuclear crisis after Chernobyl.

By HIROKO TABUCHI and MATTHEW L. WALD

TOKYO - Fourteen months after the accident, a pool brimming with used fuel rods and filled with vast quantities of radioactive cesium still sits on the top floor of a heavily damaged reactor building, covered only with plastic. The public's fears about the pool have grown in recent months as some scientists have warned that it has the most potential for setting off a new catastrophe, now that the three nuclear reactors that suffered meltdowns are in a more stable state, and as frequent quakes continue to rattle the region.

The worries picked up new traction in recent days after the operator of the plant, Tokyo Electric Power Company, or Tepco, said it had found a slight bulge in one of the walls of the reactor building, stoking fears over the building's safety.

To try to quell such worries, the government sent the environment and nuclear minister to the plant on Saturday, where he climbed a makeshift staircase in protective garb to look at the structure supporting the pool, which he said appeared sound. The minister, Goshi Hosono, added that although the government accepted Tepco's assurances that reinforcement work had shored up the building, it ordered the company to conduct further studies because of the bulge.

Some outside experts have also worked to allay fears, saying that the fuel in the pool is now so old that it cannot generate enough heat to start the kind of accident that would allow radioactive material to escape.

But many Japanese scoff at those assurances and point out that even if the building is strong enough, which they question, the jury-rigged cooling system for the pool has already malfunctioned several times, including a 24-hour failure in April. Had the outages continued, they would have left the rods at risk of dangerous overheating. Government critics are especially concerned, since Tepco has said the soonest it could begin emptying the pool is late 2013, dashing hopes for earlier action.

"The No. 4 reactor is visibly damaged and in a fragile state, down to the floor that holds the spent fuel pool," said Hiroaki Koide, an assistant professor at Kyoto University's Research Reactor Institute and one of the experts raising concerns. "Any radioactive release could be huge and go directly into the environment."

Senator Ron Wyden, Democrat of Oregon, expressed similar concerns during a trip to Japan last month.

The fears over the pool at Reactor No. 4 are helping to undermine assurances by Tepco and the Japanese government that the Fukushima plant has been stabilized, and are highlighting how complicated the cleanup of the site, expected to take decades, will be. The concerns are also raising questions about whether Japan's all-out effort to convince its citizens that nuclear power is safe kept the authorities from exploring other — and some say safer — options for storing used fuel rods.

"It was taboo to raise questions about the spent fuel that was piling up," said Hideo Kimura, who worked as a nuclear fuel engineer at the Fukushima Daiichi plant in the 1990s. "But it was clear that there was nowhere for the spent fuel to go."

The worst-case situations for Reactor No. 4 would be for the pool to run dry if there is another problem with the cooling system and the rods catch fire, releasing enormous amounts of radioactive material, or for fission to

restart if the metal panels that separate the rods are knocked over in a quake. That would be especially bad because the pool, unlike reactors, lacks containment vessels to hold in radioactive materials. (Even the roof that used to exist would be no match if the rods caught fire, for instance.)

There is considerable disagreement among scientists over whether such catastrophes are possible. But some argue that whether the chances are small or large, changes should be made quickly because of the magnitude of the potential calamity.

Senator Wyden, whose state could lie in the path of any new radioactive plumes and who has studied nuclear waste issues, is among those pushing for faster action. After his recent visit to the ravaged plant, he said the pool at No. 4 poses "an extraordinary and continuing risk" and the retrieval of spent fuel "should be a priority, given the possibility of further earthquakes."

Attention has focused on No. 4's spent fuel pool because of the large number of assemblies filled with rods that are stored at that reactor building. Three other reactor buildings at the site are also badly damaged, but their pools hold fewer used assemblies.

According to Tepco, the pool at the No. 4 reactor, which was not operating at the time of the accident, holds 1,331 spent fuel assemblies, which each contain dozens of rods. Several thousand rods were removed from the core just three months before so the vessel could be inspected. Those rods, which were not fully used up, could more easily support chain reactions than the fully spent fuel.

While Mr. Koide and others warn that Tepco must move more quickly to transfer the fuel rods to a safer location, such transfers have been greatly complicated by the nuclear accident. Ordinarily the rods are lifted by giant cranes, but at Fukushima those cranes collapsed during the series of disasters that started with the earthquake and included explosions that destroyed portions of several reactor buildings.

Tepco has said it will need to build a separate structure next to Reactor No. 4 to support a new crane.

The presence of so many spent fuel rods at Fukushima Daiichi highlights a quandary facing the global nuclear industry: how to safely store — and eventually recycle or dispose of — spent nuclear fuel, which stays radioactive for tens of thousands of years.

In the 1960s and 1970s, recycling for reuse in plants seemed the most promising option to countries with civilian nuclear power programs. And as Japan expanded its collection of nuclear reactors, local communities were told not to worry about the spent fuel, which would be recycled.

The idea of recycling fell out of favor in some countries, including the United States, which dropped the idea because it is a potential path to nuclear weapons. Japan stuck to its nuclear fuel cycle goal, however, despite leaks and delays at a vast reprocessing plant in the north, leading utilities to store a growing stockpile of spent fuel.

As early as the 1980s, researchers, including those at the United States Nuclear Regulatory Commission, started warning of the risks of storing growing amounts of nuclear fuel in pools. The United States has since concluded that densely packed pools are safe enough, but Tepco says that it never even specifically studied the risks posed by the pools.

"Japan did not want to admit that the nuclear fuel cycle might be a failed policy, and did not think seriously about a safer, more permanent way to store spent fuel," said Tadahiro Katsuta, an associate professor of nuclear science at Tokyo's Meiji University.

The capacity problem was particularly pronounced at Fukushima Daiichi, which is among Japan's oldest plants and where the oldest fuel assemblies have been stored in pools since 1973.

Eventually, the plant built an extra fuel rod pool, despite suspicions among residents that increasing capacity at the plant would mean the rods would be stored at the site far longer than promised. (They were right.)

Tepco also wanted to transfer some of the rods to sealed casks, but the community was convinced that it was a stalling tactic, and the company loaded only a limited number of casks there.

The casks, as it turns out, were the better choice. They survived the disaster unscathed.

Hiroko Tabuchi reported from Tokyo, and Matthew L. Wald from Washington.

http://www.eurekalert.org/pub_releases/2012-05/uop-tc052512.php

T cells 'hunt' parasites like animal predators seek prey, a Penn Vet-Penn Physics study reveals

T cells use a movement strategy to track down parasites that is similar to strategies that predators such as monkeys, sharks and blue-fin tuna use to hunt their prey

PHILADELPHIA - By pairing an intimate knowledge of immune-system function with a deep understanding of statistical physics, a cross-disciplinary team at the University of Pennsylvania has arrived at a surprising finding: T cells use a movement strategy to track down parasites that is similar to strategies that predators such

as monkeys, sharks and blue-fin tuna use to hunt their prey. With this new insight into immune-cell movement patterns, scientists will be able to create more accurate models of immune-system function, which may, in turn, inform novel approaches to combat diseases from cancer to HIV/AIDS to arthritis.

The research involved a unique collaboration between the laboratories of senior authors Christopher Hunter, professor and chair of the Pathobiology Department in Penn's School of Veterinary Medicine, and Andrea Liu, the Hepburn Professor of Physics in the Department of Physics and Astronomy. Penn Vet postdoctoral researcher Tajie Harris and physics graduate student Edward Banigan also played leading roles in the research.

The study, which will be published in the journal Nature, was conducted in mice infected with the parasite Toxoplasma gondii. This single-celled pathogen is a common cause of infection in humans and animals; as much as a third of the world's population has a dormant form of this infection present in the brain. However, in immunocompromised individuals, such as those with HIV/AIDS or undergoing organ transplantation, this infection can have serious consequences, including brain inflammation and even death.

Earlier work had shown that T cells — a key immune-cell type — are central in preventing disease caused by T. gondii. In the new study, the Penn researchers used the infected mice as a natural model system to learn how the movement of T cells in the brain affects the body's ability to control this infection.

Among immunologists, it's widely believed that the movement of immune cells is governed in part by signaling proteins called chemokines. The Penn-led team demonstrated that a specific chemokine, CXCL10, and its receptor were abundantly produced in the brains of T. gondii-infected mice. When CXCL10 was blocked, mice had fewer T cells, a greater parasite burden and actively reproducing parasites.

Next the researchers sought to pinpoint the exact movement patterns of individual T cells in living tissue from T. gondii-infected mice. This was possible with multi-photon imaging, a technique that relies on a refined yet powerful microscope that can display living tissues in three dimensions in real time. Using this approach, the team found that CXCL10 appeared to play a role in the speed at which T cells are able to search for and control infection.

To the extent that immunologists had considered T-cell movement patterns at all, many assumed that they moved in a highly directed fashion to find infected cells. But when the researchers analyzed the movement of T cells, they found their data did not match what would be expected: the T cells showed no directed motion. That's where the statistical physics expertise of Liu and Banigan came in.

"We looked at a much more complete way to quantify these tracks and found that the standard model didn't fit at all," Liu said. "After some work we managed to find a model that did fit the tracks beautifully. The model that finally led us down the right path," Banigan said, "had a strong signature of something really interesting," a model known as a Lévy walk.

This "walk," or a mathematically characterized path, tends to have many short "steps" and occasional long "runs." The model was not fully consistent with the data, however. "Rather, I had to look at variations on the Lévy walk model," Banigan said, because the researchers also observed that the T cells paused between steps and runs. Like the movements of the cells, the pauses were usually short but occasionally long.

Hunter likened the model to a strategy a person might employ to find misplaced keys in the house.

"When you lose your keys, how do you go about looking for them? You look in one place for a while, then move to another place and look there," he said.

"What that leads to is a much more efficient way of finding things," Liu said.

And, indeed, when the team modeled the generalized Lévy strategy against other strategies, they confirmed that the Lévy walk was a more efficient technique to find rare targets. That makes sense for T cells, which have to locate sparsely distributed parasites in a sea of mostly normal tissue.

Interestingly, T cells are not alone in employing a Lévy-type strategy to find their targets. Several animal predators move in a similar way — with many short-distance movements interspersed with occasional longer-distance moves — to find their prey. The strategy seems particularly common among marine predators, including tuna, sharks, zooplankton, sea turtles and penguins, though terrestrial species like spider monkeys and honeybees may use the same approach to locate rare resources.

This parallel with animal predators also makes sense because parasites, like prey species, have evolved to evade detection. "Many pathogens know how to hide, so T cells are not able to move directly to their target," Hunter said. "The T cell actually needs to go into an area and then see if there's anything there."

The model is also relevant to cancer and other immune-mediated diseases, Hunter noted.

"Instead of looking for a parasite, these T cells could be looking for a cancer cell," he said. By knowing what controls T cell movement, "you might be able to devise strategies to make the T cells more efficient at finding those cells."

On the physics side, while the Lévy-walk model is not new, the fact that T cells pause in between their steps or runs is something that hadn't been recognized before when mapping the paths in other contexts.
"From a physics point of view, to have runs and pauses is a new model," Liu said. "Biological phenomena can illustrate what we wouldn't have thought about otherwise."
The Penn collaborators are working to plot the tracks of other cell types and credit their unique partnership for their discovery. "We've said all along that this study could only happen because [our physics colleagues] had such a great expertise and we had our own separate expertise," Tajie Harris said. "They took a chance working with us, and it turned out to be something really rewarding."
Additional Penn contributors to this study included Penn Vet's David Christian, Christoph Konradt, Elia Tait Wojno and Beena John.
The Penn team partnered on the work with Kazumi Norose of Chiba University in Japan; Emma Wilson of the University of California, Riverside; Wolfgang Weninger of the Sydney Medical School; and Andrew Luster of Massachusetts General Hospital. The study was supported by the University of Pennsylvania, National Institutes of Health, National Science Foundation, Commonwealth of Pennsylvania, Japan Society for the Promotion of Science and Ministry of Education, Culture, Sports, Science and Technology of Japan.

http://www.eurekalert.org/pub_releases/2012-05/hu-tie052512.php

Timing is everything

Researcher shows a change in developmental timing was crucial in the evolutionary shift from dinosaurs to birds

At first glance, it's hard to see how a common house sparrow and a Tyrannosaurus Rex might have anything in common. After all, one is a bird that weighs less than an ounce, and the other is a dinosaur that was the size of a school bus and tipped the scales at more than eight tons.
For all their differences, though, scientists now say that two are more closely related than many believed. A new study, led by Harvard scientists, has shown that modern birds are, essentially, living dinosaurs, with skulls that are remarkably similar to those of their juvenile ancestors.
As reported in a May 27 paper in Nature, Arkhat Abzhanov, Associate Professor of Organismic and Evolutionary Biology and Bhart-Anjan Bhullar, a PhD student in Abzhanov laboratory and the first author of the study, found evidence that the evolution of birds is the result of a drastic change in how dinosaurs developed. Rather than take years to reach sexual maturity, as many dinosaurs did, birds sped up the clock – some species take as little as 12 weeks to mature – allowing them to retain the physical characteristics of baby dinosaurs.
"What is interesting about this research is the way it illustrates evolution as a developmental phenomenon," Abzhanov said. "By changing the developmental biology in early species, nature has produced the modern bird – an entirely new creature – and one that, with approximately 10,000 species, is today the most successful group of land vertebrates on the planet."
"The evolution of the many characteristics of birds – things like feathers, flight, and wishbones – has traditionally been a difficult problem for biologists," Mark Norell, chair of the Division of Paleontology at the American Museum of Natural History and one of the paper's co-authors, said. "By analyzing fossil evidence from skeletons, eggs, and soft tissue of bird-like dinosaurs and primitive birds, we've learned that birds are living theropod dinosaurs, a group of carnivorous animals that include Velociraptor. This new work advances our knowledge by providing a powerful example of how developmental changes played a major role in the origin and evolution of birds."
While it's clear simply from looking at the skulls of dinosaurs and modern birds that the two creatures are vastly different – dinosaurs have distinctively long snouts and mouths bristling with teeth, while birds have proportionally larger eyes and brains – it was the realization that skulls of modern birds and juvenile dinosaurs show a surprising degree of similarity that sparked the study.
"No one had told the big story of the evolution of the bird head before," Bhullar said. "There had been a number of smaller studies that focused on particular points of the anatomy, but no one had looked at the entire picture. What's interesting is that when you do that, you see the origins of the features that make the bird head special lie deep in the history of the evolution of Archosaurs, a group of animals that were the dominant, meat-eating animals for millions of years."
To tackle the problem, the researchers turned to an unusual methodology. Using CT scanners, they scanned dozens of skulls, ranging from modern birds to theropods – the dinosaurs most closely related to birds – to early dinosaur species. By marking various "landmarks" – such as the orbits, cranial cavity and other bones in the skull – on each scan, researchers were able to track how the skull changed shape over millions of years.

"We examined skulls from the entire lineage that gave rise to modern birds," Abzhanov said. "We looked back approximately 250 million years, to the Archosaurs, the group which gave rise to crocodiles and alligators as well as modern birds. Our goal was to look at these skulls to see how they changed, and try to understand what actually happened during the evolution of the bird skull."

What Abzhanov and colleagues found was surprising – while early dinosaurs, even those closely related to modern birds, undergo vast morphological changes as they mature, the skulls of juvenile and adult birds remain remarkably similar.

"This phenomenon, where a change in the developmental timing of a creature produces morphological changes is called heterochrony, and paedomorphosis is one example of it," Abzhanov explained. "In the case of birds, we can see that the adults of a species look increasingly like the juveniles of their ancestors."

In the case of modern birds, he said, the change is the result of a process known as progenesis, which causes an animal to reach sexual maturity earlier. Unlike their dinosaurian ancestors, modern birds take dramatically less time – just 12 weeks in some species – to reach maturity, allowing birds to retain the characteristics of their juvenile ancestors into adulthood.

"This study is a prime example of the heuristic power in multidisciplinary, specimen-based, anatomical research," said Gabe Bever of NYIT's New York College of Osteopathic Medicine and a co-author of the paper. "That the mechanisms of evolutionary events millions of years old can be circumscribed with this combination of modern and fossil specimens is remarkable."

Ultimately, Abzhanov said, the way the bird skull evolved – through changes in the developmental timeline – highlights the diversity of evolutionary strategies that have been used over millions of years.

"That you can have such dramatic success simply by changing the relative timing of events in a creature's development is remarkable," he said. "We now understand the relationship between birds and dinosaurs that much better, and we can say that, when we look at birds, we are actually looking at juvenile dinosaurs."

"It shows that there's so much for evolution to act upon," Bhullar agreed. "When we think of an organism, especially a complex organism, we often think of it as a static entity, but to really study something you have to look at its whole existence, and understand that one portion of its life can be parceled out and made into the entire lifespan of a new, and in this case, radically successful organism."

Other co-authors of the paper include Jesús Marugán-Lobón, Fernancdo Racimo and Timothy Rowe contributed to the research.

http://www.sciencedaily.com/releases/2012/05/120527153643.htm

Discovery Expected to Shift Research Direction in Lupus and Asthma

Newfound details of the immune system suggest a role for never-before-considered drug classes in the treatment of allergic and autoimmune diseases, according to a University of Alabama at Birmingham study published online May 27 in Nature Immunology.

ScienceDaily - The results advance the current understanding of the way the body's initial, vague reaction to any invading organism expands into a precise and massive counterattack. That expansion starts when a dendritic cell "swallows" a piece of any invader encountered, ferries it to the nearest lymph node and presents it there for notice by lymphocytes, the workhorse cells of the immune system.

According to the current model, dendritic cells first must encounter T lymphocytes in the paracortex, or T cell zone, within the node. Only there will the interaction enable lymphocytes to expand into an army of clones primed to attack the invader.

To the research team's great surprise, the data showed that, although immune response works this way during viral flu infections, it is not always the case. When the body is infested with parasitic worms, for instance, dendritic cells link with T cells near B lymphocytes, under the control of B cell-related signals and outside the T cell zone.

"Considering that diseases from asthma to lupus can occur because the system mistakenly ramps up the same types of T cell responses it normally uses against worms, our finding that B lymphocytes control the T cell/dendritic cell interactions that trigger such responses has important, practical implications," said Frances Lund, Ph.D., chair of the UAB School of Medicine's Department of Microbiology and corresponding author. "The field now has cause to look at several experimental and existing drugs known to interrupt B cell signals as potential treatments for diseases driven by T cells."

Study details

Before joining UAB in March 2012, Lund worked alongside Tim Mosmann, Ph.D., at the University of Rochester Medical Center. In 1986 Mosmann advanced his groundbreaking theory on the way the immune system decides which sets of immune cells are most effective against different invader types. According to his

Th1/Th2 model, Th1 T helper cells were best against viruses because they helped invaded human cells self-destruct before viruses could turn them into virus factories. Th2 helper T cells were best against parasites because they helped the B cells mass produce antibodies that glommed onto and removed worms from the spaces between cells.

The current study found that B cells, as part of the Th2 response to worms, start pumping out a protein called lymphotoxin, which in turn signals nearby stromal cells to produce more of the chemokine CXCL13.

B cells are able to gather in B cell areas of lymph nodes in the first place because they express CXCR5 receptor proteins that sense and move toward higher concentrations of CXCL13. The team discovered that a set of dendritic cells also begins expressing CXCR5 during a worm infection.

With B cells and activated dendritic cells gathered near B cells, T helper cells next must join the party if the immune response is to expand. While T cells dump into lymph nodes at many points, only those that happen to enter near B cells, and to bump into CXCR5-expressing dendritic cells, drive the response to worms forward, according to the authors.

The authors also believe such interactions trap T cells near the B cell area and that proximity determines the kind of cells they becomes next. Those receiving the strongest signals become the T helper follicular cells that B cells must partner with to produce antibodies specific to the current pathogen. Those getting weaker signals become Th2 effectors that travel back to the infection site to cause the histamine release and intestinal muscle contractions that help to expel worms.

Though vital to effective immune responses to worms, T helper follicular cells and Th2 cells have a dark side. For example, T helper follicular cells in some cases inappropriately help B cells produce high affinity "auto" antibodies that recognize the body's own cells as foreign and can destroy the kidneys of lupus patients and the joints of patients with rheumatoid arthritis.

In other cases, Th2 cells respond to allergens in the lung like house dust mites because the mites look like worms to the immune system and the confused Th2 cells respond to the allergen as they would to a worm. This mistaken recognition causes histamine release and bronchoconstriction in the lungs, two of the major clinical symptoms of asthma.

"We know of experimental biologics that interrupt the ability of B cells to give off lymphotoxin and prevent the development of helper Th2 cells and T helper follicular cells," Lund said. "Could such antibody-based treatments be useful against some autoimmune diseases and asthma? We think so, but time and further studies will tell."

Along with Lund, Troy Randall, Ph.D., the Claude Bennett Scholar in the UAB Department of Medicine's Division of Clinical Immunology and Rheumatology, and UAB post-docs Beatriz León, Ph.D., and André Ballesteros-Tato, Ph.D., made major contributions to the work. Also making important contributions were Jeffrey Browning at Biogen Idec and Robert Dunn at the Pfizer Centers for Therapeutic Innovation (formerly at Biogen Idec). The study was supported by the National Institute of Allergy and Infectious Diseases.

Beatriz León, André Ballesteros-Tato, Jeffrey L Browning, Robert Dunn, Troy D Randall, Frances E Lund. Regulation of TH2 development by CXCR5 dendritic cells and lymphotoxin-expressing B cells. Nature Immunology, 2012; DOI: 10.1038/ni.2309