

<http://phys.org/news/2013-05-earth-center-sync.html>

Earth's center is out of sync

Our planet's center is out of sync with the rest of the planet, frequently speeding up and slowing down

Phys.org - We all know that the Earth rotates beneath our feet, but new research from ANU has revealed that the center of the Earth is out of sync with the rest of the planet, frequently speeding up and slowing down. Associate Professor Hrvoje Tkalčić from the ANU College of Physical and Mathematical Sciences and his team used earthquake doublets to measure the rotation speed of Earth's inner core over the last 50 years. They discovered that not only did the inner core rotate at a different rate to the mantle – the layer between the core and the crust that makes up most of the planet's interior – but its rotation speed was variable. "This is the first experimental evidence that the inner core has rotated at a variety of different speeds," Associate Professor Tkalčić said.

"We found that, compared with the mantle, the inner core was rotating more quickly in the 1970s and 1990s, but slowed down in the 80s. The most dramatic acceleration has possibly occurred in the last few years, although further tests are needed to confirm that observation.

"Interestingly, Edmund Halley, namesake of Halley's Comet, speculated that the inner shells of the Earth rotate with a different speed back in 1692."

Scientists have so far assumed the rotation rate of the inner core to be constant because they lacked adequate mathematical methods for interpreting the data, says Associate Professor Tkalčić. A new method applied to earthquake doublets – pairs of almost identical earthquakes that can occur a couple of weeks to 30 or 40 years apart – has provided the solution.

"It's stunning to see that even 10, 20 or 30 years apart, these earthquakes look so similar. But each pair differs very slightly, and that difference corresponds to the inner core. We have been able to use that small difference to reconstruct a history of how the inner core has rotated over the last 50 years," he said.

Associate Professor Tkalčić says this new method could help us understand the role of the inner core in creating the magnetic field that allowed life to evolve on Earth by acting as a shield from cosmic radiation.

"What we have developed is a very powerful way to understand the internal structure and dynamics of our planet," he said.

The research was published in Nature Geoscience.

More information: Tkalčić, H., M.K. Young, T. Bodin, S. Ngo and M. Sambridge, The shuffling rotation of the Earth's inner core, Nature Geoscience, DOI:10.1038/NGEO1813, 2013.

http://www.eurekalert.org/pub_releases/2013-05/uom-wfc051113.php

World first clinical trial supports use of Kava to treat anxiety

A world-first completed clinical study by an Australian team has found Kava, a medicinal South Pacific plant, significantly reduced the symptoms of people suffering anxiety.

The study, led by the University of Melbourne and published in the Journal of Clinical Psychopharmacology, revealed Kava could be an alternative treatment to pharmaceutical products for the hundreds of thousands of Australians who suffer from Generalised Anxiety Disorders (GAD).

Lead researcher, Dr Jerome Sarris from the Department of Psychiatry at the University of Melbourne, said GAD is a complex condition that significantly affected people's day-to-day lives. Existing medications have a modest clinical effect and new effective options were needed for patients with anxiety.

"Based on previous work we have recognised that plant based medicines may be a viable treatment for patients with chronic anxiety. In this study we've been able to show that Kava offers a potential natural alternative for the treatment of chronic clinical anxiety. Unlike some other options it has less risk of dependency and less potential for side effects," he said.

The study also found that people's genetic differences (polymorphisms) of certain neurobiological mechanisms called GABA transporters, may modify their response to Kava.

"If this finding is replicated, it may pave the way for simple genetic tests to determine which people may be likely to have a beneficial anxiety-reducing effect from taking Kava," Dr Sarris said.

During the eight-week study, 75 patients with clinically diagnosed Generalised Anxiety Disorder were given Kava or placebo, and anxiety levels were regularly assessed.

Results showed a significant reduction in anxiety for the Kava group compared to the placebo group at the end of the study.

In participants diagnosed with moderate to severe GAD, Kava had an even greater effect in reducing anxiety. Following the completion of the controlled phase, 26 per cent of the Kava group were classified as in remission from their symptoms compared to six per cent of the placebo group.

Participants in the Kava group were given tablets twice per day consisting of water-soluble extracted Kava (peeled rootstock) for a total dose of 120mg of kavalactones for the first three-week controlled phase. In cases of non-response this was increased to a double-dose twice per day for the second three-week controlled phase. Participants in the placebo group took matching dummy tablets in the same manner.

Kava was also well tolerated. Results showed no significant differences across the two groups for liver function which had previously been a concern for Kava's medicinal use. In addition there were no considerable adverse reactions that could be attributed to Kava and no difference in withdrawal or addiction between the groups.

An additional novel finding of the study, recently published in *Phytotherapy Research* was that Kava increased women's sex drive compared to those in the placebo group, believed to be due to the reduction of anxiety, rather than any aphrodisiac effect.

Future studies confirming the genetic relationship to therapeutic response, and any libido-improving effects from Kava is now required.

Dr Sarris said these significant findings are of importance to sufferers of anxiety and to the South Pacific region which relies on Kava as a major export.

The study was funded by the NHMRC and Integria Healthcare who manufacture MediHerb and Thompson's Kava products.

<http://www.scientificamerican.com/podcast/episode.cfm?id=moon-base-work-yields-cleaner-steel-13-05-12>

Moon Base Work Yields Clean Steel Process

A new method to make steel using electricity rather than flame could produce virtually no carbon emissions.

David Biello reports

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Flaming cauldrons of molten metal have long been the primary venues for steel production. But blast furnaces require a lot of coal, which means greenhouse gas pollution. In fact, worldwide, steelmaking is responsible for 5 percent of annual emissions.

But scientists working on a way to harvest oxygen from the iron oxide in lunar soil for future moon bases realized that they happened on a better way to make steel here on Earth. The trick? Produce steel the way we make aluminum: use electricity rather than flame. [Antoine Allanore, Lan Yin and Donald R. Sadoway, A new anode material for oxygen evolution in molten oxide electrolysis, in *Nature*]

To make steel the old-fashioned way, you blast iron ore with heat and purify the resulting molten metal with oxygen. The process removes carbon from the steel, but produces carbon dioxide. Making a ton of steel releases roughly two tons of CO₂ - and the world uses a lot of steel in cars, buildings and other infrastructure.

The new method involves passing a current through a molten pool of iron oxide, which drives off the originally sought-after oxygen. The by-product is steel. And depending on the source of the electricity, the process could be nearly CO₂-free. Which, as far as the atmosphere is concerned, would be very cool.

http://www.eurekalert.org/pub_releases/2013-05/uoo-get051313.php

Grammar errors? The brain detects them even when you are unaware

University of Oregon neuroscientists document unconscious processing of syntactic miscues that we miss
EUGENE, Ore - Your brain often works on autopilot when it comes to grammar. That theory has been around for years, but University of Oregon neuroscientists have captured elusive hard evidence that people indeed detect and process grammatical errors with no awareness of doing so.

Participants in the study -- native-English speaking people, ages 18-30 -- had their brain activity recorded using electroencephalography, from which researchers focused on a signal known as the Event-Related Potential (ERP). This non-invasive technique allows for the capture of changes in brain electrical activity during an event. In this case, events were short sentences presented visually one word at a time.

Subjects were given 280 experimental sentences, including some that were syntactically (grammatically) correct and others containing grammatical errors, such as "We drank Lisa's brandy by the fire in the lobby," or "We drank Lisa's by brandy the fire in the lobby." A 50 millisecond audio tone was also played at some point in each sentence. A tone appeared before or after a grammatical faux pas was presented. The auditory distraction also appeared in grammatically correct sentences.

This approach, said lead author Laura Batterink, a postdoctoral researcher, provided a signature of whether awareness was at work during processing of the errors. "Participants had to respond to the tone as quickly as they could, indicating if its pitch was low, medium or high," she said. "The grammatical violations were fully visible to participants, but because they had to complete this extra task, they were often not consciously aware of the violations. They would read the sentence and have to indicate if it was correct or incorrect. If the tone was played immediately before the grammatical violation, they were more likely to say the sentence was correct even it wasn't."

When tones appeared after grammatical errors, subjects detected 89 percent of the errors. In cases where subjects correctly declared errors in sentences, the researchers found a P600 effect, an ERP response in which the error is recognized and corrected on the fly to make sense of the sentence.

When the tones appear before the grammatical errors, subjects detected only 51 percent of them. The tone before the event, said co-author Helen J. Neville, who holds the UO's Robert and Beverly Lewis Endowed Chair in psychology, created a blink in their attention. The key to conscious awareness, she said, is based on whether or not a person can declare an error, and the tones disrupted participants' ability to declare the errors. But, even when the participants did not notice these errors, their brains responded to them, generating an early negative ERP response. These undetected errors also delayed participants' reaction times to the tones.

"Even when you don't pick up on a syntactic error your brain is still picking up on it," Batterink said. "There is a brain mechanism recognizing it and reacting to it, processing it unconsciously so you understand it properly." The study was published in the May 8 issue of the Journal of Neuroscience.

The brain processes syntactic information implicitly, in the absence of awareness, the authors concluded. "While other aspects of language, such as semantics and phonology, can also be processed implicitly, the present data represent the first direct evidence that implicit mechanisms also play a role in the processing of syntax, the core computational component of language."

It may be time to reconsider some teaching strategies, especially how adults are taught a second language, said Neville, a member of the UO's Institute of Neuroscience and director of the UO's Brain Development Lab. Children, she noted, often pick up grammar rules implicitly through routine daily interactions with parents or peers, simply hearing and processing new words and their usage before any formal instruction. She likened such learning to "Jabberwocky," the nonsense poem introduced by writer Lewis Carroll in 1871 in "Through the Looking Glass," where Alice discovers a book in an unrecognizable language that turns out to be written inversely and readable in a mirror.

For a second language, she said, "Teach grammatical rules implicitly, without any semantics at all, like with jabberwocky. Get them to listen to jabberwocky, like a child does."

The National Institute on Deafness and Other Communication Disorders of the National Institutes of Health supported the research (grant 5R01DC000128). Audio: [Study summary by Laura Batterink: http://bit.ly/13FRBmC](http://bit.ly/13FRBmC)

<http://www.scientificamerican.com/podcast/episode.cfm?id=inside-the-mind-of-a-psychopath-13-05-14>

Inside The Mind of A Psychopath

The brains of psychopaths react differently to images of someone being hurt than the brains of non-psychopaths. Christie Nicholson reports

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Psychopaths are responsible for a disproportionate amount of crime. These people are primarily identified by an extreme lack of empathy. Now a study finds that when psychopaths see images of people in pain, there's a pattern of activity in their brains that is quite different from brain activity in non-psychopaths.

Researchers tested 80 prisoners to gauge their levels of psychopathy. They then scanned the prisoners' brains using functional MRI as the prisoners were shown photos of people being intentionally hurt.

Participants who scored high in psychopathy traits, versus those who were not considered psychopaths, showed much less activation in the areas of the brain involved in emotional reactions, social behavior and decision making. The study is published in the journal JAMA Psychiatry.

Unexpectedly, when viewing the photos the psychopaths experienced significant activity in the insular cortex, which is involved in emotion and self-awareness. The researchers conjecture that the reaction may have been due to the prisoners ability to imagine themselves in pain. In a still unpublished study with other inmates, subjects were specifically told to imagine the painful event happening to someone else. In that case, those scoring high in psychopathy had a lesser reaction. The psychopath thus seems able to relate to pain - as long as it's his own.

http://www.eurekalert.org/pub_releases/2013-05/tau-tas051313.php

Texas A&M study: Prehistoric ear bones could lead to evolutionary answers

Tiny ear bones - the incus, stapes, and malleus - could provide big clues to human evolution.

COLLEGE STATION - The tiniest bones in the human body – the bones of the middle ear – could provide huge clues about our evolution and the development of modern-day humans, according to a study by a team of researchers that include a Texas A&M University anthropologist.

Darryl de Ruiter, a professor in the Department of Anthropology at Texas A&M, and colleagues from Binghamton University (the State University of New York) and researchers from Spain and Italy have published their work in the current issue of PNAS (Proceedings of the National Academy of Science).

The team examined the skull of a hominin believed to be about 1.9 million years old and found in a cave called Swartkrans, in South Africa.

Of particular interest to the team were bones found in the middle ear, especially one called the malleus. It and the other ear bones – the incus and the stapes – together show a mixture of ape-like and human-like features, and represent the first time all three bones have been found together in one skull.

The malleus appears to be very human-like, the findings show, while the incus and stapes resemble those of a more chimpanzee-like, or ape-like creature. Since both modern humans and our early ancestors share this human-like malleus, the changes in this bone must have occurred very early in our evolutionary history.



Tiny ear bones (from left) the incus, stapes, and malleus could provide big clues to human evolution. Texas A&M "The discovery is important for two reasons," de Ruiter explains. "First, ear ossicles are fully formed and adult-sized at birth, and they do not undergo any type of anatomical change in an individual lifetime. Thus, they are a very close representation of genetic expression. Second, these bones show that their hearing ability was different from that of humans – not necessarily better or worse, but certainly different.

"They are among the rarest of fossils that can be recovered," de Ruiter adds.

"Bipedalism (walking on two feet) and a reduction in the size of the canine teeth have long been held to be 'hallmarks of humanity' since they seem to be present in the earliest human fossils recovered to date. Our study suggests that the list may need to be updated to include changes in the malleus as well."

de Ruiter recently authored a series of papers in Science magazine that demonstrate the intermediate nature of the closely related species, Australopithecus sediba, and provide strong support that this species lies rather close to the ancestry of Homo sapiens. The current study could yield additional new clues to human development and answer key questions of the evolution of the human lineage.

The team's research was funded by the National Research Foundation of South Africa, and by the Ray A. Rothrock Fellowship at Texas A&M.

http://www.eurekalert.org/pub_releases/2013-05/mu-foi051313.php

From ocean to land: The fishy origins of our hips

New research has revealed that the evolution of the complex, weight-bearing hips of walking animals from the basic hips of fish was a much simpler process than previously thought.

Tetrapods, or four-legged animals, first stepped onto land about 395 million years ago. This significant change was made possible by strong hipbones and a connection through the spine via an ilium - features that were not present in the fish ancestors of tetrapods.

In a study published in the journal Evolution and Development, Dr Catherine Boisvert of the Australian Regenerative Medicine Institute at Monash University, MacQuarie University's Professor Jean Joss and Professor Per Ahlberg of Uppsala University examined the hip structures of some of human's closest fish cousins.

They found the differences between us and them are not as great as they appear - most of the key elements necessary for the transformation to human hips were actually already present in our fish ancestors.

Dr Boisvert and her collaborators compared the hip development - bones and musculature - of the Australian lung fish and the Axolotl, commonly known as the Mexican Walking Fish.

The results showed that, surprisingly, the transition from simple fish hip to complex weight-bearing hip could be done in a few evolutionary steps.

"Many of the muscles thought to be "new" in tetrapods evolved from muscles already present in lungfish. We also found evidence of a new, more simple path by which skeletal structures would have evolved," Dr Boisvert said.

The researchers found that the sitting bones would have evolved by the extension of the already existing pubis. The connection to the vertebral column could have evolved from an iliac process already present in fish.

"The transition from ocean-dwelling to land-dwelling animals was a major event in the evolution of terrestrial animals, including humans, and an altered hip was an essential enabling step," Dr Boisvert said.

"Our research shows that what initially appeared to be a large change in morphology could be done with relatively few developmental steps."

http://www.eurekalert.org/pub_releases/2013-05/du-bfl051013.php

Brain frontal lobes not sole centre of human intelligence

Human intelligence cannot be explained by the size of the brain's frontal lobes, say researchers.

Research into the comparative size of the frontal lobes in humans and other species has determined that they are not - as previously thought - disproportionately enlarged relative to other areas of the brain, according to the most accurate and conclusive study of this area of the brain.

It concludes that the size of our frontal lobes cannot solely account for humans' superior cognitive abilities. The study by Durham and Reading universities suggests that supposedly more 'primitive' areas, such as the cerebellum, were equally important in the expansion of the human brain. These areas may therefore play unexpectedly important roles in human cognition and its disorders, such as autism and dyslexia, say the researchers. The study is published in the Proceedings of the National Academy of Sciences (PNAS) today. The frontal lobes are an area in the brain of mammals located at the front of each cerebral hemisphere, and are thought to be critical for advanced intelligence.

Lead author Professor Robert Barton from the Department of Anthropology at Durham University, said: "Probably the most widespread assumption about how the human brain evolved is that size increase was concentrated in the frontal lobes. "It has been thought that frontal lobe expansion was particularly crucial to the development of modern human behaviour, thought and language, and that it is our bulging frontal lobes that truly make us human. We show that this is untrue: human frontal lobes are exactly the size expected for a non-human brain scaled up to human size.

"This means that areas traditionally considered to be more primitive were just as important during our evolution. These other areas should now get more attention. In fact there is already some evidence that damage to the cerebellum, for example, is a factor in disorders such as autism and dyslexia."

The scientists argue that many of our high-level abilities are carried out by more extensive brain networks linking many different areas of the brain. They suggest it may be the structure of these extended networks more than the size of any isolated brain region that is critical for cognitive functioning.

Previously, various studies have been conducted to try and establish whether humans' frontal lobes are disproportionately enlarged compared to their size in other primates such as apes and monkeys. They have resulted in a confused picture with use of different methods and measurements leading to inconsistent findings. The Durham and Reading researchers, funded by The Leverhulme Trust, analysed data sets from previous animal and human studies using phylogenetic, or 'evolutionary family tree', methods, and found consistent results across all their data. They used a new method to look at the speed with which evolutionary change occurred, concluding that the frontal lobes did not evolve especially fast along the human lineage after it split from the chimpanzee lineage.

http://www.eurekalert.org/pub_releases/2013-05/uoy-sut051313.php

Scientists uncover the fundamental property of astatine, the rarest atom on Earth

An international team of scientists, including a University of York researcher, has carried out groundbreaking experiments to investigate the atomic structure of astatine (Z=85), the rarest naturally occurring element on Earth.

Astatine (At) is of significant interest as its decay properties make it an ideal short-range radiation source for targeted alpha therapy in cancer treatment.

The results of the project, which was conceived by Professor Andrei Andreyev, an Anniversary Professor in the Department of Physics at the University of York, and Dr Valentine Fedosseev, from CERN, the European laboratory for nuclear physics research in Geneva, are reported in Nature Communications.

Through experiments conducted at the radioactive isotope facility ISOLDE at CERN, scientists have accessed, for the first time, the ionization potential of the astatine atom. This represents the essential quantity defining chemical and physical properties of this exclusively radioactive element.

The successful measurement fills a long-standing gap in Mendeleev's periodic table, since astatine was the last element present in nature for which this fundamental property was unknown.

As binding energy of the outermost valence electron, the atomic ionization energy is highly relevant for the chemical reactivity of an element and, indirectly, the stability of its chemical bonds in compounds.

Professor Andreyev, who moved to York from the University of the West of Scotland last year, said: "Astatine is of particular interest because its isotopes are interesting candidates for the creation of radiopharmaceuticals for cancer treatment by targeted alpha therapy. "The experimental value for astatine serves also for benchmarking the theories used to predict the atomic and chemical properties of super-heavy elements, in particular the recently discovered element 117, which is a homologue of astatine."

Astatine was discovered by D. Corson and co-workers in 1940 by bombarding a bismuth target with alpha particles. The most stable isotope of this element has a half-life time of only 8.1 hours. In 1964, McLaughlin studied a 70 ng sample of artificially produced radioactive isotopes of astatine and was first to observe two spectral lines in the UV region. Apart from this, no other data on astatine's atomic spectrum was known before the study launched at CERN's ISOLDE.

At ISOLDE, short-lived isotopes created in nuclear reactions induced by a high energy proton beam release from target material and can immediately interact with laser beams inside the hot cavity of laser ion source. Once the wavelengths of lasers are tuned in resonance with selected atomic transitions the atoms are step-wise excited and ionized due to absorption of several photons with total energy exceeding the ionization threshold. This so-called Resonance Ionization Laser Ion Source (RILIS), in combination with electromagnetic separator, supplies pure isotopic beams of different elements for many experiments performed at ISOLDE.

Among these, is a study of short-lived nuclides by in-source resonance ionization spectroscopy using a highly sensitive (below 1 isotope per second) detection of nuclear decay. Physicists from KU Leuven, Belgium developed the setup for this study. The first laser-ionized ions of astatine were observed and identified by its characteristic alpha-decay in these experiments. Also the ionization threshold of astatine was found by scanning the wavelength of ionizing UV laser.

A second phase of the study of the atomic spectrum of astatine took place at the ISAC radioactive isotope facility of the Canadian national laboratory for particle and nuclear physics TRIUMF in Vancouver, where new optical transitions in the infrared region of spectrum were found. With the newly found transitions a highly efficient three-step ionization scheme of astatine was defined and used at ISOLDE RILIS for further study of astatine spectrum.

The researchers probed the interesting region around the ionization threshold and found a series of highly excited resonances – known as Rydberg states. From this spectrum the first ionization potential of astatine was extracted with high accuracy.

Dr Fedosseev, the RILIS team leader working at CERN, said: "The in-source laser spectroscopy today is a most sensitive method to study atomic properties of exotic short-lived isotopes. For artificially produced elements, like super-heavy ones, this could be a real way to probe their spectra. The success in the study of astatine spectrum added confidence to such projects started recently at GANIL, France and at JINR, Russia."

Professor Andreyev, who joined York as one of 16 Chairs established to mark the University's 50th Anniversary in 2013, added: "This development allows several new phenomena to be investigated, such as the size (radii) of astatine nuclei, along with a very exotic type of nuclear fission. Our collaboration has recently initiated a series of experiments to reach these goals."

http://www.eurekalert.org/pub_releases/2013-05/nu-mgg051313.php

Making gold green: New non-toxic method for mining gold *Scientists launch 'nano gold rush' by replacing cyanide with cornstarch*

Northwestern University scientists have struck gold in the laboratory. They have discovered an inexpensive and environmentally benign method that uses simple cornstarch -- instead of cyanide -- to isolate gold from raw materials in a selective manner.

This green method extracts gold from crude sources and leaves behind other metals that are often found mixed together with the crude gold. The new process also can be used to extract gold from consumer electronic waste. Current methods for gold recovery involve the use of highly poisonous cyanides, often leading to contamination of the environment. Nearly all gold-mining companies use this toxic gold leaching process to sequester the precious metal.

"The elimination of cyanide from the gold industry is of the utmost importance environmentally," said Sir Fraser Stoddart, the Board of Trustees Professor of Chemistry in the Weinberg College of Arts and Sciences.

"We have replaced nasty reagents with a cheap, biologically friendly material derived from starch."

Sir Fraser's team discovered the process by accident, using simple test tube chemistry. A series of rigorous follow-up investigations provided evidence for the competitive strength of the new procedure.

The findings will be published May 14 in the online journal Nature Communications.

Zhichang Liu, a postdoctoral fellow in Stoddart's lab and first author of the paper, took two test tubes containing aqueous solutions -- one of the starch-derived alpha-cyclodextrin, the other of a dissolved gold (Au) salt (called aurate) -- and mixed them together in a beaker at room temperature.

Liu was trying to make an extended, three-dimensional cubic structure, which could be used to store gases and small molecules. Unexpectedly, he obtained needles, which formed rapidly upon mixing the two solutions.

"Initially, I was disappointed when my experiment didn't produce cubes, but when I saw the needles, I got excited," Liu said. "I wanted to learn more about the composition of these needles."

"Nature decided otherwise," said Stoddart, a senior author of the paper. "The needles, composed of straw-like bundles of supramolecular wires, emerged from the mixed solutions in less than a minute."

After discovering the needles, Liu screened six different complexes -- cyclodextrins composed of rings of six (alpha), seven (beta) and eight (gamma) glucose units, each combined with aqueous solutions of potassium tetrabromoaurate (KAuBr₄) or potassium tetrachloroaurate (KAuCl₄).

He found that it was alpha-cyclodextrin, a cyclic starch fragment composed of six glucose units, that isolates gold best of all. "Alpha-cyclodextrin is the gold medal winner," Stoddart said. "Zhichang stumbled on a piece of magic for isolating gold from anything in a green way."

Alkali metal salt waste from this new method is relatively environmentally benign, Stoddart said, while waste from conventional methods includes toxic cyanide salts and gases. The Northwestern procedure is also more efficient than current commercial processes.

The supramolecular nanowires, each 1.3 nanometers in diameter, assemble spontaneously in a straw-like manner. In each wire, the gold ion is held together in the middle of four bromine atoms, while the potassium ion is surrounded by six water molecules; these ions are sandwiched in an alternating fashion by alpha-cyclodextrin rings. Around 4,000 wires are bundled parallel to each other and form individual needles that are visible under an electron microscope.

"There is a lot of chemistry packed into these nanowires," Stoddart said. "The elegance of the composition of single nanowires was revealed by atomic force microscopy, which throws light on the stacking of the individual donut-shaped alpha-cyclodextrin rings." The atomic detail of the single supramolecular wires and their relative disposition within the needles was uncovered by single crystal X-ray crystallography.

The research -- a prime example of serendipity at work, brought to fruition by contemporary fundamental science -- is poised to find technological application. This basic science has been forged by the team into a practical lab-scale process for the isolation of gold from scrap alloys.

The Defense Threat Reduction Agency and the National Science Foundation supported the research.

The paper is titled "Selective isolation of gold facilitated by second-sphere coordination with α -cyclodextrin." In addition to Stoddart and Liu, the other authors of the paper are Marco Frascioni, Juying Lei, Zachary J. Brown, Zhixue Zhu, Dennis Cao, Julien Iehl, Guoliang Liu, Albert C. Fahrenbach, Omar K. Farha, Joseph T. Hupp and Chad A. Mirkin, all from Northwestern, and Youssry Y. Botros of Intel Labs.

<http://www.technewsdaily.com/18046-biotech-outpaces-moores-law.html>

Biotech's Explosive Evolution Outpaces Moore's Law

London conference explores how Moore's Law applies to fields such as biotechnology and health care.

by Marshall Honorof, TechNewsDaily Staff Writer

Moore's Law states, in simple terms, that the processing and storage power of microchips will double every two years.

This maxim, first proposed in 1965 by technologist Gordon Moore, proved prescient, but is beginning to run up against the functional limits of traditional electronics. A conference in London now seeks to explore how Moore's Law applies to other fields, such as biotechnology and health care.

The Royal Society, Great Britain's premier scientific body, is currently hosting the "Beyond Moore's Law" conference, where eminent speakers can share their research on the future of technology's geometric evolution.

Microelectronics - the study and manufacture of the kind of tiny electronic components that go into computers, smartphones and other objects that go "beep" - is beginning to slow down after 40 years of steady exponential growth.

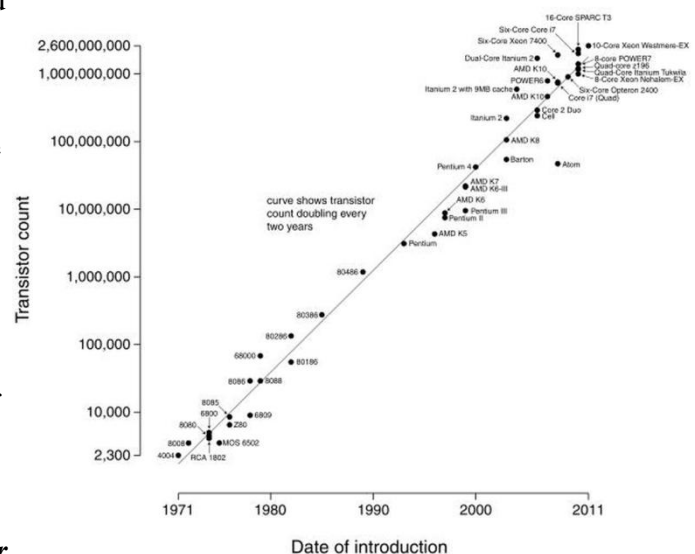
Transistor counts for integrated circuits plotted against their

dates of introduction. The curve shows Moore's law - the doubling of transistor counts every two years. The y-axis is logarithmic, so the line corresponds to exponential growth.

Wgsimon/Wikimedia

"If this technology is based on electrons flowing through transistors and wires is slowing down, what new technologies can be brought in to accelerate growth?" asked David Cumming, a professor of electronic systems at the University of Glasgow and "Beyond Moore's Law" organizer, told TechNewsDaily. If scientists want

Microprocessor Transistor Counts 1971-2011 & Moore's Law



technology to continue advancing according to Moore's Law, it would have to break out of the "microelectronics-only" mindset, Cumming said.

Moore's Law is not a scientific imperative, but rather a very accurate predictive model. The logic of applying it to new fields may not be immediately apparent, but Cumming believes that the market for advancements in traditional electronics may be about to slow down. "Microelectronics has historically delivered equipment into the communications and computing industries," he said. "There's only so much market growth available for those sectors. People are looking outside of conventional marketplaces."

One biotech field that has seen Moore's Law-level strides is that of gene sequencing. "When the human genome was first sequenced, it took large robotic machines and large laboratories," said Cumming. Now, a single scientist armed with a desktop computer can perform the work of an entire lab.

"There's a really intriguing parallel from mainframe computers [occupying whole rooms] to desktops to handheld devices," Cumming explained. He also theorized that gene sequencing could eventually transition to smartphones and tablets, just as general computing has.

Biotechnology even enlisted Moore himself - or at least a part of him - to affirm its rapid growth. "A gene sequencing chip was used to sequence Gordon Moore's DNA," added Steve Furber, a professor of computer engineering at the University of Manchester, and a Fellow of the Royal Society. That decision, he said, put a poetic capstone on the whole project.

Furber also described how biotech's rapid evolution could affect medicine. A new chip dubbed "Sensium" can streamline the process of taking a patient's vital signs. "[The chip embeds] in something that looks like sticking plaster, and you basically stick it onto the chest of a patient ... You can keep tabs on how well patients are doing on a very regular basis."

Although there are still many consumer tech advancements on the way (Cumming described "low-power tech," which would "allow devices to work almost indefinitely without having to recharge"), focusing exclusively on microelectronics has also ignored huge opportunities for financial growth.

Sensors used in automotive, health care and energy industries generate more than \$20 billion every year. By focusing on areas other than consumer electronics - whatever areas those may be - Furber and Cumming agree manufacturers can increase their profits and researchers can branch out beyond the latest smartphone advancements.

Moore himself admitted that, sooner or later, his proposed law would run up against a limit and capacity doubling every two years would become unsustainable. Although microelectronics may have nearly reached that point, as long as researchers are willing to invest resources in biotechnology, Moore's Law could prove prophetic for a very long time to come.

http://www.eurekalert.org/pub_releases/2013-05/uop-pcd051413.php

Pitt chemists demonstrate nanoscale alloys so bright they could have potential medical applications

'Think about a particle that will not only help researchers detect cancer sooner but be used to treat the tumor, too.'

PITTSBURGH - Alloys like bronze and steel have been transformational for centuries, yielding top-of-the-line machines necessary for industry. As scientists move toward nanotechnology, however, the focus has shifted toward creating alloys at the nanometer scale - producing materials with properties unlike their predecessors. Now, research at the University of Pittsburgh demonstrates that nanometer-scale alloys possess the ability to emit light so bright they could have potential applications in medicine. The findings have been published in the Journal of the American Chemical Society.

"We demonstrate alloys that are some of the brightest, near-infrared-light-emitting species known to date. They are 100 times brighter than what's being used now," said Jill Millstone, principal investigator of the study and assistant professor of chemistry in Pitt's Kenneth P. Dietrich School of Arts and Sciences. "Think about a particle that will not only help researchers detect cancer sooner but be used to treat the tumor, too."

In the paper, Millstone presents alloys with drastically different properties than before - including near-infrared (NIR) light emission - depending on their size, shape, and surface chemistry. NIR is an important region of the light spectrum and is integral to technology found in science and medical settings, said Millstone. She uses a laser pointer as an example.

"If you put your finger over a red laser [which is close to the NIR light region of the spectrum], you'll see the red light shine through. However, if you do the same with a green laser [light in the visible region of the spectrum], your finger will completely block it," said Millstone. "This example shows how the body can absorb

visible light well but doesn't absorb red light as well. That means that using NIR emitters to visualize cells and, ultimately parts of the body, is promising for minimally invasive diagnostics."

In addition, Millstone's demonstration is unique in that she was able to show - for the first time - a continuously tunable composition for nanoparticle alloys; this means the ratio of materials can be altered based on need. In traditional metallurgical studies, materials such as steels can be highly tailored toward the application, say, for an airplane wing versus a cooking pot. However, alloys at the nanoscale follow different rules, says Millstone. Because the nanoparticles are so small, the components often don't stay together and instead quickly separate, like oil and vinegar. In her paper, Millstone describes using small organic molecules to "glue" an alloy in place, so that the two components stay mixed. This strategy led to the discovery of NIR luminescence and also paves the way for other types of nanoparticle alloys that are useful not only in imaging, but in applications like catalysis for the industrial-scale conversion of fossil fuels into fine chemicals.

Millstone says that taken together these observations provide a new platform to investigate the structural origins of small metal nanoparticles' photoluminescence and of alloy formation in general. She believes these studies should lead directly to applications in such areas of national need as health and energy.

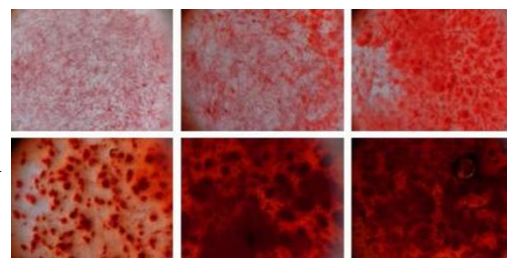
The paper, "Photoluminescent Gold-Copper Nanoparticle Alloys with Composition-Tunable Near-Infrared Emission," first appeared online April 3 and later in print April 10 in JACS (Journal of the American Chemical Society). Funding was provided by the University's Central Research Development Fund and administered by Pitt's Office of Research and University Research Council.

http://www.eurekalert.org/pub_releases/2013-05/bawh-uct051413.php

Using clay to grow bone

Researchers use synthetic silicate to stimulate stem cells into bone cells

Boston, MA – In new research published online May 13, 2013 in *Advanced Materials*, researchers from Brigham and Women's Hospital (BWH) are the first to report that synthetic silicate nanoplatelets (also known as layered clay) can induce stem cells to become bone cells without the need of additional bone-inducing factors. Synthetic silicates are made up of simple or complex salts of silicic acids, and have been used extensively for various commercial and industrial applications, such as food additives, glass and ceramic filler materials, and anti-caking agents.



Silicate nanoplatelets cause stem cells to become bone cells, as determined by the formation of bone matrix (in red).

Image courtesy of Khademhosseini lab.

"With an aging population in the US, injuries and degenerative conditions are subsequently on the rise," said Ali Khademhosseini, PhD, BWH Division of Biomedical Engineering, senior study author. "As a result, there is an increased demand for therapies that can repair damaged tissues. In particular, there is a great need for new materials that can direct stem cell differentiation and facilitate functional tissue formation. Silicate nanoplatelets have the potential to address this need in medicine and biotechnology."

"Based on the strong preliminary studies, we believe that these highly bioactive nanoplatelets may be utilized to develop devices such as injectable tissue repair matrixes, bioactive fillers, or therapeutic agents for stimulating specific cellular responses in bone-related tissue engineering," said Akhilesh Gaharwar, PhD, BWH Division of Biomedical Engineering, first study author. "Future mechanistic studies will be performed to better understand underlying pathways that govern favorable responses, leading to a better understanding of how materials strategies can be leveraged to further improve construct performance and ultimately shorten patient recovery time."

This research was supported by the National Institutes of Health (EB009196, DE019024, EB007249, HL099073, AR057837); US Army Engineer Research and Development Center; Institute for Soldier Nanotechnology; and the National Science Foundation.

<http://www.scientificamerican.com/podcast/episode.cfm?id=speed-dating-study-yields-conversat-13-05-14>

Speed Dating Study Yields Conversation Keys

A study analyzed nearly 1,000 speed dates and their aftermaths to find out what conversational cues work best for people to click. Amy Kraft reports.

Listen to this Podcast

Speed dating is a popular way to find love. But how can you make a good impression in just a few minutes? With scientific analysis, of course. Because a study finds that people can form meaningful relationships quickly as long as they say the right thing and in the right way. The study is in the *American Journal of Sociology*. [Daniel McFarland, Dan Jurafsky, and Craig M. Rawlings, in press, [Making the Connection: Social Bonding in Courtship Situations](#)]

Researchers listened to audio from speed dates and reviewed results from nearly 1,000 dates.

Women reported a connection with men who used language to indicate that what she was saying was interesting. For example:

FEMALE: I played in the orchestra.

MALE: Oh that's cool.

Daters also clicked if one interrupted the other to convey enthusiasm or interest in what was being said. For example:

FEMALE: They ought to just regulate at some point.

MALE: Exactly.

But things went sour if one participant asked a lot of questions, which women did to keep a lagging conversation going and men used when they had nothing to say.

The study confirms that people can hit it off with one another in a short amount of time. Just make sure you say all the right things before that buzzer sounds.

<http://arstechnica.com/science/2013/05/infesting-mosquitos-with-bacteria-could-block-malaria/>

Infesting mosquitos with bacteria could block malaria

Getting Wolbachia bacteria to grow in mosquitoes may help human health.

by Diana Gitig - May 15 2013, 3:00am TST

Mosquito bites kill an estimated 1-2 million people every year. It is not the mosquitoes' fault, though—it's the pathogens they transmit that are lethal, not the bites themselves. Nets and insecticides can help, but they can also be costly, logistically difficult to distribute, and not particularly green. So alternative strategies to prevent disease transmission are needed.

Wolbachia are bacteria that reside in insect cells and have a very complicated relationship with their hosts.

They can render mosquitoes resistant to certain pathogens, and they can reduce mosquitoes' lifespans, which is significant because it is often the older mosquitoes that transmit the pathogens that make us sick. Wolbachia infect up to 76 percent of the 2-5 million insect species on Earth—but not, of course, the mosquito species that carry dengue fever or malaria. That would be far too convenient.

So researchers have been trying to infect disease-carrying mosquitoes with Wolbachia in the lab and then let these infected mosquitoes out into the wild to mate with and infect disease-carrying strains in order to reduce disease transmission. This has in fact already happened in northeastern Australia, where researchers spent four years maintaining Wolbachia in mosquito cells in the lab before letting infected mosquitoes loose in January 2011 to infect wild *Aedes aegypti*, the mosquitoes that transmit dengue fever. The trial is going so well that it is being repeated in Vietnam.

But the mosquitoes that transmit malaria in the Middle East and South Asia, *Anopheles stephensi*, have resisted attempts to infect them with Wolbachia for the past twenty years or so. Finally, researchers have succeeded in not only infecting *A. stephensi* with Wolbachia but in maintaining the infection over 34 generations.

In each generation, each infected female passed the bacteria on to 100 percent of her offspring. Infected mosquitoes had an almost four-fold reduction in *Plasmodium falciparum*, one of the parasites that causes malaria. When the researchers seeded cages of uninfected mosquitoes with only five percent infected females, 100 percent of the mosquitoes were infected within eight generations. However, they also had to put in twice as many infected males as there were uninfected ones to "suppress the effective mating" of uninfected females, which could prove problematic if this strategy were to be implemented on a large scale in the wild.

There is no evidence that Wolbachia is transferred to humans via mosquito bites or to mosquito predators like geckos and spiders. The incidence of mosquito-borne diseases is increasing due to the ease of air travel and the rapid urbanization of developing countries; infecting mosquitoes to make them resistant to pathogens might be a relatively cheap and green addition to the public health measures currently used to deal with them.

Science, 2013. DOI: 10.1126/science.1236192 *EMBO Reports*, 2013. DOI: 10.1038/embor.2011.84 (About DOIs).

<http://bit.ly/16fIoFV>

Ancient Ocean Bacteria Feasted on Supernova Dust

Study carried out by researchers at the Technische Universitaet Muenchen (TUM), published in Nature, concerns a particular kind of iron loving bacteria known as magnetotactic bacteria

May 14, 2013 12:17 PM ET // by Markus Hammonds

Massive stars are like gargantuan element foundries. For millions of years, they react atomic nuclei together into increasingly heavier chemical elements, before exploding as supernovae and scattering those elements out into the cosmos. Many of the elements created in supernovae are essential to life on Earth, and now for the first time ever, life on Earth has provided some rather unusual evidence for a supernova 2.2 million years ago.

A study carried out by researchers at the Technische Universitaet Muenchen (TUM), published in *Nature*, concerns a particular kind of iron loving bacteria known as magnetotactic bacteria. These particular microbes

live in ocean sediments, where they metabolise iron to create tiny crystals of iron oxide — a particular type of iron oxide, known as magnetite (Fe_3O_4).

The magnetite crystals made by these bacteria are quite uniform, each just 80 nanometres (80 billionths of a meter) in size. The iron they use comes from dust in Earth's atmosphere, which finds its way into the ocean. And every so often, they metabolise iron, which originally came from a supernova.

When a supernova explodes, nuclear fusion goes wild. Elements fuse together haphazardly, creating unusual and unstable radioactive isotopes. This is the only natural way in which certain elements, such as uranium, can be created. One particular isotope formed this way is iron-60.

In fact, iron-60 is created almost exclusively in supernovae. With a half life of 2.6 million years, any iron-60 which was on Earth back when it formed is long gone, so finding any of this form of iron on Earth is excellent evidence for a nearby supernova sometime in the (relatively) recent past.

Shawn Bishop, a nuclear astrophysicist, and his colleagues analyzed sediment cores drilled from the floor of the Pacific Ocean. In those sediment samples, they found fossilized bacteria — and in those fossils, they found iron-60.

Studying sediment samples aged between 1.7 and 3.3 million years, they looked at intervals every 100,000 years, chemically extracting the bacterial fossils to analyze the magnetite crystals created at the time. They then tested those fossils at the Maier Leibnitz Laboratory in Garching, Munich, using an ultra sensitive mass spectrometer. The result was a glimpse of iron-60 in the fossils, providing the first ever evidence for a near-Earth supernova given directly by Earth life.

What's more, the bacterial iron-60 was dated to approximately 2.2 million years ago. This coincides perfectly with a previous study in 2004, where researchers found the same iron isotope in Earth's crust. This was the first time the isotope had been found on our planet, and was also found buried under the Pacific Ocean floor.

While this is still a preliminary (and somewhat tantalizing) result, it's certainly an impressive one. It also confirms that there was very likely a supernova near to our solar system roughly 2.2 million years ago, and that ash from that supernova made its way onto the surface of our planet.

Emboldened by their discovery, Bishop and his team are now preparing to analyze a second sediment core to try and verify their findings. The second sample contains over 10 times as much material as the first, and should be able to provide evidence either for or against their results. If they do find further iron-60, Bishop plans to map out the way the supernova-forged iron made its way into the ecosystem over time.

http://www.eurekalert.org/pub_releases/2013-05/ehs-nsr051313.php

Novel study reports marijuana users have better blood sugar control

Current marijuana users have 16 percent lower fasting insulin levels compared to non-users, according to the American Journal of Medicine

Philadelphia, PA, - Regular marijuana use is associated with favorable indices related to diabetic control, say investigators. They found that current marijuana users had significantly lower fasting insulin and were less likely to be insulin resistant, even after excluding patients with a diagnosis of diabetes mellitus. Their findings are reported in the current issue of *The American Journal of Medicine*.

Marijuana (*Cannabis sativa*) has been used for centuries to relieve pain, improve mood, and increase appetite. Outlawed in the United States in 1937, its social use continues to increase and public opinion is swinging in favor of the medicinal use of marijuana. There are an estimated 17.4 million current users of marijuana in the United States. Approximately 4.6 million of these users smoke marijuana daily or almost daily. A synthetic form of its active ingredient, tetrahydrocannabinol, commonly known as THC, has already been approved to treat side-effects of chemotherapy, AIDS-induced anorexia, nausea, and other medical conditions. With the recent legalization of recreational marijuana in two states and the legalization of medical marijuana in 19 states and the District of Columbia, physicians will increasingly encounter marijuana use among their patient populations.

A multicenter research team analyzed data obtained during the National Health and Nutrition Survey (NHANES) between 2005 and 2010. They studied data from 4,657 patients who completed a drug use questionnaire. Of these, 579 were current marijuana users, 1,975 had used marijuana in the past but were not current users, and 2,103 had never inhaled or ingested marijuana. Fasting insulin and glucose were measured via blood samples following a nine hour fast, and homeostasis model assessment of insulin resistance (HOMA-IR) was calculated to evaluate insulin resistance.

Participants who reported using marijuana in the past month had lower levels of fasting insulin and HOMA-IR and higher levels of high-density lipoprotein cholesterol (HDL-C). These associations were weaker among those who reported using marijuana at least once, but not in the past thirty days, suggesting that the impact of

marijuana use on insulin and insulin resistance exists during periods of recent use. Current users had 16% lower fasting insulin levels than participants who reported never having used marijuana in their lifetimes.

Large waist circumference is linked to diabetes risk. In the current study there were also significant associations between marijuana use and smaller waist circumferences.

"Previous epidemiologic studies have found lower prevalence rates of obesity and diabetes mellitus in marijuana users compared to people who have never used marijuana, suggesting a relationship between cannabinoids and peripheral metabolic processes, but ours is the first study to investigate the relationship between marijuana use and fasting insulin, glucose, and insulin resistance," says lead investigator Murray A. Mittleman, MD, DrPH, of the Cardiovascular Epidemiology Research Unit at the Beth Israel Deaconess Medical Center, Boston.

"It is possible that the inverse association in fasting insulin levels and insulin resistance seen among current marijuana users could be in part due to changes in usage patterns among those with a diagnosis of diabetes (i.e., those with diabetes may have been told to cease smoking). However, after we excluded those subjects with a diagnosis of diabetes mellitus, the associations between marijuana use and insulin levels, HOMA-IR, waist circumference, and HDL-C were similar and remained statistically significant," states Elizabeth Penner, MD, MPH, an author of the study.

Although people who smoke marijuana have higher average caloric intake levels than non-users, marijuana use has been associated with lower body-mass index (BMI) in two previous surveys. "The mechanisms underlying this paradox have not been determined and the impact of regular marijuana use on insulin resistance and cardiometabolic risk factors remains unknown," says coauthor Hannah Buettner.

The investigators acknowledge that data on marijuana use were self-reported and may be subject to underestimation or denial of illicit drug use. However, they point out, underestimation of drug use would likely yield results biased toward observing no association.

Editor-in-Chief Joseph S. Alpert, MD, Professor of Medicine at the University of Arizona College of Medicine, Tucson, comments, "These are indeed remarkable observations that are supported, as the authors note, by basic science experiments that came to similar conclusions.

"We desperately need a great deal more basic and clinical research into the short- and long-term effects of marijuana in a variety of clinical settings such as cancer, diabetes, and frailty of the elderly," continues Alpert. "I would like to call on the NIH and the DEA to collaborate in developing policies to implement solid scientific investigations that would lead to information assisting physicians in the proper use and prescription of THC in its synthetic or herbal form."

http://www.eurekalert.org/pub_releases/2013-05/uoc--uss051413.php

UCLA study shows warming in central China greater than most climate models indicated *Temperatures in central China are 10 to 14 degrees Fahrenheit hotter today than they were during the last ice age*

Temperatures in central China are 10 to 14 degrees Fahrenheit hotter today than they were 20,000 years ago, during the last ice age, UCLA researchers report — an increase two to four times greater than many scientists previously thought.

The findings, published today in the early online edition of the journal *Proceedings of the National Academy of Sciences*, could help researchers develop more accurate models of past climate change and better predict such changes in the future.

"Previously, we could only infer temperature on land through changes in climate archives like tree rings or pollen over time," said lead author Robert Eagle, a UCLA researcher in the department of Earth and space sciences. "This is the first time that temperature has been determined accurately on land at the time of the last ice age."

To make their temperature measurements, the scientists used a technique known as clumped isotope thermometry, which detects subtle atomic differences in calcium carbonate, a compound commonly found in rocks, snail shells and wind-blown dust deposits known as loess. The method is the most accurate land-based temperature-determination tool available today.

"We can now tell what temperatures were on land 20,000 years ago with more accuracy than was ever previously possible," said senior author Aradhna Tripathi, a UCLA assistant professor in the department of Earth and space sciences and the department of atmospheric and oceanic sciences.

Tripathi and Eagle chose to study the Loess Plateau in central China, a 250,000-square-mile agricultural region some 500 miles southwest of Beijing, because of its wide expanses of loess, the silty sediments that give the area its name and which contain deposits from the last ice age.

"We can calculate temperatures and reconstruct the chemistry of rainwater from the past ice age, then compare this to the present day climate in specific regions," Eagle said. "We can then use this information to validate current climate models and study atmospheric processes."

The researchers collected two unique ice age sample types from the Loess Plateau region: fossilized land-snail shells and soil deposits. While snails calcify quickly over just a few years, soil carbonates grow over longer time periods, ranging from a few hundred to thousands of years. Eagle and Tripati used clumped isotope thermometry to determine the temperature at which these samples formed roughly 20,000 years ago.

"One of the most important aspects of the study was showing that we could get the same result from such different types of carbonates," said Tripati, who is also a member of UCLA's Institute of the Environment and Sustainability. "Even though these materials integrate over very different time frames, they gave us the same result."

Comparing the findings with climate models

When Eagle and Tripati matched their findings against climate models predicting the change in temperature in central China from the previous ice age to the present, they found that those models that took into account atmospheric processes tended to be more accurate.

"The climate models that did the best job of resolving temperature changes in this region were the ones that accurately depicted very large-scale atmospheric processes, such as patterns of winds in the atmosphere, the position of the jet stream and various atmospheric fronts," Tripati said. "The models that didn't resolve these atmospheric phenomena tended to do a poorer job of predicting temperature."

"It's so important to have models that accurately depict regional climates on land for the study of past and future climate change. We were surprised at how poorly most climate models predicted temperature change in central China and also surprised at how sensitive this region has been to changes in climate forcing."

Since the last ice age, numerous factors have influenced changes in global wind and precipitation patterns in Earth's atmosphere. Atmospheric processes move in relation to a standing, stationary wave, which is an oscillating reference point that wraps around our planet like an invisible piece of string. The position of that wave around our planet has changed over time. Contributing factors have been a rise in carbon dioxide and other greenhouse gases, changes in incoming solar radiation and changes in the amount of ice covering the Earth's surface.

For example, ice sheets can deflect the stationary waves so that winds and precipitation patterns fall more frequently in certain locations on the planet. But as ice has melted over the last 20,000 years, the stationary waves have shifted, influencing the circulation of the atmosphere.

"Clumped isotope thermometry has allowed us to say with more confidence how temperatures have warmed in central China, and how the chemistry of rainfall has changed. The climate models that did the best job of simulating temperature changes seemed to also be the ones to give the best depiction of changes in water cycling in this region," Tripati said. "Our results suggest that in this region, temperature, water cycling and winds are very sensitive to changing climate forcing. Rises in greenhouse gas levels, melting ice sheets and changes in solar radiation can all affect not only temperature but precipitation and winds as well."

"We have not dissected out the specific role of greenhouse gases, such as carbon dioxide, in this study, but they are certainly a contributing factor to temperature change and ice-sheet extent," Eagle said.

The climate model developed by researchers at France's Institut Pierre Simon Laplace des sciences de l'Environnement Global (the IPSL model) closely matched the data for this region in this study, but it has traditionally been one of the less frequently used climate models for predicting future climate change.

"That is quite extraordinary," said Eagle, "because while more commonly used models have simulated a very small amount of temperature change in the region, that prediction was not validated by our data."

Types of sediment similar to that found in central China exist in the Midwestern U.S., ranging from Mississippi to Nebraska, and they are currently being studied by scientists at UCLA.

"One of the things we're doing is measuring samples from the loess deposits in the Midwestern U.S. to see how climate has changed in these regions," Tripati said. "These deposits were also formed at the time of the last ice age and contain similar types of snail and soil carbonates that we analyzed in central China. It will be interesting to repeat a similar investigation in this region."

This research was funded by the National Science Foundation (EAR-0949191).

Significant contributions to the research were made by Eagle and Tripati at UCLA; Gaojun Li, a faculty member at Nanjing University in China; UCLA collaborators Jonathan L. Mitchell, Ulrike Seibt and David Neelin; and Camille Risi, a research scientist at the Laboratory of Dynamic Meteorology (LMD/IPSL) at the Center for National Scientific Research (CNRS) in Paris, France.

http://www.eurekalert.org/pub_releases/2013-05/aaon-scm050713.php

Skin cancer may be linked to lower risk of Alzheimer's disease

People who have skin cancer may be less likely to develop Alzheimer's disease

MINNEAPOLIS – People who have skin cancer may be less likely to develop Alzheimer's disease, according to new research published in the May 15, 2013, online issue of Neurology®, the medical journal of the American Academy of Neurology. The link does not apply to melanoma, a less common but more aggressive type of skin cancer.

The study involved 1,102 people with an average age of 79 who did not have dementia at the start of the study. The participants were followed for an average of 3.7 years. At the start of the study, 109 people reported that they had skin cancer in the past. During the study, 32 people developed skin cancer and 126 people developed dementia, including 100 with Alzheimer's dementia.

People who had skin cancer were nearly 80 percent less likely to develop Alzheimer's disease than people who did not have skin cancer. Of the 141 people with skin cancer, two developed Alzheimer's disease. The association was not found with other types of dementia, such as vascular dementia.

Study author Richard B. Lipton, MD, of Albert Einstein College of Medicine in Bronx, NY, and a Fellow of the American Academy of Neurology, said the reason for this possible protective effect of skin cancer is not yet known. "One possible explanation could be physical activity," he said. "Physical activity is known to protect against dementia, and outdoor activity could increase exposure to UV radiation, which increases the risk of skin cancer."

Lipton said biological factors including genetic factors likely also play a role, as physical activity does not reduce the risk of Alzheimer's disease to the extent found in the link between skin cancer and Alzheimer's disease.

The findings do not mean that people should stop taking measures to avoid skin cancer, Lipton said. "People should continue to wear sunscreen, avoid the sun during midday and wear clothing to protect their skin," he said. "The hope is that these results help us learn more about how Alzheimer's develops so we can create better preventive methods and treatments."

The study was supported by the National Institute on Aging, Einstein Aging Study, and National Cancer Institute, Albert Einstein Cancer Center.

<http://nyti.ms/Z3g8Dy>

From Fearsome Predator to Man's Best Friend

An international network of scientists compared pieces of DNA from different canines and concluded that wolves started their transformation into dogs in East Asia.

By CARL ZIMMER

Imagine a wolf catching a Frisbee a dozen times in a row, or leading police officers to a stash of cocaine, or just sleeping peacefully next to you on your couch. It's a stretch, to say the least. Dogs may have evolved from wolves, but the minds of the two canines are profoundly different.

Dog brains, as I wrote last month in The New York Times, have become exquisitely tuned to our own.

Scientists are now zeroing in on some of the genes that were crucial to the rewiring of dog brains.

Their results are fascinating, and not only because they can help us understand how dogs turned into man's best friend. They may also teach us something about the evolution of our own brains: Some of the genes that evolved in dogs are the same ones that evolved in us.

To trace the change in dog brains, scientists have first had to work out how dog breeds are related to one another, and how they're all related to wolves. Ya-Ping Zhang, a geneticist at the Chinese Academy of Sciences, has led an international network of scientists who have compared pieces of DNA from different canines.

They've come to the conclusion that wolves started their transformation into dogs in East Asia.

Those early dogs then spread to other parts of the world. Many of the breeds we're most familiar with, like German shepherds and golden retrievers, emerged only in the past few centuries.

Meanwhile, back in China, those early dogs lingered on for thousands of years. Today, they're known as Chinese native dogs. "The Chinese native dogs live in rural villages, helping humans to guard homes," Dr. Zhang explained in an e-mail.

Dr. Zhang and his colleagues see Chinese native dogs as the key to better understanding how dogs evolved.

Recently, they sequenced the entire genome of Chinese native dogs and compared them with the genomes of Asian wolves and modern breeds like German shepherds. By comparing the mutations in the genomes, they've been able to estimate when wolves and dogs diverged.

As they reported on Tuesday in the journal *Nature Communications*, they found that the split started 32,000 years ago. Those early dogs would have encountered small bands of hunter-gatherers. People didn't settle in villages to farm in East Asia until about 10,000 years ago.

After dogs split from wolves, their genes began to evolve in a new direction. Dr. Zhang and his colleagues were able to identify some of these evolving genes. A number of them, it turned out, are active in dog brains. (Dr. Zhang and some of his colleagues published some of these results last week in the journal *Molecular Biology and Evolution*.)

Some of the genes that evolved early in dog evolution are involved in smell or hearing. Others are active in a region called the prefrontal cortex, where mammals make decisions about how to behave. Some genes are involved in growing connections between neurons. One gene, called SLC6A4, transports a neurotransmitter called serotonin into neurons.

The results offer some tantalizing hints about how wolves first turned doglike. "The conventional view is that the hunter-gatherers go out and get a puppy," said Chung-I Wu of the University of Chicago, an author of the *Nature Communications* study. If humans actually did breed early dogs this way, then dogs would have descended from a very small population.

That's not what Dr. Wu and his colleagues have found, though. Instead, it appears that a large population of wolves started lingering around humans — perhaps scavenging the carcasses that hunters left behind. In this situation, aggressive wolves would have fared badly, because humans would kill them off. Mellow wolves, by contrast, would thrive. If this notion turns out to be true, it means that we didn't domesticate wolves — they domesticated themselves. SLC6A4 may have played a crucial part in this change, because serotonin influences aggression.

To test these ideas, Dr. Zhang and his colleagues are gathering DNA from more dogs and wolves. They also hope to collaborate with cognitive scientists to see how variants of genes like SLC6A4 affect the behavior of dogs today. Their results may also help explain human evolution, because Dr. Zhang and his colleagues found that some of the same genes that evolved in dog brains, such as SLC6A4, also experienced natural selection in human brains.

"Humans have had to tame themselves," said Adam Boyko of Cornell University, one of Dr. Zhang's collaborators on the *Molecular Biology and Evolution* study. "The process is probably similar to dogs — you have to tolerate the presence of others."

http://www.eurekalert.org/pub_releases/2013-05/uom-bwc051313.php

Billion-year-old water could hold clues to life on Earth and Mars

A UK-Canadian team of scientists has discovered ancient pockets of water, which have been isolated deep underground for billions of years and contain abundant chemicals known to support life.

This water could be some of the oldest on the planet and may even contain life. Not just that, but the similarity between the rocks that trapped it and those on Mars raises the hope that comparable life-sustaining water could lie buried beneath the red planet's surface. The findings, published in *Nature* today, may force us to rethink which parts of our planet are fit for life, and could reveal clues about how microbes evolve in isolation.

Researchers from the universities of Manchester, Lancaster, Toronto and McMaster analysed water pouring out of boreholes from a mine 2.4 kilometres beneath Ontario, Canada.

They found that the water is rich in dissolved gases like hydrogen, methane and different forms – called isotopes – of noble gases such as helium, neon, argon and xenon. Indeed, there is as much hydrogen in the water as around hydrothermal vents in the deep ocean, many of which teem with microscopic life.

The hydrogen and methane come from the interaction between the rock and water, as well as natural radioactive elements in the rock reacting with the water. These gases could provide energy for microbes that may not have been exposed to the sun for billions of years. The crystalline rocks surrounding the water are thought to be around 2.7 billion years old. But no-one thought the water could be the same age, until now.

Using ground-breaking techniques developed at the University of Manchester, the researchers show that the fluid is at least 1.5 billion years old, but could be significantly older.

NERC-funded Professor Chris Ballentine of the University of Manchester, co-author of the study, and project director, says: 'We've found an interconnected fluid system in the deep Canadian crystalline basement that is billions of years old, and capable of supporting life. Our finding is of huge interest to researchers who want to understand how microbes evolve in isolation, and is central to the whole question of the origin of life, the sustainability of life, and life in extreme environments and on other planets.'

Before this finding, the only water of this age was found trapped in tiny bubbles in rock and is incapable of supporting life. But the water found in the Canadian mine pours from the rock at a rate of nearly two litres per

minute. It has similar characteristics to far younger water flowing from a mine 2.8 kilometres below ground in South Africa that was previously found to support microbes.

Ballentine and his colleagues don't yet know if the underground system in Canada sustains life, but Dr Greg Holland of Lancaster University, lead author of the study says:

'Our Canadian colleagues are trying to find out if the water contains life right now. What we can be sure of is that we have identified a way in which planets can create and preserve an environment friendly to microbial life for billions of years. This is regardless of how inhospitable the surface might be, opening up the possibility of similar environments in the subsurface of Mars.'

Professor Ballentine, based in Manchester's School of Earth, Atmospheric and Environmental Sciences, adds: 'While the questions about life on Mars raised by our work are incredibly exciting, the ground-breaking techniques we have developed at Manchester to date ancient waters also provide a way to calculate how fast methane gas is produced in ancient rock systems globally. The same new techniques can be applied to characterise old, deep groundwater that may be a safe place to inject carbon dioxide.'

David Willetts, Minister for Universities and Science, says:

'This is excellent pioneering research. It gives new insight into our planet. It has also developed new technology for carbon capture and storage projects. These have the potential for growth, job creation and our environment.'

This work was funded by NSERC Discovery and CRC grants, a NERC grant and Deep Carbon Observatory (DCO) support.

Notes for editors:

The paper – Deep fracture fluids isolated in the crust since the Precambrian era by G. Holland, B. Sherwood Lollar, L. Li, G. Lacrampe-Couloume, G. F. Slater & C. J. Ballentine, in Nature – will be published online on 16 May 2013

<http://phys.org/news/2013-05-method-adding-omega-fatty-acids.html>

Method developed for adding omega-3 fatty acids to foods

The omega-3 fatty acids contained in fatty salt-water fish are an important component of a healthy diet in humans.

Despite being aware of this fact, Germans still do not eat enough fish. Now Fraunhofer researchers have developed a method that allows omega-3 fatty acids to be added to popular foods. They are launching the first of these products exclusively in EDEKA stores: the omega-3 sausage.

Our bodies need fat. They use it to repair their cells and store energy. Omega-3 fatty acids are especially important. They play a particularly large role when the body is regenerating heart, brain, and nerve cells. Especially valuable are unsaturated fatty acids such as docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA). Not only are they easily absorbed into cells, they also have an anti-inflammatory effect. "Unlike saturated varieties, which are present in butter for example, unsaturated fatty acids are capable of reacting in the body," explains Christian Zacherl from the Fraunhofer Institute for Process Engineering and Packaging IVV in the Bavarian town of Freising. "This is because of their molecular structure, which enables them to capture and neutralize pro-inflammatory substances."

Germans do not eat enough fish

Unable to produce these important fatty acids by itself, the human body has to absorb them from food. DHA and EPA are present, for example, in fatty salt-water fish such as herring, salmon, and mackerel. But here's the rub: according to a current survey commissioned by the German food retailer EDEKA, Germans know that omega-3 fatty acids are important and that fish contain them in a particularly high-value form, yet neither women nor men eat the recommended weekly amount of 150 to 220 grams of fish. "We thought that the surest way to solve this problem would be to increase the amount of effective fatty acids in popular foods that people eat in large quantities, such as pizza, pasta, bread, and sausages," says project manager Dr. Peter Eisner, describing Fraunhofer IVV's approach. "First, though, we had to deal with the fish smell issue."

Omega-3 fatty acids are virtually odorless in their natural form as they occur for instance in fresh fish or fish oil. If they come into contact with oxygen, however, they oxidize. The resulting degradation products have two drawbacks: the quality of the original substance diminishes and a fishy smell is produced. What was needed, therefore, was a process that locked in the precious fatty acids and protected them against oxidization. "This is what we achieved by means of a special emulsion system," explains Zacherl. "It optimally combines the effects of various anti-oxidants with each other." Some of the substances used are directly responsible for oxidization protection, while others support the effects of the first group, and yet others eliminate substances that accelerate the degradation process in fatty acids. "The oxygen has to clear a lot of hurdles before it can react with the omega-3 fatty acids. Thanks to our method, the fatty acids remain stable and can be incorporated into a variety of foods. The emulsion can be adapted specifically to individual products. All we have to do, effectively, is vary the number and type of hurdles," says Zacherl. Fraunhofer IVV has patented its technology (www.triomeg.de).

Omega-3 sausage in cooperation with EDEKA

In conjunction with EDEKA, Fraunhofer IVV has now exclusively launched the first of these products: the omega-3 sausage, which has been on the market since mid-April and is produced in EDEKA meat processing plants. "The new omega-3 products underscore EDEKA's nutritional and gourmet expertise. At the same time, the cooperation with Fraunhofer IVV shows that EDEKA is a major driver of innovation in the German food trade," says Markus Mosa, CEO of EDEKA AG. The food retailer has included the omega-3 sausage in its own-brand range and is initially offering nine different varieties: Bavarian white sausage, Bavarian meatloaf in thin and thick slices, Lyon sausage, Lyon sausage with paprika pieces, "bierschinken" ham sausages, a "Gourmet Trio" package of three different cold sausages, wienerwurst, and boiled bratwurst. Not only do the sausage varieties contain particularly high amounts of DHA and EPA, their overall fat content is well below that of comparable conventional products. "We use specially processed fish oil that contains by itself over 90 percent of valuable fatty acids," explains Eisner. "For comparison: the original product contains only 30 percent. Because we optimized the fat balance in general, EDEKA was able to reduce the total amount of fat. And despite the added value in terms of health benefits, the sausages are just as tasty as their "regular" counterparts."

http://www.eurekalert.org/pub_releases/2013-05/ohs-ort051313.php

OHSU research team successfully converts human skin cells into embryonic stem cells *The breakthrough marks the first time human stem cells have been produced via nuclear transfer and follows several unsuccessful attempts by research groups worldwide*

PORTLAND, Ore. – Scientists at Oregon Health & Science University and the Oregon National Primate Research Center (ONPRC) have successfully reprogrammed human skin cells to become embryonic stem cells capable of transforming into any other cell type in the body. It is believed that stem cell therapies hold the promise of replacing cells damaged through injury or illness. Diseases or conditions that might be treated through stem cell therapy include Parkinson's disease, multiple sclerosis, cardiac disease and spinal cord injuries.

The research breakthrough, led by Shoukhrat Mitalipov, Ph.D., a senior scientist at ONPRC, follows previous success in transforming monkey skin cells into embryonic stem cells in 2007. This latest research will be published in the journal *Cell* online May 15 and in print June 6.

The technique used by Drs. Mitalipov, Paula Amato, M.D., and their colleagues in OHSU's Division of Reproductive Endocrinology and Infertility, Department of Obstetrics & Gynecology, is a variation of a commonly used method called somatic cell nuclear transfer, or SCNT. It involves transplanting the nucleus of one cell, containing an individual's DNA, into an egg cell that has had its genetic material removed. The unfertilized egg cell then develops and eventually produces stem cells.

"A thorough examination of the stem cells derived through this technique demonstrated their ability to convert just like normal embryonic stem cells, into several different cell types, including nerve cells, liver cells and heart cells. Furthermore, because these reprogrammed cells can be generated with nuclear genetic material from a patient, there is no concern of transplant rejection," explained Dr. Mitalipov. "While there is much work to be done in developing safe and effective stem cell treatments, we believe this is a significant step forward in developing the cells that could be used in regenerative medicine."

Another noteworthy aspect of this research is that it does not involve the use of fertilized embryos, a topic that has been the source of a significant ethical debate.

The Mitalipov team's success in reprogramming human skin cells came through a series of studies in both human and monkey cells. Previous unsuccessful attempts by several labs showed that human egg cells appear to be more fragile than eggs from other species. Therefore, known reprogramming methods stalled before stem cells were produced.

To solve this problem, the OHSU group studied various alternative approaches first developed in monkey cells and then applied to human cells. Through moving findings between monkey cells and human cells, the researchers were able to develop a successful method.

The key to this success was finding a way to prompt egg cells to stay in a state called "metaphase" during the nuclear transfer process. Metaphase is a stage in the cell's natural division process (meiosis) when genetic material aligns in the middle of the cell before the cell divides. The research team found that chemically maintaining metaphase throughout the transfer process prevented the process from stalling and allowed the cells to develop and produce stem cells.

"This is a remarkable accomplishment by the Mitalipov lab that will fuel the development of stem cell therapies to combat several diseases and conditions for which there are currently no treatments or cures," said Dr. Dan Dorsa, Ph.D., OHSU Vice President for Research. "The achievement also highlights OHSU's deep reproductive

expertise across our campuses. A key component to this success was the translation of basic science findings at the OHSU primate center paired with privately funded human cell studies."

One important distinction is that while the method might be considered a technique for cloning stem cells, commonly called therapeutic cloning, the same method would not likely be successful in producing human clones otherwise known as reproductive cloning. Several years of monkey studies that utilize somatic cell nuclear transfer have never successfully produced monkey clones. It is expected that this is also the case with humans. Furthermore, the comparative fragility of human cells as noted during this study, is a significant factor that would likely prevent the development of clones.

"Our research is directed toward generating stem cells for use in future treatments to combat disease," added Dr. Mitalipov. "While nuclear transfer breakthroughs often lead to a public discussion about the ethics of human cloning, this is not our focus, nor do we believe our findings might be used by others to advance the possibility of human reproductive cloning."

The human studies were funded by OHSU and a grant from Leducq Foundation. The nonhuman primate studies were funded by the following grants from the National Institutes of Health: HD063276, HD057121, HD059946, EY021214 and OD011092.

http://www.eurekalert.org/pub_releases/2013-05/icl-bfh051513.php

Body fat hardens arteries after middle age

Having too much body fat makes arteries become stiff after middle age, a new study has revealed.

In young people, blood vessels appear to be able to compensate for the effects of obesity. But after middle age, this adaptability is lost, and arteries become progressively stiffer as body fat rises – potentially increasing the risk of dying from cardiovascular disease. The researchers suggest that the harmful effects of body fat may be related to the total number of years that a person is overweight in adulthood. Further research is needed to find out when the effects of obesity lead to irreversible damage to the heart and arteries, they said.

Obesity is known to be a major risk factor for heart disease, but the reasons for this are not fully understood. Researchers at the Medical Research Council (MRC) Clinical Sciences Centre at Imperial College London scanned 200 volunteers to measure the speed of blood flow in the aorta, the biggest artery in the body. Blood travels more quickly in stiff vessels than in healthy elastic vessels, so this allowed them to work out how stiff the walls of the aorta were using an MRI scanner.

In young adults, those with more body fat had less stiff arteries. However, after the age of 50 increasing body fat was associated with stiffer arteries in both men and women.

Body fat percentage, which can be estimated by passing a small electric current through the body, was more closely linked with artery stiffness than body mass index, which is based just on weight and height. Men are on average about 21 per cent fat and women 31 per cent fat.

The research was funded by the MRC, the National Institute for Health Research (NIHR) Imperial Biomedical Research Centre, and the British Heart Foundation, and published in the journal Hypertension.

Dr Declan O'Regan, who led the study, said: "The effects of having more fat seem to be different depending on your age. It looks like young people may be able to adapt to excess body fat, but by middle age the cumulative exposure to years of obesity may start to cause permanent damage to the arteries. One implication is that the potential beneficial effects of weight loss may depend on your age and how long you have been overweight. This is something we plan to study further.

"We don't know for sure how body fat makes arteries stiffer, but we do know that certain metabolic products in the blood may progressively damage the elastic fibres in our blood vessels. Understanding these processes might help us to prevent the harmful effects of obesity."

<http://phys.org/news/2013-05-exhaustive-shift-english-language.html>

Exhaustive computer research project shows shift in English language

Sharp increase in the use of "informal" Old English words in literary writing after 1800

University of Illinois English professor Ted Underwood recently wrapped up a research project involving more than 4,200 books. Since that work revealed dramatic shifts in the English language between the 18th and 19th centuries, he's now expanding his research to include more than 470,000 books – almost every English language book written during that era and preserved in a university library.

How did he find time to read 4,000 books, let alone 400,000? He didn't, of course. Underwood, who teaches 18th- and 19th-century literature, worked with the U. of I.'s Institute for Computing in Humanities, Arts and Social Science (I-CHASS) and the HathiTrust Research Center (a collaboration of the U. of I. and Indiana University) to develop computer programs to crawl through digitized copies of the books, counting words and sorting genres. Underwood's data mining venture has already yielded some gems. "Increasingly, I'm finding that there are big patterns to be discovered in literary history at that scale," he said. "We just hadn't been able to back up far enough to see it."

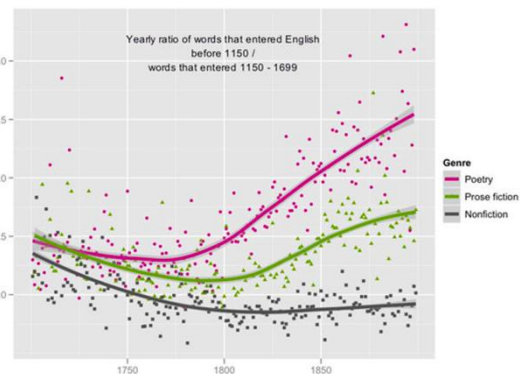
He initially set out simply to confirm his hunch that the English language acquired a bit of starchiness around 1800. "There's a very Latinate diction that sets in around that time," he said. "I had a vague sense that written English became more formal. For example, you no longer 'need' something; you 'require' it."

He used data from Google Books to find the 10,000 words used most frequently in 18th- and 19th-century books (not counting determiners, prepositions, conjunctions and pronouns). By using a "Web-scraper" and dictionary.com, he traced the etymology of each of those 10,000

words, sorted them by the date of entry into the English language, and divided them into two groups – pre- and post-Norman Conquest.

The 1066 invasion made French the official language of Britain, used (along with Latin) for all written business and spoken by the ruling class. The Old English vernacular spoken by the lower class survived, but by the time English regained its status as the official language, some 200 years later, the vocabulary of business and government had been lost, replaced by French and Latin words. "So that's sort of a rough-and-ready way of assessing formality,"

Underwood said.



This graph shows a sharp increase in the use of "informal" Old English words in literary writing after 1800. Credit: Ted Underwood

Using that 12th-century dividing line, Underwood plotted the ratio of formal to informal words used in books each year from 1700 to 1899. The resulting graph confirmed his assumption, but just barely. "You did get more Latinate words around 1800," he said, "but it was a pretty slight effect."

When he sorted the books by genre, however, the result was surprisingly profound. While the language of nonfiction works indeed became more formal, the language of fiction, drama and especially poetry became more formal until about 1775, and then reversed course and increasingly relied on less-formal, pre-Norman Conquest words. By 1899, Old English words occurred in drama and fiction at a rate more than 1 ½ times higher than in nonfiction, according to Underwood's data. In poetry, the rate was almost three times higher. This large shift coincides with the advent of the style of writing we now think of as "literature" – writing that's set apart by its imaginative intention. "If you go back to 1700, literature basically means anything written – just literacy, actually. Our concept of literature as fictive and aesthetic really emerges in the late 18th century," Underwood said. "I think the most important result I stumbled upon was how literary genres changed from non-literary prose."

In an article titled "The Emergence of Literary Diction," published in the *Journal of Digital Humanities*, Underwood and co-author Jordan Sellers, a graduate student at the U. of I., explained their discovery and theorized about why literature – considered to be the most artful form of writing – adopted the simplest vocabulary.

"In a sense, poetry became more specialized than it had been before: Its diction became more remote from prose. But it specialized in the direction of old words that would appear plain, common and universal," they wrote.

Underwood suspects that "literature" as we know it evolved into a vehicle for expressing individual experience, leaving nonfiction writers to analyze abstract ideas and social structures. "In my view, the decreasing formality of literary language was a side effect of this emphasis on the elementary and the personal," he said.

This research will be included in his book, "Why Literary Periods Mattered: Historical Contrast and the Prestige of English Studies," to be published this summer by Stanford University Press. This research recently won him an \$85,000 Digital Innovation fellowship from the American Council of Learned Societies and a \$57,000 digital humanities startup grant from the National Endowment for the Humanities, which he is using to expand his research to 470,000 volumes.

One of the first steps involves categorizing each of those volumes by genre – a task that's trickier than it sounds. "Like Aristotle's 'Poetics' – it's about poetry, but it's not poetry," Underwood said. He has already crafted a program to automatically classify texts based on word patterns (similar to how a spam filter works on email), but he is constantly tweaking and refining the process.

"Genres change across time, and genre boundaries are fuzzy. So humanists are rightly wary of crisp computational solutions to problems that are really fuzzy," he said. "We can build in and acknowledge some of that fuzziness."

Using computer programs to analyze creative writing is a branch of digital humanities – a field so new that it's still considered controversial in certain circles. "In the academy, I think it's viewed with a mixture of excitement and apprehension," Underwood said.

However, Underwood's father is in computer science, and Underwood spent summers during his undergraduate years working for his dad, writing computer programs. Combining that skill with his passion for literature comes naturally to the English professor, but he realizes it may not come so easily to his colleagues.

"What I'm trying to do now is create tools that will make it easier for other researchers to use this bigger collection," he said. He shares his data, his processes and his programs through his blog, The Stone and the Shell (tedunderwood.com), which takes its name from Wordsworth's epic poem, "The Prelude," in which a shell seems to represent poetry, and a stone represents mathematics.

More information: journalofdigitalhumanities.org/1-2/the-emergence-of-literary-diction-by-ted-underwood-and-jordan-sellers/

http://www.eurekalert.org/pub_releases/2013-05/uom-cdm051513.php

Cholesterol-lowering drug may reduce exercise benefits for obese adults, MU study finds

Generic type of statin hindered the positive effects of exercise for obese and overweight adults

COLUMBIA, Mo. – Statins, the most widely prescribed drugs worldwide, are often suggested to lower cholesterol and prevent heart disease in individuals with obesity, diabetes and metabolic syndrome, which is a combination of medical disorders including excess body fat and/or high levels of blood pressure, blood sugar and/or cholesterol. However, University of Missouri researchers found that simvastatin, a generic type of statin previously sold under the brand name "Zocor," hindered the positive effects of exercise for obese and overweight adults.

"Fitness has proven to be the most significant predictor of longevity and health because it protects people from a variety of chronic diseases," said John Thyfault, an associate professor of nutrition and exercise physiology at MU. "Daily physical activity is needed to maintain or improve fitness, and thus improve health outcomes. However, if patients start exercising and taking statins at the same time, it seems that statins block the ability of exercise to improve their fitness levels."

Thyfault says many cardiologists want to prescribe statins to all patients over a certain age regardless of whether they have metabolic syndrome; the drugs also are recommended for people with Type 2 diabetes. He recommends that cardiologists more closely weigh the benefits and risks of statins given this new data about their effect on exercise training. "Statins have only been used for about 15-20 years, so we don't know what the long-term effects of statins will be on aerobic fitness and overall health," Thyfault said. "If the drugs cause complications with improving or maintaining fitness, not everyone should be prescribed statins."

Thyfault and his colleagues measured cardiorespiratory fitness in 37 previously sedentary, obese individuals ages 25-59 with low fitness levels. The participants followed the same exercise regimen on the MU campus for 12 weeks; 18 of the 37 people also took 40 mg of simvastatin daily.

Statins significantly affected participants' exercise outcomes. Participants in the exercise-only group increased their cardiorespiratory fitness by an average of 10 percent compared to a 1.5 percent increase among participants also prescribed statins. Additionally, skeletal muscle mitochondrial content, the site where muscle cells turn oxygen into energy, decreased by 4.5 percent in the group taking statins while the exercise-only group had a 13 percent increase, a normal response following exercise training.

Thyfault suggests that future research determine whether lower doses of simvastatin or other types of statins similarly affect people's exercise outcomes and thus their risk for diseases such as Type 2 diabetes. Starting a statin regimen after exercising and obtaining a higher fitness level may reduce the drugs' effects on fitness, he says.

The study, "Simvastatin impairs exercise training adaptations," was published in the Journal of the American College of Cardiology. Co-authors included first author Catherine Mikus, who is now a postdoctoral fellow at Duke University, and MU researchers Leryn Boyle, Douglas Oberlin, Scott Naples, Justin Fletcher, Harold Laughlin, Kevin Dellsperger and Paul Fadel. Funding was provided by a grant from the MU Research Board, the Veterans Affairs' Career Development Award, an American Heart Association Midwest Affiliate Clinical Research Award and the National Institutes of Health. The Department of Nutrition and Exercise Physiology is jointly administered by the College of Agriculture, Food and Natural Resources, the College of Human Environmental Sciences and the School of Medicine. Thyfault has a joint appointment in the Department of Internal Medicine in the Division of Gastroenterology and Hepatology in the MU School of Medicine.

<http://www.scientificamerican.com/article.cfm?id=polio-somalia-eradication>

Why You Should Worry about a Case of Polio in Somalia

Low vaccination rates in multiple African countries could doom global eradication efforts

By Christine Gorman | Thursday, May 16, 2013 | 6

From Afghanistan to Somalia, the struggle to eradicate polio continues to lurch along in fits and starts. The past few days have brought a modicum of good news and some potentially quite bad news.

On May 13, the Taliban issued a statement declaring that it would no longer target polio vaccine workers and is ordering its fighters to help in vaccination campaigns. The group had previously marked vaccine workers for death because of fears that they might be acting as spies for Western countries—fears that were further

inflamed by a successful US effort to assassinate Osama bin Laden that included a sham hepatitis vaccine campaign by the CIA.

Just two days earlier, however, the World Health Organization reported that “wild-type” poliovirus was isolated in Somalia from a 32-month-old girl who suddenly became paralyzed, as well as from three other individuals with whom she was in contact. Genetic testing has since indicated that the virus in question is linked to polioviruses circulating in northern Nigeria, according to Nature’s newsblog. The setback marks the first new case of naturally occurring polio in Somalia since March 2007. Emergency vaccination initiatives - and fund-raising to pay for them - are now underway. As the accompanying map shows, this development is a concern not just for Somalia, but for a broad swath of Africa, where low vaccination rates leave children particularly vulnerable to infection with polio, most likely from Nigeria (particularly northern Nigeria), where the virus is still endemic. In our increasingly interconnected world, an uncontrolled outbreak in these countries could fuel polio’s return around the globe-- which would be particularly tragic considering that there had been only 26 cases of polio (before the Somalia news) reported worldwide so far in 2013, compared with 53 at this point last year.

Several countries in Africa's polio belt that are currently polio-free are particularly vulnerable to renewed infection because of their low vaccination rates

http://www.eurekalert.org/pub_releases/2013-05/eaps-rtu051613.php

Reading the unreadable

Pioneering X-ray technology is making it possible to read fragile rolled-up historical documents for the first time in centuries.

Old parchment is often extremely dry and liable to crack and crumble if any attempt is made to physically unroll or unfold it. The new technology, however, eliminates the need to do so by enabling parchment to be unrolled or unfolded 'virtually' and the contents displayed on a computer screen.

Developed at Cardiff University and Queen Mary, University of London with funding from the Engineering and Physical Sciences Research Council (EPSRC), the breakthrough means historians will be able to access previously unusable written sources and gain new insight into the past.

No other technique developed anywhere in the world has the capability to make text concealed in rolled or folded historical parchments genuinely legible. The system has now been tested successfully on a medieval legal scroll provided by the Norfolk Record Office.

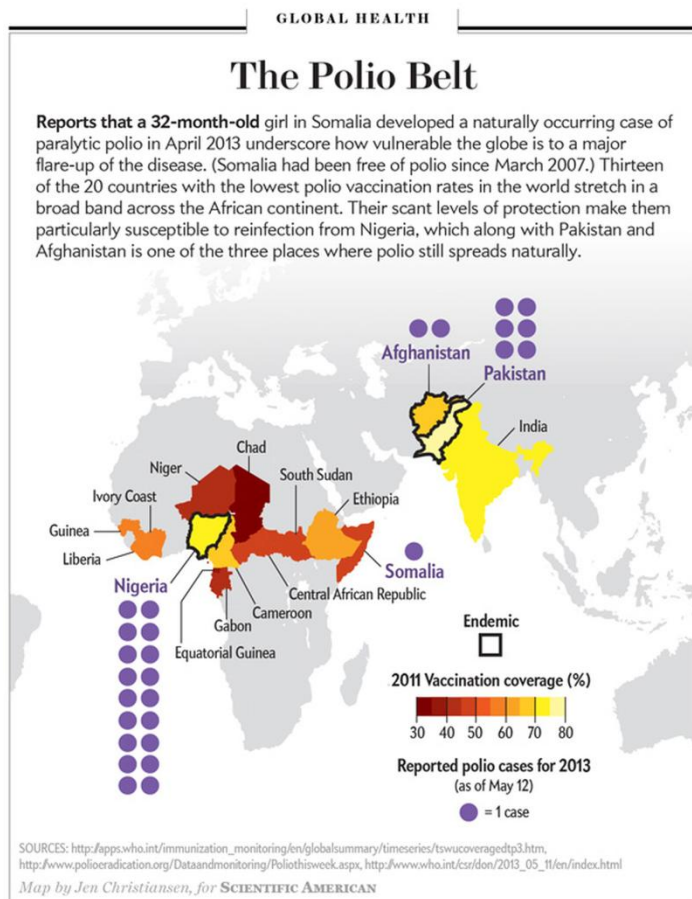
In a completely innovative approach to the problem, the technique works by scanning parchment with X-rays in order to detect the presence of iron contained in 'iron gall ink' – the most commonly used ink in Europe between the 12th and 19th centuries.

Using a method called microtomography, a 3-dimensional 'map' showing the ink's exact location is built up by creating images made from a series of X-ray 'slices' taken through the parchment.

Advanced software specially developed by the Cardiff project team combines the data obtained with information about the way the parchment is rolled or folded up and calculates exactly where the ink sits on the parchment. An image of the document as it would appear unrolled or unfolded can then be produced.

The key difference between the new method and other techniques previously developed to read un-openable historical documents is the unprecedentedly high contrast resolution it provides to distinguish between ink and parchment. This means the ink shows up very well against the parchment and is genuinely readable.

The scanning takes place at the Institute of Dentistry at Queen Mary, University of London led by Dr Graham Davis: "Because no commercial or research X-ray tomography scanners were capable of providing the quality of image we needed, we've developed our own advanced scanner which is also being adapted for a diverse range of other scientific uses, including those within our own Institute of Dentistry where enhanced, high



contrast images are enabling the detection and analysis of features in teeth that we haven't been able to see before."

Professor Tim Wess of Cardiff University says: "This is a milestone in historical information recovery. The conservation community is rightly very protective of old documents and isn't prepared to risk damaging them by opening them. Our breakthrough means they won't have to. Across the world, literally thousands of previously unusable documents up to around a thousand years old could now become available for historical research. It really will be possible to read the unreadable."

You can find out more about the research in an audio slide show on the EPSRC YouTube channel. (NB the full link address is <http://www.youtube.com/user/EPSRCvideo?feature=mm>). The title of the audio slide show is 'Reading the Unreadable'.

<http://www.bbc.co.uk/news/business-22550536>

Retirement 'harmful to health', study says

Retirement has a detrimental impact on mental and physical health, a new study has found.

The study, published by the Institute of Economic Affairs (IEA), a think tank, found that retirement results in a "drastic decline in health" in the medium and long term. The IEA said the study suggests people should work for longer for health as well as economic reasons. The government already plans to raise the state pension age. The study, which was published in conjunction with the Age Endeavour Fellowship, a charity, compared retired people with those who had continued working past retirement age, and took into account possible confounding factors. Philip Booth, programme director at the IEA, said the government should go further to deregulate labour markets and allow people to work for longer.

No 'normal' retirement age

"Working longer will not only be an economic necessity, it also helps people live healthier lives," he said.

Edward Datnow, chairman of the Age Endeavour Fellowship, said: "There should be no 'normal' retirement age in future.

"More employers need to consider how they will capitalise on Britain's untapped grey potential and those seeking to retire should think very hard about whether it is their best option."

The study suggests there is a small boost to health immediately after retirement, before a significant decline in the longer term. Retirement is found to increase the chances of suffering from clinical depression by 40%, while you are 60% more likely to suffer from a physical condition. The effect is the same for men and women, while the chances of becoming ill appear to increase with the length of time spent in retirement.

http://www.eurekalert.org/pub_releases/2013-05/cifa-wbi051613.php

World's biggest ice sheets likely more stable than previously believed

Researchers show that high ancient shorelines do not necessarily reflect ice sheet collapse millions of years ago

For decades, scientists have used ancient shorelines to predict the stability of today's largest ice sheets in Greenland and Antarctica. Markings of a high shoreline from three million years ago, for example – when Earth was going through a warm period – were thought to be evidence of a high sea level due to ice sheet collapse at that time.

This assumption has led many scientists to think that if the world's largest ice sheets collapsed in the past, then they may do just the same in our modern, progressively warming world.

However, a new groundbreaking study now challenges this thinking.

Using the east coast of the United States as their laboratory, a research team led by David Rowley, CIFAR Senior Fellow and professor at the University of Chicago, has found that the Earth's hot mantle pushed up segments of ancient shorelines over millions of years, making them appear higher now than they originally were millions of years ago.

"Our findings suggest that the previous connections scientists made between ancient shoreline height and ice volumes are erroneous and that perhaps our ice sheets were more stable in the past than we originally thought," says Rowley. "Our study is telling scientists that they can no longer ignore the effect of Earth's interior dynamics when predicting historic sea levels and ice volumes."

The study, published online in Science on May 16, was a collaboration that included CIFAR Senior Fellows Alessandro Forte (Université du Québec à Montréal) and Jerry Mitrovica (Harvard), and a former CIFAR-supported post-doctoral fellow Rob Moucha (Syracuse).

"This study was the culmination of years of work and deep collaboration by researchers in CIFAR's program in Earth System Evolution," explains Rowley. "For this study, each of us brought our individual expertise to the table: Rob and Alex worked on simulations of Earth's mantle dynamics, Jerry provided calculations on how glaciers warp Earth's surface, and I shaped our understanding of the geology of the landscape we were looking at. This study would not have been possible without CIFAR."

The team studied the coast from Virginia to Florida, which has an ancient scarp tens of metres above present-day sea level. Until now, many research groups have studied this shoreline and concluded that during a warm period three million years ago, the Greenland, West Antarctic and a fraction of East Antarctic ice sheets collapsed, raising the sea level at least 35 metres.

But the new findings by Rowley and his team suggest that these ice sheets, particularly the East Antarctic Ice Sheet (the world's largest), were probably more stable.

To do their study, the team used computer simulations to follow the movement of mantle and tectonic plates that occurred over time.

Their prediction of how the ancient shoreline would have developed over millions of years matched what geologists mapping this ancient coast have observed. The next steps for the team are to try to make accurate predictions in other locations around the world.

"The paper is important because it shows that no prediction of ancient ice volumes can ever again ignore the Earth's interior dynamics," explains Rowley.

"It also provides a novel bridge between two disciplines in Earth science that rarely intersect: mantle dynamics and long-term climate. It is the kind of study that changes how people think about our past climate and what our future holds."

<http://www.sciencedaily.com/releases/2013/05/130516123804.htm>

Faulty Energy Production in Brain Cells Leads to Disorders Ranging from Parkinson's to Intellectual Disability

For the first time dysfunctional mitochondria in brain cells shown to lead to learning disabilities

Neuroscientist Patrik Verstreken of VIB (Flanders Institute for Biotechnology) and KU Leuven has shown for the first time that dysfunctional mitochondria in brain cells can lead to learning disabilities. The link between dysfunctional mitochondria and Parkinson's disease is known, but this new research shows that it is also present in other brain disorders.

Patrik Verstreken (VIB / KU Leuven): "This discovery shows that energy production in brain cells is the basis of various brain disorders. We hope that a better understanding of the mechanisms used by the cell to maintain optimum energy levels will lead in the long term to medical applications that prevent or cure these diseases."

Dysfunctional mitochondria toxic for the brain cell

Well-functioning mitochondria -- the organelles that generate energy in cells -- are essential for a healthy brain. They provide the energy needed for communication between brain cells, which is crucial for transmitting stimuli and signals and thus for optimal functioning of the body.

Earlier research has shown that Parkinson's disease is often paired with dysfunctional mitochondria. Moreover, dysfunctional mitochondria are not efficiently discarded from the cell, which complicates the operation of other healthy mitochondria and leads to insufficient energy production in the cell. They can be compared to a faulty engine that emits toxic fumes.

Quality control by the brain cell

The Leuven-based VIB researchers Dominik Haddad, Vanessa Morais and Patrik Verstreken have unraveled the mechanism by which brain cells trigger the destruction of dysfunctional mitochondria. Once the mechanism is triggered, communication between brain cells is reestablished.

The researchers were surprised to find that this mechanism is not only defective in Parkinson's disease, but also in specific cases of intellectual disability. These results indicate the wider importance of mitochondria for optimal functioning of our brains. Haddad, Morais and Verstreken hope that their insights eventually contribute to the prevention of various brain disorders.

Brain disorders in Europe

1 in 3 Europeans will suffer from a brain disorder during his or her lifetime. All of us know people with dementia, schizophrenia, intellectual disability or another brain condition. Each of these diseases penetrates to a person's core and have a huge impact on the patient and his or her family. They also carry an economic impact: €800 billion is spent each year in Europe to cover brain disorder-related health needs.

Bart De Strooper (VIB/KU Leuven): "The brain is decisive in shaping who we are, but from a scientific standpoint, it is uncharted territory. This research constitutes an important piece of the complex puzzle. Brain research is vital, especially because brain disorders weigh so heavily on patients, their families and society. I am delighted that May 2013 has been designated the European Month of the Brain."

Dominik M. Haddad, Sven Vilain, Melissa Vos, Giovanni Esposito, Samer Matta, Vera M. Kalscheuer, Katleen Craessaerts, Maarten Leyssen, Raffaella M.P. Nascimento, Angela M. Vianna-Morgante, Bart De Strooper, Hilde Van Esch, Vanessa A. Morais, Patrik Verstreken. Mutations in the Intellectual Disability Gene Ube2a Cause Neuronal Dysfunction and Impair Parkin-Dependent Mitophagy. Molecular Cell, 2013; DOI: 10.1016/j.molcel.2013.04.012

<http://bit.ly/12EpFiS>

Parcels find their way to you via the crowd

A new delivery concept uses the location of random strangers to TwedEx parcels directly to you – wherever you are

16 May 2013 by Hal Hodson

JANE yawns and climbs the stairs from the subway at 145th Street, New York. She's almost home. A stranger rises from a bench as she approaches, catching her eye. "Jane Murphy?" She nods. "Here's your package." This is the ultimate aim of a crowd-powered delivery system dreamed up by a group of Microsoft researchers. Fictional Jane never has to deviate from her normal route to pick up her package. Instead, it is sent via a chain of people – an algorithm calculates the fastest route using aggregated location data from New York tweeters. Eric Horvitz of Microsoft Research in Seattle, Washington, calls the concept TwedEx. The idea could make it possible to deliver purchases to customers on the move, as well as making it cheaper to send them.

Basic crowdsourced systems already exist, which hire strangers from the internet to deliver packages. But TwedEx is different because it taps into existing human journeys. All the sender need do is write the recipient's unique identifier on the package, their Twitter handle, for example, and let the TwedEx algorithm and the crowd do the rest.

By learning people's average movements from their past Twitter data, TwedEx predicts which people to hand a package to at intermediate locations based on the package's final destination. A user would tell the network they had a package, the system would work out the best route and then each person in the chain would be told who to give the parcel to, as well as where, and when. Citizen couriers would be paid a small incentive to carry packages – depending how far out of their way they go to deliver or receive one.

In simulations, TwedEx works remarkably well. "We see that the typical time to get across the country is just five hours," Horvitz says, explaining that packages can make it from New York to San Francisco in that time even when they don't begin their journey next to the airport. Real world packages would be held up by factors such as airport security.

A real life TwedEx wouldn't need to track people in real time to set up a delivery chain. It would just send out messages to people along the possible route, asking them to make the exchange at a certain place and time.

Bulky items could be divided up among multiple couriers.

TwedEx can cover 50 per cent of New York if each link in the delivery chain waits up to 30 minutes and deviates up to 100 metres off-course from their usual route at exchange points.

You can also expand TwedEx's coverage by increasing the amount of time an individual in the delivery chain waits at transfer points for the package to reach them, and the distance they must deviate from their normal path, Horvitz says.

A paper describing the system will be presented at the AAI Conference on Weblogs and Social Media in Boston in July. So far, TwedEx only exists in a simulation, but Horvitz says Microsoft is discussing building an app for a real-world pilot.

Adam Sadilek, who worked on TwedEx but is now at Google, says the most viable initial scenario for TwedEx would be in poor countries. "You can imagine using this for the distribution of vaccines," he says.

Another group is already working on making this a reality. James McInerney of the University of Southampton, UK, told the NetMobs conference in Boston earlier this month about a crowdsourced delivery system for rural communities in the Ivory Coast. McInerney's system maps people's movements via their cellphone data logs, provided by telecoms firm Orange. "This would all be done by text," says McInerney. "Each participant would receive a text if they've been chosen by the algorithm, with the pickup and destination information, and they'd just have to follow their normal mobility patterns."

In McInerney's model, delivery time to remote areas would be 28 days. This is much longer than a dedicated van would take, but he sees the network as a delivery route for regular supplies, rather than irregular purchases, as it would be in US cities.

At least one of the US's largest companies is already thinking about using the crowd for deliveries. In March, Reuters reported that Wal-Mart is considering using its own customers to build a delivery network for goods bought online, and that the idea is in the early planning stages. A DHL concept called Bring Buddy was floated at Expo 2010 in China, but has since disappeared.

And Horvitz isn't the only one who dreams of postal addresses that match people, not places. Matternet co-founder Andreas Raptopoulos says the ultimate vision for his company is to build a delivery system that uses a network of drones (see "The drone is flying it to you now"), with package delivery reaching the same level of abstraction as the delivery of email on smartphones. "An email doesn't care where you are, we want to do the same with physical packages," he says.

The drone is flying it to you now

Matternet is aptly named. The firm's CEO Andreas Raptopoulos is building an internet for stuff, which can transport small items over short distances using flying drones. The drones will be suitcase-sized and should cost less than \$5000 each, while maintaining a 10-kilometre range. Each will have on-board sensing systems that are sophisticated enough to land the drone at drop-off targets that are smaller than GPS can handle.

"We are in early phase discussions with the TNT courier company in Europe," Raptopoulos says. "They work with the UN as a food distribution partner and we are working out where Matternet fits in the infrastructure chain."

<http://www.japantimes.co.jp/news/2013/05/17/national/fish-milt-used-to-glean-rare-earths/>

Fish milt used to glean rare earths

Japanese researchers said Friday they have found a better, cheaper way to smelt rare earth metals by using salmon milt, or sperm.

Rare earth ores can contain several of the 17 metals considered essential to manufacturing motors, phone parts and other high-tech products, but separating and recovering the metals from the ore is expensive and tedious because a special type of resin must be used.

The breakthrough made by researchers from Aisin Cosmos R&D Co., however, will make the process "low-cost and environment-friendly," said Yoshio Takahashi, a professor of environmental chemistry at Hiroshima University who was part of the team. The team, based in Aichi Prefecture, announced its findings at the Japan Sustainable Mining, Investment & Technology business forum in Tokyo.

After the team found a 2010 study that said phosphate groups found on the surface of bacteria can absorb and separate rare earths over 10 times more efficiently than the resin, it looked into the possibility of using milt, which is rich in phosphoric acids but mostly thrown away.

They performed an experiment in which salmon milt was dried, powdered and put into a beaker containing a solution consisting of rare earth metals. The milt ended up absorbing the rare earth elements as well as bacteria does, especially the scarce and expensive elements thulium and lutetium.

http://www.eurekalert.org/pub_releases/2013-05/asu-amw051713.php

Attacking MRSA with metals from antibacterial clays

Certain varieties of clay have the ability to aggressively kill a range of pathogens

Written by: Richard Harth Science Writer: The Biodesign Institute

In the race to protect society from infectious microbes, the bugs are outrunning us. The need for new therapeutic agents is acute, given the emergence of novel pathogens as well as old foes bearing heightened antibiotic resistance.

Shelley Haydel, a researcher at Arizona State University's Biodesign Institute has a new approach to developing effective, topical antibacterial agents — one that draws on a naturally occurring substance recognized since antiquity for its medicinal properties: clay.

In research appearing in the journal PLOS ONE, Haydel and her graduate student, Caitlin Otto, lay out the case for clay, demonstrating that certain varieties of clay have the ability to aggressively kill a range of pathogens including E. coli and methicillin-resistant Staphylococcus aureus (MRSA) — a stubborn, highly contagious, and dangerous pathogen that has lately been the scourge of many hospitals and is a common cause of skin infections in the community. Their study further indicates that, rather than the physical particles of the clays, particular metal ions attached to the clay are likely responsible for its potent antibacterial properties.

"While some natural clays, which have absorptive properties similar to sponges, have been used topically for centuries, scientific studies investigating the antibacterial mechanisms represent a relatively new area of research," Haydel says. "With this study, we have demonstrated that the antibacterial activity of these natural clays is not dependent on the physical clay particles, but rather the abiotic, microbicidal activities of specific metal ions desorbed from the clay surface. While we are still working on mechanism of action studies, determining that specific metal ions influenced antibacterial activity was critical in leading us in the appropriate scientific directions."

Medical use of clay has a storied history. As early as 5000 years ago, clay was listed in the ancient tablets of Nippur as a wound-healing medicament. Around 1600 BC, the Ebers Papyrus—recognized as the world's oldest medical text—recommended clay for ailments including diarrhea, dysentery, tapeworm, hookworm, wounds, and abscesses. Clays came into common use in the 19th century as topical treatments for surgical wounds, demonstrating their beneficial effects for pain management, inflammation, putrefaction, and healing processes. In their current study, Otto and Haydel examined four clay samples and their respective aqueous mineral extracts or leachates and determined that the clays exhibited different in vitro antibacterial activities against E.

coli and MRSA. Mineralogically, the samples were nearly identical with 52 percent clay and 48 percent non-clay minerals, but the composition of metal ions released from the mineral surfaces varied considerably across the samples. The tests, using aqueous mineral leachates of the four clay samples, uncovered a variety of elements in varying concentrations. Based on previous studies, the research team focused on five metal ions—iron (Fe), copper (Cu), cobalt (Co), nickel (Ni), and zinc (Zn).

When non-antibacterial clays with low concentrations of these five critical metal ions were supplemented with higher amounts and the pH was matched with that of antibacterial clays, the new formulation displayed killing ability against *E. coli* and MRSA. The result pointed to the presence of metal ions in sufficient concentration as the antibacterial agent in the clay. Further tests narrowed the field of antibacterial candidates, establishing Fe⁺², Cu⁺², and Zn⁺² ions as contributing antibacterial agents.

While the pH level was found to play a mediating role, the lethal effect of the clays could not be attributed exclusively to pH, absent the influence of metal ions. Metal speciation modeling and statistical analysis of the results indicated that Cu⁺², Co⁺², Ni⁺², and Zn⁺² are effective against *E. coli*, while Cu⁺², Co⁺², and Zn⁺² are effective against MRSA. Intriguingly, the study found that the metal ion toxicity of a given clay sample is not always proportional to the total ion concentration. Toxicity instead is critically dependent on a variety of other factors including pH, ion solubility, osmotic strength, and temperature. The tests undertaken helped to evaluate the interplay of these factors in determining both the antibacterial effectiveness and toxicity of the samples.

Haydel notes that physical and chemical properties of minerals contained in clays together contribute to healing properties. Minerals contained in clay mixtures have a negative surface charge that allows the free exchange of compounds from the environment, including bacteria, viruses, proteins, nucleic acids, and cations. Kaolinite, talc, and smectite clay minerals are highly absorptive. Due to their ability to adhere to the skin, clays offer mechanical protection similar to a bandage, sealing out external physical or chemical agents, as well as absorptive properties which assist in removing devitalized tissue, particulate matter, or foreign materials from a wound.

Haydel is optimistic about the potential for medicinal clays to play a greater therapeutic role, particularly against the growing threat of topical and antibiotic-resistant infections:

"We have demonstrated that mineralogically-identical clays exhibit chemical variability which correlates with variability in antibacterial activity. Since clays can contain toxic metals, such as arsenic, cadmium, lead, and mercury, safety precautions must be in place to minimize exposure to toxic ions. Efforts must be taken to standardize the composition and antibacterial efficacy of clays if they are to be used therapeutically and prophylactically." *PLOS ONE paper: <http://dx.plos.org/10.1371/journal.pone.0064068>*

<http://bit.ly/189HIj2>

Venus, Jupiter and Mercury Will Dance on May 28

On May 28 Venus, Jupiter and Mercury will seem to gracefully sweep past one another in a tight grouping in the sky

May 17, 2013 12:56 PM ET // by Mark Thompson

Understanding events in the night sky is much like enjoying a cup of coffee in your favorite coffee shop!

For example, right now, a delicious 'grande' mug of decaf skinny peppermint latte (it's really good, you should try it) is sitting a foot or two behind my screen. From where I am sitting, the screen and cup appear to be right next to each other, yet I know that they are separated by some distance.

This is a great analogy for the many planetary alignments, or conjunctions, we can enjoy in the night sky. And one impressive one is coming on May 28 -- Venus, Jupiter and Mercury will seem to gracefully sweep past one another in a tight grouping in the sky, but in reality they are millions of kilometers apart.



A simulated view of Jupiter, Venus and Mars in conjunction on May 28, 2013. Mark Thompson

I still find it amazing that we can predict such celestial events and even send spacecraft not to where a planet is right now, but where it will be in a few years time when the spacecraft arrives! Totally crazy.

One of the key developments in history that has given us this beautiful ability is the articulation of a set of laws that the planets seem to adhere to during their relentless journey around the sun.

It was Johannes Kepler who documented his three laws of planetary motion back in the first few decades of the 17th Century. The laws are all pretty self explanatory:

1. Planets move in elliptical orbits with the sun at one of the foci.

2. A line joining the sun to a planet -- the radius vector -- sweeps out equal areas of space at equal intervals of time (basically means planets travel faster nearer the sun and slower further away)

3. The square of the orbital period of a planet is proportional to the cube of its mean distance from the sun.

Using these laws, which fundamentally come from the laws of gravitation, allows us to predict with incredible accuracy how the planets move so we can tell that on May 28th, 2013, Venus and Jupiter will pass within one degree of one other (about twice the apparent size of the full moon). To add a little bit of sparkle, a little further above the horizon Mercury will put in an appearance.

Although they may look close from our point of view, in reality Jupiter will be 660 million kilometers further away than Venus, and 744 million kilometers further away than Mercury, which is the closest of all of them come to us. Mercury is always an elusive planet but the 28th will be a great evening to try and spot it low in the west after sunset.

If you want to try and spot this beauty of a conjunction then wait until the sun has set and the western sky has started to go dark. Look out for two bright 'stars'; the lowest will be Jupiter, above and brighter will be Venus and higher up and a little fainter than both of them will be Mercury.

Clear skies and happy stargazing!

<http://www.bbc.co.uk/news/science-environment-22546875>

Deep sea mining 'gold rush' moves closer

The prospect of a deep sea "gold rush" opening a controversial new frontier for mining on the ocean floor has moved a step closer.

David Shukman By David Shukman Science editor, BBC News

The United Nations has published its first plan for managing the extraction of so-called "nodules" - small mineral-rich rocks - from the seabed. A technical study was carried out by the UN's International Seabed Authority - the body overseeing deep sea mining. It says companies could apply for licences from as soon as 2016.

The idea of exploiting the gold, copper, manganese, cobalt and other metals of the ocean floor has been considered for decades but only recently became feasible with high commodity prices and new technology. Conservation experts have long warned that mining the seabed will be highly destructive and could have disastrous long-term consequences for marine life. The ISA study itself recognizes that mining will cause "inevitable environmental damage". But the report comes amid what a spokesman describes as "an unprecedented surge" of interest from state-owned and private mining companies.

Sharing the proceeds

The number of licences issued to prospect for minerals now stands at 17 with another seven due to be granted and more are likely to follow. They cover vast areas of the Pacific, Atlantic and Indian Oceans.

One of the most recent to be granted was to UK Seabed Resources, a subsidiary of the British arm of Lockheed Martin, the American defence giant.

Under the UN Convention on the Law of the Sea, the ISA was set up to encourage and manage seabed mining for the wider benefit of humanity - with a share of any profits going to developing countries.

Now the ISA is taking the significant step of moving from simply handling bids for mineral exploration to considering how to license the first real mining operations and how to share the proceeds. The ISA's legal counsel, Michael Lodge, told the BBC: "We are at the threshold of a new era of deep seabed mining."

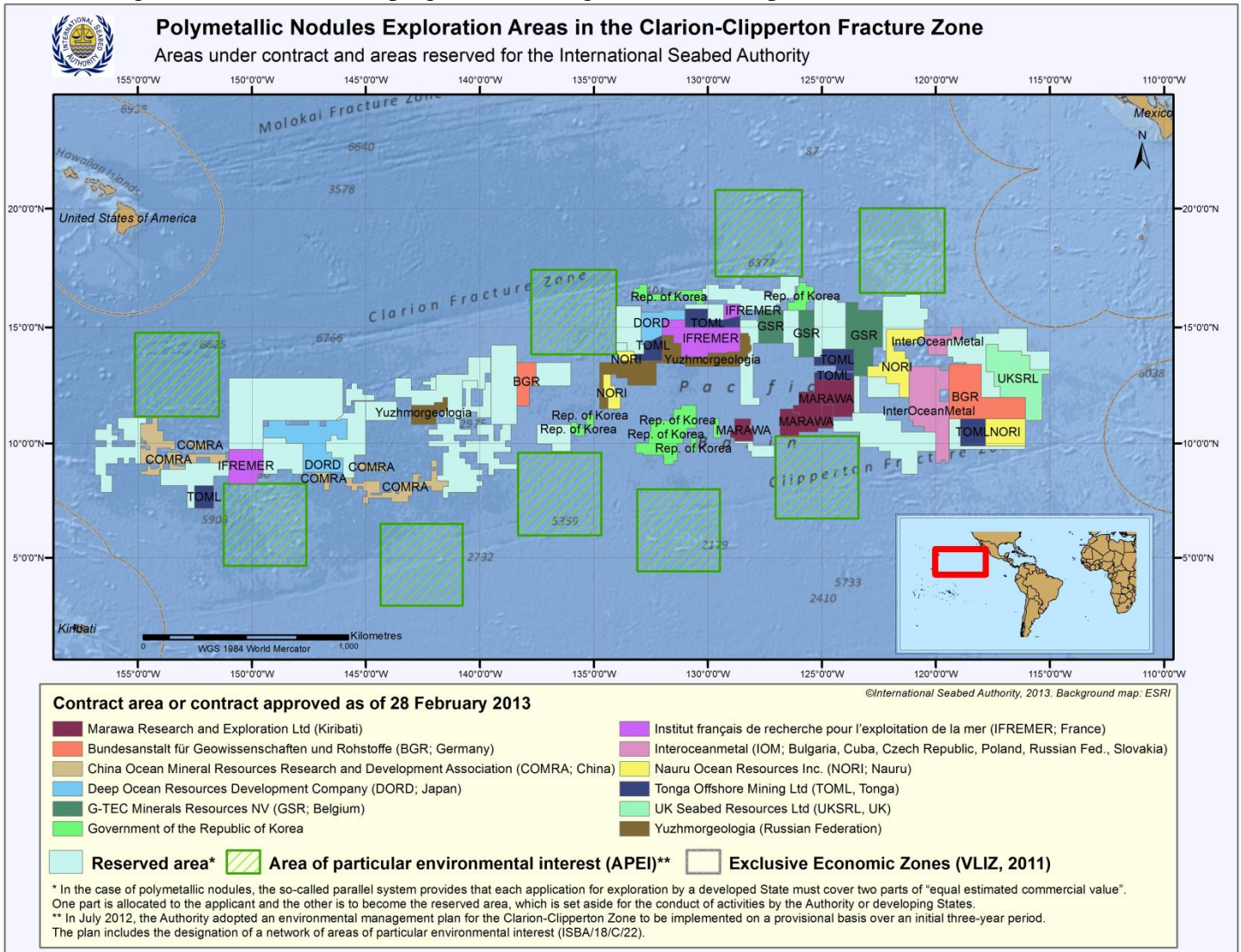
The lure is obvious. An assessment of the eastern Pacific - a five million sq km area known as the Clarion-Clipperton Zone - concluded that more than 27 billion tonnes of nodules could be lying on the sand.

Those rocks would contain a staggering seven billion tonnes of manganese, 340 million tonnes of nickel, 290 million tonnes of copper and 78 million tonnes of cobalt - although it's not known how much of this is accessible.

Right incentives

According to the planning study, the ISA faces the challenge of trying to ensure that nodule mining's benefits will reach beyond the companies themselves while also fostering commercially viable operations.

The plan relies on providing operators with the right incentives to risk what would be expensive investments without losing the chance for developing countries to get a slice of the proceeds.



A map shows the spread of licensed areas across the zone.

But the ISA identifies what it calls a "Catch-22" in this brand new industry as it tries to assess which companies are skilled enough to carry out the work. "Competence cannot be gained," it says, "without actual mining at a commercial scale, but at the same time mining should not be allowed without prior demonstration of competence."

A key factor in the ISA's thinking is the need for environmental safeguards, so the document calls for monitoring of the seabed during any mining operation - though critics wonder if activity in the ocean depths can be policed.

The prospect of deep sea mining has already sparked a vigorous debate among marine scientists, as I found earlier this year on a visit to the British research ship, James Cook, exploring the hydrothermal vents of the Cayman Trough.

The expedition's chief scientist, Dr Jon Copley, a biologist from the University of Southampton, urged caution. "I don't think we own the deep ocean in the sense that we can do what we like with it," he said. "Instead we share responsibility for its stewardship. "We don't have a good track record of achieving balance anywhere else - think of the buffalo and the rainforest - so the question is, can we get it right?"

Extinction risk

And Prof Paul Tyler, also a biologist, of the National Oceanography Centre, warned that unique species would be at risk. "If you wipe out that area by mining, those animals have to do one of two things: they disperse and colonise another hydrothermal vent somewhere or they die. "And what happens when they die is that the vent will become biologically extinct."

However, marine chemist Prof Rachel Mills, of the University of Southampton, called for a wider debate about mining generally on the grounds that we all use minerals and that mines on land are far larger than any would be on the seabed. She has carried out research for Nautilus Minerals, a Canadian firm planning to mine

hydrothermal vents off Papua New Guinea. "Everything we are surrounded by, the way we live, relies on mineral resources and we don't often ask where they come from," she said.

"We need to ask whether there is sustainable mining on land and whether there is sustainable mining in the seas. "I actually think it is the same moral questions we ask whether it's from the Andes or down in the Bismarck Sea." This debate is set to intensify as the reality of the first mining operations comes closer.

http://www.eurekalert.org/pub_releases/2013-05/tmsh-kss051513.php

Ketamine shows significant therapeutic benefit in people with treatment-resistant depression

Drug associated with rapid antidepressant effect in largest clinical trial to date

Patients with treatment-resistant major depression saw dramatic improvement in their illness after treatment with ketamine, an anesthetic, according to the largest ketamine clinical trial to-date led by researchers from the Icahn School of Medicine at Mount Sinai. The antidepressant benefits of ketamine were seen within 24 hours, whereas traditional antidepressants can take days or weeks to demonstrate a reduction in depression.

The research will be discussed at the American Psychiatric Association meeting on Monday, May 20, 2013 at 12:30 pm in the Press Briefing Room at the Moscone Center in San Francisco.

Led by Dan Iosifescu, MD, Associate Professor of Psychiatry at Mount Sinai; Sanjay Mathew, MD, Associate Professor of Psychiatry at Baylor College of Medicine; and James Murrough, MD Assistant Professor of Psychiatry at Mount Sinai, the research team evaluated 72 people with treatment-resistant depression—meaning their depression has failed to respond to two or more medications—who were administered a single intravenous infusion of ketamine for 40 minutes or an active placebo of midazolam, another type of anesthetic without antidepressant properties.

Patients were interviewed after 24 hours and again after seven days. After 24 hours, the response rate was 63.8 percent in the ketamine group compared to 28 percent in the placebo group. The response to ketamine was durable after seven days, with a 45.7 percent response in the ketamine group versus 18.2 percent in the placebo group. Both drugs were well tolerated.

"Using midazolam as an active placebo allowed us to independently assess the antidepressant benefit of ketamine, excluding any anesthetic effects," said Dr. Murrough, who is first author on the new report.

"Ketamine continues to show significant promise as a new treatment option for patients with severe and refractory forms of depression."

Major depression is caused by a breakdown in communication between nerve cells in the brain, a process that is controlled by chemicals called neurotransmitters. Traditional antidepressants such as selective serotonin reuptake inhibitors (SSRIs) influence the activity of the neurotransmitters serotonin and norepinephrine to reduce depression. In these medicines, response is often significantly delayed and up to 60 percent of people do not respond to treatment, according to the U.S Department of Health and Human Services.

Ketamine works differently than traditional antidepressants in that it influences the activity of the glutamine neurotransmitter to help restore the dysfunctional communication between nerve cells in the depressed brain, and much more quickly than traditional antidepressants.

Future studies are needed to investigate the longer term safety and efficacy of a course of ketamine in refractory depression. Dr. Murrough recently published a preliminary report in the journal *Biological Psychiatry* on the safety and efficacy of ketamine given three times weekly for two weeks in patients with treatment-resistant depression.

"We found that ketamine was safe and well tolerated and that patients who demonstrated a rapid antidepressant effect after starting ketamine were able to maintain the response throughout the course of the study," Dr. Murrough said. "Larger placebo-controlled studies will be required to more fully determine the safety and efficacy profile of ketamine in depression."

The potential of ketamine was discovered by Dennis S. Charney, MD, Anne and Joel Ehrenkranz Dean of the Icahn School of Medicine at Mount Sinai, and Executive Vice President for Academic Affairs of The Mount Sinai Medical Center, in collaboration with John H. Krystal, MD, Chair of the Department of Psychiatry at Yale University.

"Major depression is one of the most prevalent and costly illnesses in the world, and yet currently available treatments fall far short of alleviating this burden," said Dr. Charney. "There is an urgent need for new, fast-acting therapies, and ketamine shows important potential in filling that void."

Dr. Murrough will present his research on Sunday, May 19, 2013 from 1:00 pm to 3:00 pm in the Moscone exhibit hall at the APA meeting.

http://www.eurekalert.org/pub_releases/2013-05/mc-ccl051513.php

Consuming coffee linked to lower risk of detrimental liver disease, Mayo Clinic finds

Consumption of coffee is associated with a reduced risk of primary sclerosing cholangitis

ROCHESTER, Minn. -- Regular consumption of coffee is associated with a reduced risk of primary sclerosing cholangitis (PSC), an autoimmune liver disease, Mayo Clinic research shows. The findings were being presented at the Digestive Disease Week 2013 conference in Orlando, Fla.

PSC is an inflammatory disease of the bile ducts that results in inflammation and subsequent fibrosis that can lead to cirrhosis of the liver, liver failure and biliary cancer.

"While rare, PSC has extremely detrimental effects," says study author Craig Lammert, M.D., a Mayo Clinic gastroenterologist. "We're always looking for ways to mitigate risk, and our first-time finding points to a novel environmental factor that also might help us to determine the cause of this and other devastating autoimmune diseases."

The study examined a large group of U.S. patients with PSC and primary biliary cirrhosis (PBC) and a group of healthy patients. Data showed that coffee consumption was associated with reduced risk of PSC, but not PBC. PSC patients were much likelier not to consume coffee than healthy patients were. The PSC patients also spent nearly 20 percent less of their time regularly drinking coffee than the control.

The study suggests PSC and PBC differ more than originally thought, Konstantinos Lazaridis, M.D., a Mayo Clinic hepatologist and senior study author says: "Moving forward, we can look at what this finding might tell us about the causes of these diseases and how to better treat them."

The National Institutes of Health funded part of this with a grant to principal investigator Dr. Lazaridis. The American Liver Foundation awarded Dr. Lammert a postdoctoral research fellowship.

<http://www.wired.com/wiredscience/2013/05/fecal-transplants-fda/>

Fecal Transplants: The FDA Steps In

US Food and Drug Administration has decided to bring the semi-outlaw procedure called "fecal transplant" under its auspices

By Maryn McKenna

Hi constant readers: I am traveling again, and while I'm in a far time zone, news has broken that you might be interested in. So while I don't have a full understanding myself yet of what's going on, I'm going to throw up what I've got, because I know how many people are interested in this.

Briefly: The US Food and Drug Administration has decided to bring the semi-outlaw — but very safe and very effective — procedure called "fecal transplant" under its auspices, ruling that to perform it, physicians must have applied for an "investigational new drug application," or IND. This requires a lot of advance paperwork, 30 days of consideration, and does not return not a guaranteed yes. For the transplants, which have been performed informally but carefully by a growing number of physicians as a treatment (and often cure) for devastating *C. difficile* infection, it may improve safety, but it can't help but impose obstacles and delay. (My past posts on fecal transplants here and here.)

The decision is confirmed in this letter from the FDA to the American Gastroenterological Association, which also explains the background in this post.

Physician Mike Edmond, of Controversies in Hospital Infection, posts his reaction here. Excerpt:

Even before the FDA did this, there were already hurdles for patients who are really suffering a great deal. First, there are few physicians who are providing this therapy. I have had patients drive over 8 hours to come for a treatment that is quite primitive but amazingly effective. For the doctor it's time consuming and the reimbursement is very poor. Nonetheless, I have felt morally compelled to provide this therapy and as a result I have many thankful patients. Then there is the issue of insurance companies not covering the cost of donor testing, which costs \$1500-2000. Now there's the additional burden of the FDA red tape and the numerous documents required by institutional review boards.

So now I must apply for an IND number, which requires that I send the FDA my protocol. On the 30th day after receipt of my documents the FDA will let me know whether I can proceed. When I talked to the FDA officer yesterday she informed me that the FDA is only interested in fecal transplants with regards to safety. They want to ensure that donors are appropriately screened. Thus, I need to send them my protocol for donor testing and then I will get a ruling. I asked the officer what the FDA was looking for and was told that they can't say but will either approve or not approve my protocol. Now wouldn't it have made more sense for the FDA to review the literature and consult experts about what optimal testing of donors and safeguards should be for the procedure and simply require practitioners to follow their guideline instead of the guess-what-I'm-thinking-and-wait-30-days game?

Researcher Jonathan Eisen counters (and also curates a bunch of links):

*Given how many scam artists and oversellers of the microbiome are out there I think some sort of increased protection or regulation is probably a good thing. But I am not sure what the best way to do this is. ... given how little we know about FTs other than as treatment for *Clostridium difficile* infections it seems like one could make a*

reasonable argument for more regulation or caution. It seems strange though that we can do just about anything and everything we want to kill all the microbes around us with very little regulation and yet attempting to manipulate the microbes in and on us or add a few here and there is being regulated more.

The major digestive-disease societies and the American Society for Microbiology both began their annual meetings yesterday. Can't imagine this won't be a hot topic of conversation at both.

<http://www.bbc.co.uk/news/science-environment-22567023>

Climate slowdown means extreme rates of warming 'not as likely'

Scientists say the recent downturn in the rate of global warming will lead to lower temperature rises in the short-term.

By Matt McGrath Environment correspondent, BBC News

Since 1998, there has been an unexplained "standstill" in the heating of the Earth's atmosphere.

Writing in Nature Geoscience, the researchers say this will reduce predicted warming in the coming decades. But long-term, the expected temperature rises will not alter significantly. The slowdown in the expected rate of global warming has been studied for several years now. Earlier this year, the UK Met Office lowered their five-year temperature forecast. But this new paper gives the clearest picture yet of how any slowdown is likely to affect temperatures in both the short-term and long-term. An international team of researchers looked at how the last decade would impact long-term, equilibrium climate sensitivity and the shorter term climate response.

Transient nature

Climate sensitivity looks to see what would happen if we doubled concentrations of CO₂ in the atmosphere and let the Earth's oceans and ice sheets respond to it over several thousand years. Transient climate response is much shorter term calculation again based on a doubling of CO₂. The Intergovernmental Panel on Climate Change reported in 2007 that the short-term temperature rise would most likely be 1-3C (1.8-5.4F).

But in this new analysis, by only including the temperatures from the last decade, the projected range would be 0.9-2.0C. "The hottest of the models in the medium-term, they are actually looking less likely or inconsistent with the data from the last decade alone," said Dr Alexander Otto from the University of Oxford. "The most extreme projections are looking less likely than before."

The authors calculate that over the coming decades global average temperatures will warm about 20% more slowly than expected. But when it comes to the longer term picture, the authors say their work is consistent with previous estimates. The IPCC said that climate sensitivity was in the range of 2.0-4.5C.

Ocean storage

This latest research, including the decade of stalled temperature rises, produces a range of 0.9-5.0C. "It is a bigger range of uncertainty," said Dr Otto. "But it still includes the old range. We would all like climate sensitivity to be lower but it isn't."

The researchers say the difference between the lower short-term estimate and the more consistent long-term picture can be explained by the fact that the heat from the last decade has been absorbed into and is being stored by the world's oceans.

Not everyone agrees with this perspective.

Prof Steven Sherwood, from the University of New South Wales, says the conclusion about the oceans needs to be taken with a grain of salt for now. "There is other research out there pointing out that this storage may be part of a natural cycle that will eventually reverse, either due to El Nino or the so-called Atlantic Multidecadal Oscillation, and therefore may not imply what the authors are suggesting," he said.

The authors say there are ongoing uncertainties surrounding the role of aerosols in the atmosphere and around the issue of clouds. "We would expect a single decade to jump around a bit but the overall trend is independent of it, and people should be exactly as concerned as before about what climate change is doing," said Dr Otto.

Is there any succour in these findings for climate sceptics who say the slowdown over the past 14 years means the global warming is not real? "None. No comfort whatsoever," he said.

http://www.eurekalert.org/pub_releases/2013-05/ats-gcm051413.php

Ginger compounds may be effective in treating asthma symptoms

Purified components of ginger also may have properties that help asthma patients breathe more easily

ATS 2013, PHILADELPHIA — Gourmands and foodies everywhere have long recognized ginger as a great way to add a little peppery zing to both sweet and savory dishes; now, a study from researchers at Columbia University shows purified components of the spicy root also may have properties that help asthma patients breathe more easily.

The results of the study will be presented at the ATS 2013 International Conference.

Asthma is characterized by bronchoconstriction, a tightening of the bronchial tubes that carry air into and out of the lungs. Bronchodilating medications called beta-agonists (β -agonists) are among the most common types of

asthma medications and work by relaxing the airway smooth muscle (ASM) tissues. This study looked at whether specific components of ginger could help enhance the relaxing effects of bronchodilators.

"Asthma has become more prevalent in recent years, but despite an improved understanding of what causes asthma and how it develops, during the past 40 years few new treatment agents have been approved for targeting asthma symptoms," said lead author Elizabeth Townsend, PhD, post-doctoral research fellow in the Columbia University Department of Anesthesiology. "In our study, we demonstrated that purified components of ginger can work synergistically with β -agonists to relax ASM."

To conduct their study, the researchers took human ASM tissue samples and caused the samples to contract by exposing them to acetylcholine, a neurotransmitting compound that causes bronchoconstriction. Next, the researchers mixed the β -agonist isoproterenol with three separate components of ginger: 6-gingerol, 8-gingerol or 6-shogaol. Contracted tissue samples were exposed to each of these three mixtures as well as unadulterated isoproterenol and the relaxation responses were recorded and compared.

At the conclusion of their study, the researchers found that tissues treated with the combination of purified ginger components and isoproterenol exhibited significantly greater relaxation than those treated only with isoproterenol; of the three ginger components, 6-shogaol appeared most effective in increasing the relaxing effects of the β -agonist.

Once they were able to demonstrate that the ginger components enhanced the relaxing effects of the β -agonist, they turned their attention to learning why. First, the researchers wanted to determine if the ginger components might work by affecting an enzyme called phosphodiesterase4D (PDE4D). Previous studies have shown that PDE4D, which is found in the lungs, inhibits processes that otherwise help relax ASM and lessen inflammation. Using a technique called fluorescent polarization, they found that all three components significantly inhibited PDE4D.

Next, the study looked at F-actin filaments, a protein structure which previous studies have shown plays a role in the constriction of ASM, and found that 6-shogaol was effective in speedily dissolving these filaments.

"Taken together, these data show that ginger constituents 6-gingerol, 8-gingerol and 6-shogaol act synergistically with the β -agonist in relaxing ASM, indicating that these compounds may provide additional relief of asthma symptoms when used in combination with β -agonists," Dr. Townsend noted. "By understanding the mechanisms by which these ginger compounds affect the airway, we can explore the use of these therapeutics in alleviating asthma symptoms."

Dr. Townsend and her colleague, Dr. Charles Emala, hope future studies will enable them to gain a better understanding of the cellular mechanisms that facilitate ASM relaxation and to determine whether aerosol delivery of these purified constituents of ginger may have therapeutic benefit in asthma and other bronchoconstrictive diseases.

** Please note that numbers in this release may differ slightly from those in the abstract. Many of these investigations are ongoing; the release represents the most up-to-date data available at press time.*

Abstract 38824

Active Constituents Of Ginger Potentiate β -Agonist-Induced Relaxation Of Airway Smooth Muscle

Type: Scientific Abstract

Category: 03.10 - Smooth Muscle: Airway (RSF)

Authors: E.A. Townsend, Y. Zhang, C. Xu, R. Wakita, C. Emala; Columbia University - New York, NY/US

Abstract Body

Rationale: Asthma prevalence has steadily increased and is characterized by bronchoconstriction. Bronchodilators are the first-line therapy to reverse airway obstruction by relaxing airway smooth muscle (ASM). Asthma therapies include β -agonists that induce bronchodilation by activating adenylyl cyclase, increasing cAMP and activating protein kinase A. Despite improved understanding of the pathogenesis of asthma, few novel therapeutics have been approved for targeting asthma symptoms in the last 40 years. This highlights the need for new therapies that relax contracted airways while also augmenting traditional therapies. We demonstrated that purified components of ginger can relax ASM. By understanding the mechanisms by which these compounds exert their effects on the airway, we can explore the use of these phytotherapeutics in alleviating asthma symptoms. We hypothesized that unique chemical components of ginger have bronchorelaxant properties and work synergistically with β -agonist signaling to relax ASM.

Methods and Results: Epithelial-denuded human ASM tissue (deidentified; exempt from Columbia's IRB) was contracted with acetylcholine in organ baths. ASM tissues were then relaxed dose-dependently with β -agonist, isoproterenol (100 pM – 10 μ M, half-log increments). The tissues were treated concurrently at 300 pM isoproterenol with vehicle, 6-gingerol, 8-gingerol, or 6-shogaol (100 μ M). Significant potentiation of isoproterenol-induced relaxation was observed with each of the ginger constituents. 6-shogaol showed the largest leftward shift in the EC50 for isoproterenol. Purified phosphodiesterase 4D enzyme, the prominent isoform in the lung, was used to assess PDE inhibitory action of the ginger constituents using fluorescent polarization analyses. 6-gingerol, 8-gingerol, and 6-shogaol (100 μ M, 15 min) significantly inhibited PDE4D compared to vehicle control (0.2% DMSO), the PDE4-selective inhibitor, rolipram (10 μ M) and non-

selective PDE inhibitor, IBMX (250 μ M) were used as positive controls. β -agonist induced depolymerization of actin via a PKA-HSP20-dependent pathway contributes to ASM relaxation. In primary human ASM cells transiently transfected with RFP-actin, treatment with 6-gingerol, 8-gingerol, or 6-shogaol showed acute (within seconds) dissolution of F-actin filaments. This was not due to PKA phosphorylation of HSP20.

Conclusions: Taken together, these data show synergistic effects of ginger constituents 6-gingerol, 8-gingerol, and 6-shogaol with β -agonist in relaxing ASM. This may be attributed to increased cAMP due to PDE4D inhibitory activity. Additionally, these compounds stimulate actin depolymerization through a novel PKA-independent pathway, providing another pathway for potentiation with β -agonists. These compounds may provide additional relief of asthma symptoms when used in combination with β 2-agonists and highlight novel use of phytotherapeutics in the treatment of obstructive lung disease.

http://www.eurekalert.org/pub_releases/2013-05/giot-rco051413.php

RNA capable of catalyzing electron transfer on early earth with iron's help, study says
A new study shows how complex biochemical transformations may have been possible under conditions that existed when life began on the early Earth.

The study shows that RNA is capable of catalyzing electron transfer under conditions similar to those of the early Earth. Because electron transfer, the moving of an electron from one chemical species to another, is involved in many biological processes – including photosynthesis, respiration and the reduction of RNA to DNA – the study's findings suggest that complex biochemical transformations may have been possible when life began.

There is considerable evidence that the evolution of life passed through an early stage when RNA played a more central role, before DNA and coded proteins appeared. During that time, more than 3 billion years ago, the environment lacked oxygen but had an abundance of soluble iron.

"Our study shows that when RNA teams up with iron in an oxygen-free environment, RNA displays the powerful ability to catalyze single electron transfer, a process involved in the most sophisticated biochemistry, yet previously uncharacterized for RNA," said Loren Williams, a professor in the School of Chemistry and Biochemistry at the Georgia Institute of Technology.

The results of the study were scheduled to be published online on May 19, 2013, in the journal *Nature Chemistry*. The study was sponsored by the NASA Astrobiology Institute, which established the Center for Ribosomal Origins and Evolution (Ribo Evo) at Georgia Tech.

Free oxygen gas was almost nonexistent in the Earth's atmosphere more than 3 billion years ago. When free oxygen began entering the environment as a product of photosynthesis, it turned the earth's iron to rust, forming massive banded iron formations that are still mined today. The free oxygen produced by advanced organisms caused iron to be toxic, even though it was – and still is – a requirement for life. Williams believes the environmental transition caused a slow shift from the use of iron to magnesium for RNA binding, folding and catalysis.

Williams and Georgia Tech School of Chemistry and Biochemistry postdoctoral fellow Chiaolong Hsiao used a standard peroxidase assay to detect electron transfer in solutions of RNA and either the iron ion, Fe²⁺, or magnesium ion, Mg²⁺. For 10 different types of RNA, the researchers observed catalysis of single electron transfer in the presence of iron and absence of oxygen. They found that two of the most abundant and ancient types of RNA, the 23S ribosomal RNA and transfer RNA, catalyzed electron transfer more efficiently than other types of RNA. However, none of the RNA and magnesium solutions catalyzed single electron transfer in the oxygen-free environment.

"Our findings suggest that the catalytic competence of RNA may have been greater in early Earth conditions than in present conditions, and our experiments may have revived a latent function of RNA," added Williams, who is also director of the RiboEvo Center.

This new study expands on research published in May 2012 in the journal *PLoS ONE*. In the previous work, Williams led a team that used experiments and numerical calculations to show that iron, in the absence of oxygen, could substitute for magnesium in RNA binding, folding and catalysis. The researchers found that RNA's shape and folding structure remained the same and its functional activity increased when magnesium was replaced by iron in an oxygen-free environment.

In future studies, the researchers plan to investigate whether other unique functions may have been conferred on RNA through interaction with a variety of metals available on the early Earth.

In addition to Williams and Hsiao, Georgia Tech School of Biology professors Roger Wartell and Stephen Harvey, and Georgia Tech School of Chemistry and Biochemistry professor Nicholas Hud, also contributed to this work as co-principal investigators in the Ribo Evo Center at Georgia Tech.

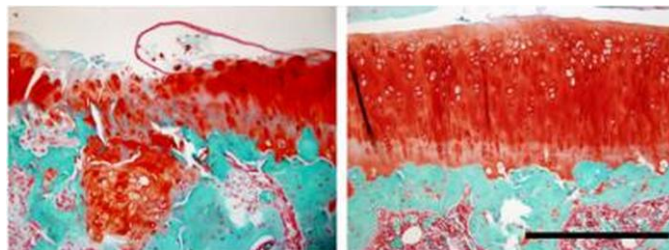
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New theory on genesis of osteoarthritis comes with successful therapy in mice

In the future, joint replacement surgery might be avoidable

Scientists at Johns Hopkins have turned their view of osteoarthritis (OA) inside out. Literally. Instead of seeing the painful degenerative disease as a problem primarily of the cartilage that cushions joints, they now have evidence that the bone underneath the cartilage is also a key player and exacerbates the damage. In a proof-of-concept experiment, they found that blocking the action of a critical bone regulation protein in mice halts progression of the disease.



When placed in the bone (green) beneath the cartilage (red) of a rat's knee joint, antibodies against the protein TGF-beta1 can prevent the damage caused by osteoarthritis. Left, without treatment; right, with treatment. Gehua Zhen, Courtesy of Nature Medicine

The prevailing theory on the development of OA focuses on joint cartilage, suggesting that unstable mechanical pressure on the joints leads to more and more harm to the cartilage—and pain to the patient—until the only treatment option left is total knee or hip replacement. The new theory, reported May 19 in *Nature Medicine*, suggests that initial harm to the cartilage causes the bone underneath it to behave improperly by building surplus bone. The extra bone stretches the cartilage above and speeds its decline.

"If there is something wrong with the leg of your chair and you try to fix it by replacing the cushion, you haven't solved the problem," says Xu Cao, Ph.D., director of the Center for Musculoskeletal Research in the Department of Orthopaedic Surgery at the Johns Hopkins University School of Medicine. "We think that the problem in OA is not just the cartilage 'cushion,' but the bone underneath," he adds.

Joints are formed at the intersection of two bones. To prevent the grinding and wearing down of the ends of the bones, they are capped with a thin layer of cartilage, which not only provides a smooth surface for joint rotation but also absorbs some of the weight and mechanical strain placed on the joint. The degeneration of this protective layer causes extreme pain leading to limited mobility.

Cao says degeneration is most frequently initiated by instability in the load-bearing joints of the knee and hip caused by injury or strain, so athletes, overweight people and people whose muscles are weakened by aging are at highest risk of developing OA. The prevalence of the disease is rapidly increasing; it currently affects 27 million Americans and may double by 2030. The only treatment available is pain management, or surgical replacement of the arthritic joint with a prosthetic one.

Cao says that the lack of effective drugs or a complete understanding of the underlying process that causes OA to progress led his group to search for a different underlying cause. "We began to think of cartilage and the bone underneath it, called subchondral bone, as functioning as a single unit," says Cao. "That helped us to see the ways in which the bone was responding to changes in the cartilage and exacerbating the problem."

Using mice with ACL (anterior cruciate ligament) tears, which are known to lead to OA of the knee, the researchers found that, as soon as one week after the injury, pockets of subchondral bone had been "chewed" away by cells called osteoclasts. This process activated high levels in the bone of a protein called TGF-beta1, which, in turn, recruited stem cells to the site so that they could create new bone to fill the holes. Cao calls these pockets of new bone formation "osteoid islets."

But the bone building and the bone destruction processes were not coordinated in the mice, and the bone building prevailed, placing further strain on the cartilage cap. It is this extraneous bone formation that Cao and his colleagues believe to be at the heart of OA, as confirmed in a computer simulation of the human knee.

With this new hypothesis in hand, complete with a protein suspect, the team tried several methods to block the activity of TGF-beta1. When a TGF-beta1 inhibitor drug was given intravenously, the subchondral bone improved significantly, but the cartilage cap deteriorated further. However, when a different inhibitor of TGF-beta1, an antibody against it, was injected directly into the subchondral bone, the positive effects were seen in the bone without the negative effects on the cartilage. The same result was also seen when TGF-beta1 was genetically disrupted in the bone precursor cells alone. "Our results are potentially really good news for patients with OA," says Cao. "We are already working to develop a clinical trial to test the efficacy of locally applied TGF-beta1 antibodies in human patients at early stages of OA." If successful, their nonsurgical treatment could make OA — and the pain and debilitation it causes — halt in its tracks, he says.

Other authors of the report include Gehua Zhen, Xiaofeng Jia, Janet Crane, Simon Mears, Frederic Askin, Frank Frassica, Weizhong Chang, John Carrino, Andrew Cosgarea, Dmitri Artemov, Lee Riley, Paul Sponseller and Mei Wan of the Johns Hopkins University School of Medicine; Chunyi Wen, Jie Yao and William Weijia Lu of the University of Hong Kong; and Yu Li, Qianming Chen, Zhihe Zhao and Xuedong Zhou of Sichuan University. This work was supported by grants from the National Institute of Diabetes and Digestive and Kidney Diseases (DK057501, DK08098). Link to article (live after embargo lifts): <http://dx.doi.org/10.1038/nm.3143>