

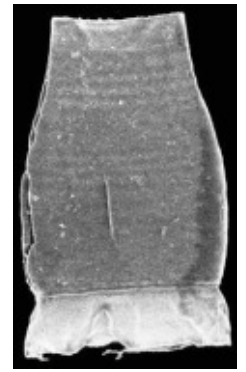
Modern Earth - 460 Million Years Ago

By News Staff | August 9th 2010 07:34 PM

A team of scientists say they have reconstructed the Earth's climate belts of the late Ordovician Period, between 460 and 445 million years ago, and their study says these ancient climate belts were surprisingly like those of the present.

The team of scientists looked at the global distribution of fossils called chitinozoans – probably the egg-cases of extinct planktonic animals – before and during this Ordovician glaciation, and found a pattern that revealed the position of ancient climate belts, including such features as the polar front, which separates cold polar waters from more temperate ones at lower latitudes.

*Specimen of the chitinozoan species **Armoricochitina nigerica** (length = c. 0.3mm). Chitinozoans are microfossils of marine zooplankton in the Ordovician. Their distribution allows to track climate belts in deep time, much in a way that zooplankton has been used for climate modeling in the Cenozoic. **A. nigerica** is an important component of the Polar Fauna during the late Ordovician Hirnantian glaciation. Credit: University of Leicester*



The position of these climate belts changed as the Earth entered the Ordovician glaciation – but in a pattern very similar to that which happened in oceans much more recently, as they adjusted to the glacial and interglacial phases of our current (and ongoing) Ice Age.

The researchers write, "The world of the ancient past had been thought by scientists to differ from ours in many respects, including having carbon dioxide levels much higher – over twenty times as high – than those of the present. However, it is very hard to deduce carbon dioxide levels with any accuracy from such ancient rocks, and it was known that there was a paradox, for the late Ordovician was known to include a brief, intense glaciation – something difficult to envisage in a world with high levels of greenhouse gases."

The 'modern-looking' pattern suggests that those ancient carbon dioxide levels could not have been as high as previously thought, but were more modest, at about five times current levels. They would have had to be somewhat higher than today's, because the sun in those far-off times shone less brightly.

"These ancient, but modern-looking oceans emphasise the stability of Earth's atmosphere and climate through deep time – and show the current man-made rise in greenhouse gas levels to be an even more striking phenomenon than was thought," the researchers conclude.

Crocodile Fossil Reveals Teeth of a Mammal

By SINDYA N. BHANOO Published: August 9, 2010

Modern crocodiles have conical teeth they use to grab at prey. Sometime the crocodiles rip off pieces of flesh from their prey, and sometimes they swallow their victims whole. They do not, however, chew their food, as humans and many other mammals do.



The fossil of a crocodile the size of a house cat was found in Tanzania. Patrick O'Connor/Ohio University

But crocodiles that lived 144 million years ago, during the Cretaceous period, had the dental structure to allow for chewing, scientists report in the journal Nature. The researchers say they discovered a virtually complete skull and skeleton of such a crocodile in southwestern Tanzania.

"It has a very mammalianlike dental organization," said Patrick M. O'Connor, a paleontologist at Ohio University and the study's lead author. "What really blew us away were the molarlike teeth in the back of the jaw, with a series of crests and troughs that actually interlocked to help the crocodile eat food."

The crocodile, known as Pakasuchus, was much smaller than today's version. An adult was about the size of a house cat, with a head less than three inches long.

Pakasuchus is one of several species of crocodiles from the time period thought to have a mammalian dental structure. The crocodiles lived in Gondwana, a landmass that included present-day Africa, Antarctica, Australia, India and South America. Fossils of other crocodile species have been found in Africa and South America, but the new fossil is the most complete piece to date, Dr. O'Connor said.

The crocodiles became extinct probably around 65 million years ago, at the end of the Cretaceous.

Water on Moon Unlikely, a New Study Indicates

By SINDYA N. BHANOO Published: August 9, 2010

In the long discussion of water on the Moon, a new study contradicts some recent reports that say the Moon had water at the time of its formation. A group of researchers reports in the journal Science that when the Moon was created, some 4.5 billion years ago, there was not much hydrogen on it, and therefore no water.

The researchers determined this by analyzing chlorine isotopes found in lunar rock samples from Apollo missions. The range of chlorine isotopes in lunar samples was 25 times that found in samples from Earth.

If the Moon had significant levels of hydrogen, as Earth did, this range would have been far less, said Zachary D. Sharp, a scientist in the Department of Earth and Planetary Sciences at the University of New Mexico and the study's lead author.

The chlorine would have bonded with hydrogen, forming compounds like hydrogen chloride, and escaped from the Moon's surface, he said. The abundance of chlorine points to a lack of hydrogen and water. "The amount of water on the Moon was way too low for life to have ever possibly have existed there," he said.

Most scientists believe the Moon was formed when a large object struck Earth, breaking off a chunk that has since orbited Earth. On Earth, goes one theory, water was released as steam from molten basalts over time, eventually forming bodies of water.

"An understanding of whether the Moon was dry or wet will help us understand how water appeared on Earth," Dr. Sharp said.

The Claim: Smoking Relieves Stress

By ANAHAD O'CONNOR Published: August 9, 2010

THE FACTS The benefits of quitting smoking — reduced risk of cancer and many other health problems — are known. But for millions of smokers, the calming effect of a cigarette can be reason enough to start up again. Studies have found, however, that in reality, lighting up has the opposite effect, causing long-term stress levels to rise, not fall. For those dependent on smoking, the only stress it relieves is the withdrawal between cigarettes.

In a recent study conducted at the London School of Medicine and Dentistry, researchers looked at 469 people who tried to quit after being hospitalized for heart disease. At the start, the subjects had similar levels of stress and generally believed that smoking helped them to cope.

A year later, 41 percent had managed to stay abstinent. After controlling for several factors, the scientists found that the abstainers had "a significantly larger decrease in perceived stress," roughly a 20 percent drop, compared with the continuing smokers, who showed little change.

The scientists' hypothesis was that the continuing smokers were dealing with uncomfortable cravings between cigarettes multiple times a day, while the abstainers, after facing some initial withdrawal, had greater freedom from nicotine cravings and thus had eliminated a frequent and significant source of stress.

Other studies have also found that smokers experience higher levels of stress and tension between cigarettes and lower levels over all when they quit.

THE BOTTOM LINE The calming effect of a cigarette is a myth, at least in the long term.

Climate change 'partly to blame' for sweltering Moscow

By Katia Moskvitch Science reporter, BBC News

Global climate change is partly to blame for the abnormally hot and dry weather in Moscow, cloaked in a haze of smoke from wildfires, say researchers.

The UK Met Office said there are likely to be more extreme high temperatures in the future.

Experts from the environmental group WWF Russia have also linked climate change and hot weather to raging wildfires around the Russian capital. Meteorologists say severe conditions may linger for several more days.

The Moscow health department said earlier that the number of people dying daily in the city had reached about 700 - twice the usual number.

Jeff Knight, a climate variability scientist at the UK Met Office, attributed the situation in Moscow to a number of factors, among them greenhouse gas concentrations, which are steadily rising.

The recent El Nino, a climate pattern that occurs across the tropical Pacific Ocean and affects weather around the world, and local weather patterns in Russia may have also contributed to this summer's abnormal conditions.

"The Russian heatwave is related to a persistent pattern of circulation drawing air from the south and east (the very warm steppes)," said Dr Knight.

"Circulation anomalies tend to create warm and cool anomalies: while it has been very hot in western Russia, it has been cooler than average in adjacent parts of Siberia that lie on the other side of the high pressure system where Arctic air is being drawn southwards.

"Some long-term records have been broken - for example the highest daily temperature in Moscow. We expect more extreme high temperatures as the climate changes. This means that when weather fluctuations promote high temperatures... there is more likelihood of records being broken."

The head of the climate and energy programme at WWF Russia, Alexei Kokorin, said the abnormal temperatures soaring to up to 40C increased the likelihood of wildfires around the capital.

And though this summer in Moscow had proven harsh for people and animals alike, it was possible that temperatures would continue to rise over the years to come, he warned.

"We have to get ready to fight such fires in the future because there is a great possibility that such a summer will be repeated. This tendency won't stop in the coming 40 years or so, until the greenhouse gas emissions are

reduced," he said. "In a few decades, fires may affect the main forest regions of Russia. Of course, there are a lot less people living there, but we could lose a lot more forests.

"We can now say that the wave of abnormal phenomena that the rest of the world has been experiencing has finally reached central Russia," Dr Kokorin added.

Temperatures have been record-high for weeks and smoke from wildfires has driven airborne pollutants levels to the worst ever recorded in the capital and the Moscow region.

Besides people suffering and entire villages burnt down, Russian wildlife has been hit hard as well.

Greenpeace Russia has criticised the Russian authorities for poor handling of the catastrophe, and mainly for abolishing a centralised woodland fire control system several months ago. Environmentalists say the number of personnel employed to spot wildfires has been slashed by over a half.

This has greatly contributed to the massive loss of forests and wildlife around the capital, Mikhail Kreyndlin, head of Greenpeace Russia's programme on specially protected natural areas, told BBC News. "If bigger animals are able to escape the fires, smaller ones, including insects, have perished," he said.

Smog has also been a major issue, he added, especially for birds.

"Birds have very intensive breathing, and such extreme levels of air pollutants have definitely affected them," he said, explaining that it was possible for birds to basically drop dead from the skies.

Dr Kokorin said global warming creates another problem. "If it gets warmer in the winter and in the spring and hotter in the summer, fauna changes. "For example, we have never had as many regions in Russia affected by malaria, and the same goes for ticks carrying encephalitis. This is because winters are becoming much warmer, and less and less of these organisms die during the freezing periods."

There have also been reports of freshwater jellyfish, commonly found in warm lakes and rivers in North America, Europe and Asia, fished out from the abnormally warm waters of the Moscow river.

DNA Test May Speed Colon Cancer Diagnosis

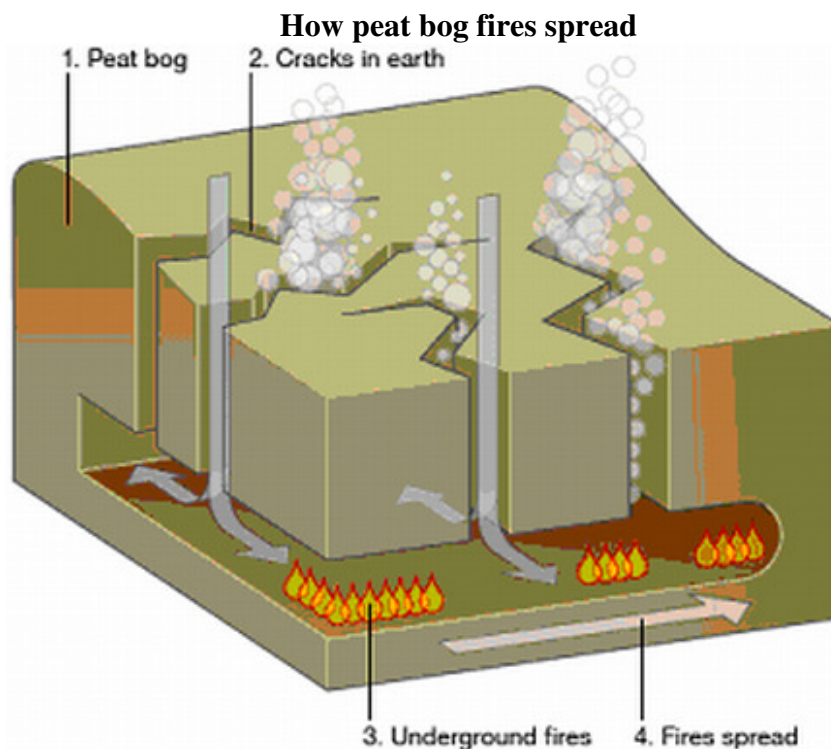
By NICHOLAS WADE Published: August 9, 2010

A new generation of DNA tests for colon cancer seems likely to improve the detection both of cancers and of the precancerous polyps that precede them. The tests, if validated, could reduce the burden of disease substantially by detecting tumors at an early stage, including those not picked up by a colonoscopy.

Colorectal cancers tend to grow slowly and are easily removed if caught early. But many people over 50 do not comply with the recommendation to have a colonoscopy - a time-consuming procedure in which a tube is threaded up the intestine - and even colonoscopies do not catch everything. Colorectal cancer has become the second most common cancer in the United States; each year it causes more than 50,000 deaths and costs about \$14 billion to treat.

Colon tumors provide considerable evidence of their presence by shedding blood and cells that are detectable in the stool. Tests for blood have reduced deaths from colorectal cancer only modestly, because they are not very sensitive to precancerous polyps, the stage at which cancer is best prevented.

Researchers turned to measuring mutations in DNA after Dr. Bert Vogelstein of Johns Hopkins University discovered the series of mutations by which a colon polyp advances to full cancer. But no single mutation predicts a patient's risk, and the mutation tests, though more accurate than the blood tests, have not been a decisive improvement.



- 1. Peat is formed from decayed vegetation in bogs, moors or swamps.**
- 2. Deliberate drainage or drought can expose peat to air.**
- 3. Peat can then be ignited by wildfires or spontaneously combust. The air flow allows the peat to continue burning.**
- 4. Once alight, the smouldering fire spreads slowly through the peat and can cause the ground above to collapse.**

By 2004 it was clear that looking for the Vogelstein mutations was “neat biology but not a home run,” said Dr. David Ransohoff, an expert on colon cancer screening at the University of North Carolina.

A new generation of tests being developed depends on a different process in cancer cells. All cells switch off the genes they do not need by attaching small chemicals called methyl groups to certain sites along their DNA. In cancer cells, there is generally less methylation than usual, except for certain regions of DNA where the methylation process is taken to excess, perhaps because the cells need to shut down tumor suppressor genes. These and other genes are highly methylated in colon tumors and other kinds of cancer.

Exact Sciences, a company based in Madison, Wis., is developing a colon cancer test based on highly methylated DNA. Its researchers reported last month that by testing for methylated DNA at four markers, pieces of DNA drawn from specific genes, they could detect colon tumors and polyps, distinguishing them from normal tissue with 100 percent sensitivity and with no false positives.

The tests of methylated DNA were performed directly on tumors and are expected to be less accurate in the real world, in which they would have to work in stool samples. Almost all of the DNA in stool is from bacteria, and the methylated DNA is a fraction of the 0.01 percent that is human DNA.

Still, Kevin T. Conroy, chief executive of Exact Sciences, said he expected that the four-marker test, when applied to stool samples, would detect at least half of all precancerous polyps and 85 percent of actual cancers. Results of a trial now under way in 1,600 patients will be reported in October, he said.

The test would cost less than \$300, and samples could be collected at home. Patients would be advised to take the test every three years. People with a positive result would then have a colonoscopy to verify and remove any polyps, with the result that colonoscopies could be focused on high-risk patients instead of the population at large.

Exact Sciences’ test is based on work by Dr. Vogelstein, Dr. Sanford Markowitz at Case Western Reserve University and Dr. David A. Ahlquist of the Mayo Clinic. Dr. Ahlquist, who is a scientific adviser to the company, identified some of the highly methylated genes the company is testing as markers for colon cancer.

Dr. Ahlquist said that if the test worked as well as hoped on stool samples, “this will be the first noninvasive test that will reliably detect malignant lesions.” Cervical cancer has been virtually eliminated by the Pap test, he said, and “we feel that colon cancer could be eliminated to the same extent.”

The four-marker test can pick up a kind of precancerous tissue called a serrated polyp which is often missed by colonoscopies, Dr. Ahlquist said. It also ignores most innocuous small polyps.

Using different sets of four markers, other kinds of cancer can be detected. “We can detect all of the cancers above the colon — pancreas, esophagus, stomach, bile duct,” Dr. Ahlquist said. Thus in principle, all the cancers of the gastrointestinal tract, which account for nearly a quarter of all cancer deaths in the United States, should be detectable from stool samples.

Dr. Vogelstein said tests for DNA mutations would be better in theory than tests for DNA methylation because “mutations are entirely specific and they are what is driving the tumor”; the methylation is less causative and increases naturally with age.

But the DNA methylation tests are promising in principle, he said, and it seems feasible for Exact Sciences to get a sensitivity of better than 90 percent and a false positive rate of only 5 to 10 percent. “We can tolerate 5 to 10 percent false positives because those people will just get colonoscopies,” he said.

For cancers above the colon, there are many enzymes that digest DNA, so whether such cancers can be detected efficiently can be answered only with experiments, Dr. Vogelstein said. And false positives would be more of a problem, since for these cancers there is no easy verification method like colonoscopy. “That’s when these false positives really start to be the devil,” he said.

Dr. Ransohoff said the Exact Sciences test was still at a preliminary point. “This is neat and it’s promising,” he said. “But we’ve been down this road before and we need to be hopeful without being carried away.”

Portuguese Scientists Discover An Extraordinary New Type Of White Blood Cell

By Catarina Amorim | August 10th 2010 11:53 AM

One of the biggest challenges of transplants is the need to suppress the immune response - so the new organ is not rejected - while keeping it strong enough to be able to fight all kinds of disease. As the high numbers of rejected organs show, this is a tricky balance. But a discovery by Maria Monteiro and Luis Graça, two Portuguese scientists, could help solving the problem, at least in the liver. They have found a new type of white blood cell – baptised NKTreg (reg from regulatory) – that, remarkably, once activated, migrate into this organ where it suppress any immune response in its vicinity (but not elsewhere). The implications of the discovery are not limited to liver transplant as, once these cells create an “immune tolerant organ”, we can graft any type of tissue or express any gene that the body might need into it, knowing that it would be safe from the IS. The

potential of NTreg cells is such, that a patent by Monteiro and Graça for the production and therapeutic use of these cells in humans has already been accepted.

Controlling an unwanted immune response, whether to stop organ rejection after a transplant or for the treatment of autoimmune diseases – in which an abnormal IS attacks the own body- can be tricky. At the moment there are two types of approaches: general immunosuppression or, alternatively, deletion of entire “arms” of the IS. Both methods require a difficult equilibrium between stopping the damaging immune response and keeping patients’ immuno-competent, and both carry potentially serious side effects. Most recent therapies fall in the second approach, working by deleting a particular type of cell or protein (an “arm” of the IS) at the core of the immune response we want to stop. While these deletions can be extraordinarily effective – thousands of lives have already been rescued from pain and disability– unfortunately, they do not seem to work for long, probably because the IS adapts and brings other cells and proteins to do the job of the lost “arm”. While this is not a problem for pharmaceutical companies that can go on developing new and even more expensive drugs, to patients it means a life of constant uncertainty and many potential problems– will the next new drug be effective, will it stop working, will then be yet another drug ready, what about side effects?

The truth is that this kind of approaches is a far cry from the personalised, or at least very specific, 21st century medicine that society aims, and new and better treatments need to be found.

It is in this context that a family of white blood cells called regulatory T cells has been hailed as “next big thing”. Shown to suppress immune responses and part of the body’s mechanisms to stop undesired immune responses, these cells could be key to more specific treatments while are also less prone to be “overridden” by the body control mechanisms. And in fact, human trials, using them in transplants, are already under way, but much about them still needs to be understood. Meanwhile another family of white blood cells - called NKT cells - has also come to the attention of scientists when shown to protect mice from several autoimmune diseases, including diabetes and autoimmune encephalomyelitis (EAE) - the animal equivalent of multiple sclerosis

To try to understand better the potential of NKT cells Marta Monteiro, Luis Graça and colleagues at the Instituto de Medicina Molecular, University of Lisbon and the Instituto Gulbenkian de Ciência in Oeiras, Portugal they studied mice protected from EAE by NKT cells injection (like shown by other groups). In them they looked into the lymph nodes draining the brain – the logic being that, since EAE affects the brain, any protective cells should be found in the lymph nodes closer to this organ. To their surprise they discovered a new population of NKT cells that expressed the molecule Foxp3. Until now Foxp3 was thought to only exist in regulatory T cell where is believed to be behind the immunosuppressive capabilities of these cells. When these new NKT cells were further analysed they showed to be a mix of NKT and regulatory T cells – while conserving the characteristics of the first they also had many receptors of the latter and, like them, when activated in the presence of a molecule called TGFbeta they express Foxp3 expression and show immunosuppressive abilities. As result, Monteiro and Graça named these new discovered white blood cells NKTreg cells.

But how do these cells act when in the body? To answer this question, after activating NKT cells to become NKTreg (so Foxp3 positive) and tag them with a fluorescent marker so they could be easily traced, Monteiro and Graça injected the (suppressive) cells back into mice. Remarkably these cells homed straight to the liver – in contrast with regulatory T cells that go to all lymphoid organs; spleen, lymph nodes, etc - suggesting that in normal conditions NKTreg cells could perform some important immunosuppressive role in this organ.

The implications of this discovery are important and many. In liver transplants although success rate has increased substantially the odds that the organ will survive up to 15 years remain around 58%, with as many as 10-15% of patients experiencing organ rejection before the end of the first year. Not only that, but current immunosuppression therapies are costly and affect patients’ life expectancy by putting them at higher risk of cancer and mortal infections. NKTreg cells – if proved to function in humans, and Monteiro has already shown that we, at least, have them - might be the answer to these problems.

As Luis Graça explains “the liver is already the transplanted organ with higher chances of success due to its unique characteristics, by using these new cells we might be able to achieve an almost 100% organ acceptance and this without touching the remaining IS, what is remarkable. Patients might be able to survive with only a minimum dose of other immunosuppressors”.

But there are other major implications to be able to create a “bubble of tolerance” within the body. Many diseases caused by the absence of a molecule or metabolic tissue are being treated with therapies that insert replacements into the body. The problem is that the IS soon or later detects these new “parts” and destroys them. The liver is already a place where the immune system seems to be less vigilant - probably so it is not over-

activated all the time by the food and microbial molecules that come through the digestive system – add NKTreg cells to this organ and it can become the perfect place to hide anything from the IS.

Already some diabetic patients – that lack insulin to metabolise sugars – already have insulin-producing grafts on their liver, while some gene therapies, for example for the production of clotting factors in haemophilia (a disease where patients' blood does not coagulate) are already being expressed in this organ. NKTreg, if shown to work in humans, can radically improve the chances of success of these and other therapies. The potential of being able to create a contained area of immunosuppression within someone without touching the remaining immune responses elsewhere, is just immense.

But first we need to see if and how NKTreg cells work in humans, and that is exactly what Monteiro and Graça plan to do next.

CITATION: Marta Monteiro, Catarina F. Almeida, Marta Caridade, Julie C. Ribot, Joana Duarte, Ana Agua-Doce, Ivonne Wollenberg, Bruno Silva-Santos, and Luis Graca, "Identification of Regulatory Foxp3+ Invariant NKT Cells Induced by TGF-beta", Journal of Immunology 2010 doi:10.4049/jimmunol.1000359

'New' human adenovirus may not make for good vaccines, after all AdHu26 demonstrates same fault as previously studied vaccine vectors

In recent years, scientists have studied the possibility of using engineered human adenoviruses as vaccines against diseases such as HIV, tuberculosis, and malaria. In this approach, adenoviruses, which commonly cause respiratory-tract infections, are rendered relatively harmless before they are used as vectors to deliver genes from pathogens, which in turn stimulate the body to generate a protective immune response.

In a new study of four adenovirus vectors, researchers from The Wistar Institute show that a reportedly rare human adenovirus, called AdHu26, is not so rare, after all, and would thus be unlikely to be optimal as a vaccine carrier for mass vaccination. As previous research has shown, a viral vector may be ineffective if the virus it is based on is common in a given population. According to the Wistar scientists, their study also supports the use of chimpanzee adenoviruses as vaccine vectors, since humans have little exposure to these viruses. Their findings were published online, ahead of print, in the *Journal of Virology*.

"Despite previous reports to the contrary, we find that AdHu26 commonly infects people, particularly those in Sub-Saharan Africa, the very people for whom the need for novel vaccine strategies is most dire," said senior author Hildegund C. J. Ertl, M.D., Wistar professor and director of The Wistar Institute's Vaccine Center. "HIV, malaria, and other infectious diseases take a tremendous toll in the developing world, especially in Sub-Saharan Africa, and a vaccine platform that could be used in those regions could save the lives of millions."

Scientists believe that prior immunity to human adenoviruses is what led, in part, to the failure in 2007 of the STEP trial, a large vaccine trial in the US and other countries that used an adenovirus vector as the basis for an HIV vaccine.

In the current study, Ertl and her colleagues analyzed blood samples collected from people at seven sites around the world, including Thailand, the United States, and five sub-Saharan African nations. They tested the samples to see if they contained neutralizing antibodies and responsive immune cells when exposed to AdHu26 and AdHu5, the virus used in the STEP trial. Surprisingly, neutralizing antibodies to AdHu26 were very prevalent in blood.

According to Ertl, adenoviruses are still good vaccine vectors, just not necessarily human adenoviruses.

In addition to testing AdHu5 and AdHu26, the Wistar scientists also tested two adenoviruses that originated in chimpanzees, called AdC6 and AdC7. As expected, neutralizing antibodies were far less likely to be detected in human samples. Mouse studies of all four vectors demonstrated that that were similar in their ability to generate cellular immune responses.

"This study also confirms our current line of research that suggests engineered chimpanzee adenovirus vectors could be superior to related, native human adenoviruses," Ertl said. "Both human and chimpanzee adenoviruses function in similar ways, but the simple benefit is that humans are rarely exposed to adenoviruses of chimpanzee origin."

The Ertl laboratory is currently developing an HIV vaccine utilizing chimpanzee adenoviruses.

Along with senior author Ertl, co-authors from the Ertl laboratory include senior staff scientists Zhi Quan Xiang, M.D., and Xiang Zhou, M.D.; staff scientist Dongming Zhou, M.D., Ph.D.; research technician Yan Li; research assistant Ang Bian; and visiting scientists Heng Chen and Raj Kurupati, Ph.D. Co-authors also include Michael Betts, Ph.D.; Natalie Hutnick; Sally Yuan, Ph.D.; and Clive Gray, Ph.D.; of the University of Pennsylvania School of Medicine's Department of Microbiology; Jennifer Serwanga, Ph.D., of the National Institute for Communicable Diseases in South Africa; and Betty Auma, Ph.D.; and Pontiano Kaleebu, Ph.D.; of the Uganda Research Unit on AIDS in Uganda. Funding for this study was provided through grants from the National Institutes of Health.

Oldest Earth mantle reservoir discovered

Researchers discover evidence for the oldest Earth mantle reservoir on Baffin Island

Researchers have found a primitive Earth mantle reservoir on Baffin Island in the Canadian Arctic. Geologist Matthew Jackson and his colleagues from a multi-institution collaboration report the finding--the first discovery of what may be a primitive Earth mantle--this week in the journal *Nature*.

The Earth's mantle is a rocky, solid shell that is between the Earth's crust and the outer core, and makes up about 84 percent of the Earth's volume. The mantle is made up of many distinct portions or reservoirs that have different chemical compositions.

Scientists had previously concluded that the Earth was slightly older than 4.5 billion years old, but had not found a piece of the Earth's primitive mantle.

Until recently, researchers generally thought that the Earth and the other planets of the solar system were chondritic, meaning that the mantle's chemistry was thought to be similar to that of chondrites--some of the oldest, most primitive objects in the solar system. Assuming a chondritic model of the Earth, a piece of the primitive mantle would have certain isotope ratios of the chemical elements of helium, lead and neodymium.

The model that the Earth was chondritic was called into question with a discovery five years ago by a team at the Carnegie Institution of Washington, which suggested the ratio of neodymium on Earth was higher than what would be expected if the Earth were indeed chondritic.

That finding changed the neodymium ratio expected in the primitive mantle and in turn, changed where researchers should be looking to find evidence of a primitive mantle. According to the lead author, Matthew Jackson, "We had been looking under the wrong rock."

Since many of the ancient rocks have melted over time, finding a piece of the primitive mantle means studying lavas. Lavas retain the same isotopic composition of the rocks that have melted into the lava. Therefore, testing the lava's composition is identical to testing the original rock's composition.

When the assumption about the neodymium ratio was altered, Jackson and his colleagues knew they should take a look at lava samples from Baffin Island, since those samples contained the correct ratios of helium and neodymium. They discovered that the lavas also had the correct ratio for lead. The lead isotopes suggest that the samples from Baffin Island date the lava's mantle source reservoir to between 4.55 and 4.45 billion years old, only a little younger than the age of the Earth. The lava sample comes from an ancient rock that melted 62 million years ago.

When the researchers studied the composition of the lava found at Baffin Island, they discovered that the sample had the correct ratios of all three chemical elements--helium, lead, and the new non-chondritic neodymium ratio. This discovery suggests that the sample from Baffin Island is the first evidence for the oldest mantle reservoir.

This study challenges the idea that the Earth has a chondritic primitive mantle and according to Matthew Jackson is, "suggesting an alternative." One possibility, according to Jackson, is that "the early Earth went through a differentiation event and the Earth's crust was extracted from the early mantle and is now hidden in the deep earth; the hidden crust and the mantle found on Baffin Island would sum to chondritic."

This discovery will help researchers understand the composition of the original, early Earth. This research was supported by the National Science Foundation and the Carnegie Institution of Washington.

Research shows sugary drinks do not cause weight gain

New research from Queen Margaret University, Edinburgh, shows that sugary drinks, consumed in moderate quantities, do not promote weight gain, carbohydrate craving or adverse mood effects in overweight women when they do not know what they are drinking.

The study, 'Effects of sucrose drinks on macronutrient intake, body weight, and mood state in overweight women over 4 weeks', which was conducted by Marie Reid, Richard Hammersley and colleagues set out to determine the long-term effects of adding a sucrose drink to the diet of overweight women (BMI 25-30, aged 20 - 55), on dietary intake and mood. The results show that overweight women do not suffer adverse effects, such as weight gain or mood fluctuation, if they do not know whether or not they are drinking a sugary or artificially sweetened drink. Instead women took in fewer calories elsewhere in the diet, to balance the calories in the drinks.

In a single-blind, between-subjects design, soft drinks (4 x 25cl per day; 1800 kJ sucrose sweetened versus 67 kJ aspartame sweetened) were added to the diet of overweight women (n = 53, BMI 25 - 30, age 20 - 55) for 4 weeks. Participants were split into two groups and at the beginning of each week subjects took away 28 bottles of an unidentified drink for that week (4 per day). One group received sucrose (n = 24), the other aspartame (n = 29).

Subjects were instructed to consume the specified amount (25cl) each day at specified times (11:00, 14:00, 18:00, 20:00) and to rate their mood directly after the drink in their 7 day diary. Throughout the 5 week study (week 0 baseline, weeks 1 – 4 experimental), participants were also instructed to eat, drink and exercise as usual. At screening and each subsequent week thereafter, subjects' food diaries were checked and biometric data were obtained.

Mean daily energy intake at baseline (week 0) was 9126.36 kJ (SD 306.28), so the added drinks comprised some 20% of daily energy intake (1,800 kJ). Throughout the study, it was found that the mean increase in energy intake of those taking sucrose drinks between baseline week and week 1 was only 0.5 MJ, and by week 4 participants were consuming no more energy than at baseline. Across both groups it was found that some women in both groups lost, or gained weight, but it was found that there was no consistent trend for sucrose to influence this.

These findings suggest that because it is widely believed that sugary drinks are bad and part of an unhealthy diet, people then go on to behave accordingly. The primary causes of any negative effects of sugar on food choices and mood, may be psychological, and Prof Marie Reid, Professor of Applied Psychology at Queen Margaret University concludes: "Widespread publicity about the supposed harmful effects of sugar may make such effects more likely, as believing sugar to be harmful may encourage negative emotions after eating sugary food and lead to the abstinence violation effect. In other words, knowing that you're drinking sugary drinks, while believing that they're harmful, might result in the derailing of a generally healthy low-fat diet".

"Sugar in moderation plays a neutral role in the balanced diet, but an emotionally charged role in the psychology of food choice," she added.

The new research is published in the August issue of the journal *Appetite*, and replicates a previous study conducted by Reid in 2007, with normal weight women. The results substantiate those of the earlier study and show that women reduced their voluntary energy intake when the sucrose drinks were added to the diet. By the final week of the study, women had reduced their total energy intake back to baseline levels.

Russian Fires Raise Fears of Radioactivity

By MICHAEL SCHWIRTZ

MOSCOW — As if things in Russia were not looking sufficiently apocalyptic already, with 100-degree temperatures and noxious fumes rolling in from burning peat bogs and forests, there is growing alarm here that fires in regions coated with fallout from the Chernobyl nuclear disaster 24 years ago could now be emitting plumes of radioactive smoke.

Several fires have been documented in the contaminated areas of western Russia, including three heavily irradiated sites in the Bryansk region, the environmental group Greenpeace Russia said in a statement released Tuesday. Bryansk borders Belarus and Ukraine.

"Fires on these territories will without a doubt lead to an increase in radiation," said Vladimir Chuprov, head of the energy program at Greenpeace Russia. "The smoke will spread and the radioactive traces will spread. The amount depends upon the force of the wind."

Officials from Russia's federal forest protection service confirmed that fires were burning at contaminated sites on Tuesday, and expressed fears that lax oversight as a result of recent changes in the forestry service could increase the chances that radioactive smoke would waft into populated areas.

It is unclear what health risks the radiation could pose, or to what extent radioactive particles have spread in the weeks that wildfires have been raging throughout Russia, consuming villages and blanketing huge tracts with thick smoke.

The danger comes from radioactive residue still coating large areas of Ukraine, Belarus and Russia, years after the explosion of Reactor No. 4 at the Chernobyl nuclear power plant on April 26, 1986, in what was then the Soviet republic of Ukraine.

"The Chernobyl catastrophe occurred and these areas were littered with radioactive fallout," said Aleksandr Nikitin, director of the St. Petersburg office of Bellona, an international environmental group.

"This contaminated the trees and the grass," he said. "Now, when there is a fire and when all of this burns, all of this radioactivity, together with smoke, comes out and spreads to other territories, including populated areas where people breathe it in as smog."

Russia's emergency minister, Sergei K. Shoigu, warned last week that the fires could release radioactive particles.

But with the government coming under criticism for its handling of the fires, which have left more than 50 dead and caused tens of millions of dollars in damage, little official information has been made available about the radioactive threat.

Responding to the Greenpeace statement on Tuesday, Dr. Gennadi G. Onishchenko, Russia's chief sanitary doctor, played down the danger.

"There is no need to sow panic," he told the Interfax news agency. "Everything is fine."

Dr. Onishchenko and other officials have already come under fire for appearing to cover up information on above-average mortality rates resulting from the high temperatures and heavy smoke. On Monday, Moscow's chief health official announced that the death rate had doubled in the capital because of the heat.

Russia has a history of whitewashing potentially embarrassing national disasters, a lingering legacy of the Soviet era. It took days for the Soviet government to inform its people of the Chernobyl explosion, leaving thousands unknowingly exposed to deadly radiation.

No one is saying that the radioactive fallout from the fires could reach the magnitude of the Chernobyl disaster. Scientists have known for years that fires in the contaminated zones have the potential to spread radioactive materials in small amounts.

The forest protection service has identified seven regions where dozens of fires have been burning in contaminated zones, with attention focusing on Bryansk, one of the regions most heavily contaminated by the Chernobyl disaster.

Tool-making and meat-eating began 3.5 million years ago

By Jason Palmer Science and technology reporter, BBC News

Researchers have found evidence that hominins - early human ancestors - used stone tools to cleave meat from animal bones more than 3.2 million years ago.

That pushes back the earliest known tool use and meat-eating in such hominins by more than 800,000 years.

Bones found in Ethiopia show cuts from stone and indications that the bones were forcibly broken to remove marrow.

The research, in the journal Nature, challenges several notions about our ancestors' behaviour.



Bones from Dikika site The bones belonged to a goat-sized and a cow-sized animal

Previously the oldest-known use of stone tools came from the nearby Gona region of Ethiopia, dating back to about 2.5 million years ago. That suggests that it was our more direct ancestors, members of our own genus Homo, that were the first to use tools.

But the marked bones were found in the Dikika region, with their age determined by dating the nearby volcanic rock - to between 3.2 million and 3.4 million years ago.

A battery of tests showed that the cuts, scrapes and scratches were made before the bones fossilised, and detailed analysis even showed that there were bits of stone lodged in one of the cuts.

In Lucy's hands

The only hominin species known from the Dikika region at that time was Australopithecus afarensis, the species represented by the famed "Lucy" fossil, and one that is hypothesised to be a direct ancestor of Homo and therefore of us.

But Lucy and her contemporaries were thought to be vegetarians, and many had assumed that tool use arose only in later, Homo species.

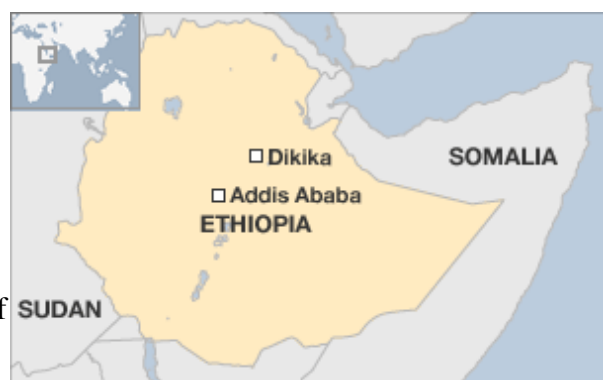
Study co-author Zeresenay Alemseged, the palaeoanthropologist from the California Academy of Sciences in San Francisco who leads a large research effort in the region, said that the find overturns much of what was thought about A. afarensis.

"For 30 years, no-one has been able to put stone tools in their hands, and we've done that for the first time," he told BBC News.

"We are showing for the first time that stone tool use is not unique to Homo or Homo-related species - we have A. afarensis now behaving like Homo in a way both by using tools and eating meat. It's another attribute that could enable us to link A. afarensis to the genus Homo."

The conclusions, however, are based on a small number of bones, and the inference of stone tool use is made indirectly: no tools were actually found at the site. That means it remains unclear if A. afarensis actually made the tools from larger bits of stone, or simply used sharpened fragments that were found.

'Big story'



Both Alemseged and Shannon McPherron, an archaeologist from the Max Planck Institute of Evolutionary Anthropology in Leipzig, Germany, and lead author of the study, say that the next task is to return to the region and keep looking for evidence to tie up the story.

They hope to establish that it was in fact *A. afarensis* that used the tools, rather than any other species that has not yet been found in the region.

"It's always hard to associate a behaviour with a particular hominin," Dr McPherron explained to BBC News.

"We're never so lucky as to find a hominin dead with the archaeology in its hand."



Analysis showed the cuts were definitely made by stone, not scavengers

But more than that, the team want to look for tools and any potential evidence of their manufacture, to find what kind of tools the *A. afarensis* butcher actually had.

The previous record-holders for oldest stone tools seemed relatively advanced, Dr McPherron explained, so experts have guessed for some time that less sophisticated tools would be found.

"What we can now think about is a fairly extended period of time when these hominins were experimenting with stone, perhaps using naturally occurring flakes," he said.

"But at some point they would've started to make their own. What we need to do is fill in that time period."

Chris Stringer of the Natural History Museum in London cautions against making firm conclusions about the development of tool use, given the limited number of artifacts from the current find.

"We have to be cautious that these are just a couple of bones with what seem to be cut marks on them; one would like to have stone tools associated with them to really clinch the case," he told BBC News.

However, he agrees that pushing the first known date of tool use back by nearly a million years is, regardless, "a big story".

"It suggests that meat-eating and butchery behaviour is pre-human - it's an ancestral behaviour and as such it gives an interesting perspective on the Australopithecines that we didn't have before," he said.

"They seemed to be vegetarian and lacking significant aspects of human behaviour, and in a sense this would bring them somewhat closer to us."

Russia Fires, Pakistan Floods Linked?

Extreme weather driven partly by global warming, experts say.

They're raging a continent apart, but two deadly natural disasters—the Russian wildfires and the Pakistan floods—may be connected by the Asian monsoon, one of the most powerful atmospheric forces on the planet, scientists say.

That's because the monsoon—a seasonal wind system that brings rain and floods to Pakistan and much of the rest of Asia in summer—also drives the circulation of air as far away as Europe, said Kevin Trenberth, a senior scientist at the Boulder, Colorado-based National Center for Atmospheric Research.

Air pumped into the upper atmosphere by monsoon winds has to come down somewhere. And with the monsoon's giant reach, much of that air seems to be settling over Russia, where it's creating high-pressure conditions, which favor heat waves, Trenberth said. Near high-pressure systems, air tends to sink, which discourages clouds from forming.

Such circulation patterns are normal, but they're also being enhanced by rising sea temperatures due in part to global warming, he added.

For instance, the northern Indian Ocean has warmed 2 degrees Fahrenheit (1.1 degrees Celsius) since the 1970s. Warmer water releases more moisture into the air, which can supercharge monsoon rains.

"The key message is that it's not just natural variability and not just global warming" but a combination of both, Trenberth said. For instance, the last months of a recent El Niño—a cyclical warming of tropical waters in the central and eastern Pacific Ocean—likely contributed to the high sea temperatures in the Indian Ocean.

He also cautioned that the monsoon link between the Russia fires and Pakistan floods is difficult to prove, since it's based on observations and interpretations of past research.

Fires, Floods, Heat: Record-Breaking Extremes in 2010

This year's fierce monsoon rains have spawned Pakistan's worst flooding in 80 years, affecting nearly 14 million people, according to the New York Times.

And in Russia, widespread fires are stoked by the worst heat wave in Russian memory. Around Moscow, choked with fire-related smog, temperatures have hovered around 100 degrees Fahrenheit (38 degrees Celsius) for weeks and show no sign of letting up soon, according to the Bloomberg news agency.

Trapping the smoke are anticyclones, atmospheric high-pressure centers that occur when monsoon winds form a stable layer of air a few thousand feet above Earth's surface.

Both Russia and Pakistan are also experiencing "remarkable" temperatures in 2010, which is shaping up to be one of the hottest years since record-keeping began in the late 1880s, Jeff Masters, director of meteorology for the Weather Underground website, told National Geographic News in July.

Nine countries have shattered heat records, including Pakistan, which on May 26 logged a mercury reading of 128.3 degrees Fahrenheit (53.5 degrees Celsius)—the highest ever seen in Asia, Masters said.

Extreme events such as heat waves, drought, and monsoon floods are believed by some scientists to be increasing with global warming, and the disasters in Russia and Pakistan may be indications of this, Rosanne D'Arrigo, a research professor at Columbia University's Lamont-Doherty Earth Observatory, said in an email. (See a world map of potential global warming impacts.)

However, D'Arrigo said, it's not possible to ascribe any one event to global warming.

Atmospheric "Logjam" Prolonging Russia Fires, Pakistan Floods

D'Arrigo added that there's a "possible relationship" between the monsoon and the fires—for instance, the Asian monsoon has been linked before in various ways to higher-latitude conditions, such as in the North Atlantic, she said.

Deke Arndt, head of the Climate Monitoring Branch of the U.S. National Oceanic and Atmospheric Administration's National Climatic Data Center, agreed it's likely that the fires can be traced back to the monsoon. He noted that the events may also be prolonged by an atmospheric "logjam" that's common in the summer but which has been unusually "stubborn and long-lasting" this year.

The blockage occurs when atmospheric winds lock climate phenomena—such as large storms or heat waves—into place for a long period of time. In the United States in the summer, for example, storms will "squat on a place and sit and spin for a week," Arndt said.

"These features, while they're strong, are also really persistent," he said. They "show up [as] day after day of rainfall in India and Pakistan ... and day after day of oppressive conditions in western Russia."

Overall, scientists often struggle to quantify how the climate fits in with such natural occurrences, Arndt said.

But the likely link between the Russian fires and the Pakistan floods "is a great example that things that happen in the atmosphere don't occur in isolation."

Over-the-counter painkiller may help ease emotional slights, UF study finds

GAINESVILLE, Fla. - Maybe that disgruntled JetBlue flight attendant should have popped a couple of Tylenols.

A University of Florida researcher says acetaminophen, an ingredient in the popular over-the-counter pain reliever, may relieve social pain from hurt feelings. The findings suggest for the first time that emotional and physical pain are interrelated, said Gregory Webster, a UF psychologist who co-authored the study with a team of researchers.

"We think that social pain piggybacks onto physical pain and the two systems sort of bleed into each other, so that just as you feel emotional distress from physical pain, the social pain of having a romance breakup or getting a horrible grade can translate into feeling sick to your stomach or getting a bad headache," he said.

In the study, to be published in the journal *Psychological Science* and available online, people who took acetaminophen daily for three weeks reported less emotional suffering over time and showed less activity in regions of the brain previously shown to respond to social rejection than those who took the placebo, Webster said. "Even so," Webster said, "we don't want to tell people to go take Tylenol to cope with their personal problems until more research is done."

The findings have the potential for acetaminophen to be used eventually to treat minor social pains instead of more powerful drugs, Webster said. Acetaminophen may also show promise in curtailing antisocial behavior, Webster said. Because research has found that being rejected triggers aggression, using acetaminophen to alleviate emotional distress could reduce the likelihood of destructive actions, he said.

"The fMRI (functional magnetic resonance imaging) results from our study show that acetaminophen diminished reactivity in regions of the brain that have been linked to emotional processing, which helps regulate aggression," he said.

The study's participants received functional magnetic resonance imaging during a computerized game of cyberball, which simulated social rejection. Each participant, accustomed to passing a ball with two computerized images of people who were ostensibly other participants, was suddenly excluded from the exchange as the others pass it back and forth, he said.

"They were not given a reason why, which made it frustrating, which is exactly what we wanted to do," Webster said. "We wanted to give them this feeling of being socially ostracized."

By random assignment, nearly half the participants, 24 women and six men, took a 500-mg pill of acetaminophen immediately after waking up each day and another 500-mg pill one hour before going to sleep, while 24 women and eight men took a placebo. Each night the participants filled out a survey to assess their level of hurt feelings during the day.

Throughout the three weeks, those who took acetaminophen reported significantly fewer hurt feelings on average than participants in the placebo group, Webster said. In addition, they showed much less activity in areas of the brain linked with emotional feelings, such as hurt and rejection, he said.

"The possibility of this link between physical and social pain systems is exciting because we live in a dualistic society where people see the mind and body as being very separate," Webster said. "In terms of public policy, it may indirectly support the notion that we should treat mental health issues the same way we treat physical health issues instead of having separate systems for the two."

The connection of mind and body to the extent that pain in one sphere can be transferred at least indirectly to another may have provided an evolutionary edge to our ancestors, he said.

Because humans have an extended infancy compared with many other animals in which they are unable to defend or feed themselves, developing social connections from an early age was crucial, Webster said. As a result, humans' social attachment system may have developed by piggybacking onto the physical pain system and becoming an outgrowth of it in order to promote survival, he said.

"Our findings have important implications because social exclusion is such a common part of life," he said. "People can feel ostracized at work, snubbed by friends, excluded by their partners or slighted in any number of situations."

Move Over Hydrogen, Make Way for Magnesium Power ***Magnesium stores about 10 times as much energy as hydrogen.***

By Gene Charleton | Thu Aug 12, 2010 08:12 AM ET

When people talk about alternative energy, hydrogen often comes up. How about magnesium? We'll see. Today, on Engineering Works! Listen to the podcast.

Magnesium is nifty stuff. Pure magnesium is a silvery metal, and you probably remember from high school chemistry that it burns with a hot white flame.

While a lot of research has already gone into using hydrogen to store energy, either directly as a fuel or as part of fuel cell systems, some researchers think we should be looking at magnesium as a way to store energy. Magnesium stores about 10 times as much energy as hydrogen. And there's enough magnesium in seawater to provide energy for 300,000 years.

Engineers at a Canadian company are working on a fuel cell that uses magnesium, air and water to produce electricity. An Israeli researcher has come up with a magnesium-based battery sort of like the rechargeable lithium-ion batteries we all know about. And a California researcher is working on a way to use magnesium to produce hydrogen for fuel.

All of this sounds good, but there's a problem. It takes a lot of energy to purify magnesium to a form we can use. Maybe more than we'd get back. One researcher in Japan thinks he has the answer: solar energy to power a laser that would give us the almost 6,700° F. heat needed. We'll see how that turns out.

Our magnesium power is somewhere in the future, so we're done. See you next time.