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Lithium restores cognitive function in Down syndrome mice

Lithium restores neurogenesis in the hippocampus

Down syndrome is a neurodevelopmental disorder that is the leading cause of genetically defined intellectual disability. In the brain, Down syndrome results in alterations in the connections between neurons and a reduction in the development of new neurons (neurogenesis) that usually occurs during learning. In this issue of the Journal of Clinical Investigation, researchers led by Laura Gasparini at the Istituto Italiano di Tecnologia in Genova, Italy report that lithium, a drug commonly used for the treatment of mood disorders in humans, restores neurogenesis in the hippocampus, a part of the brain strongly associated with learning and memory. Lithium also significantly improved the performance of Down syndrome mice in tasks measuring contextual learning, spatial memory, and object discrimination. These results suggest that lithium-based therapies may help Down syndrome patients.

TITLE: Lithium rescues synaptic plasticity and memory in Down syndrome mice
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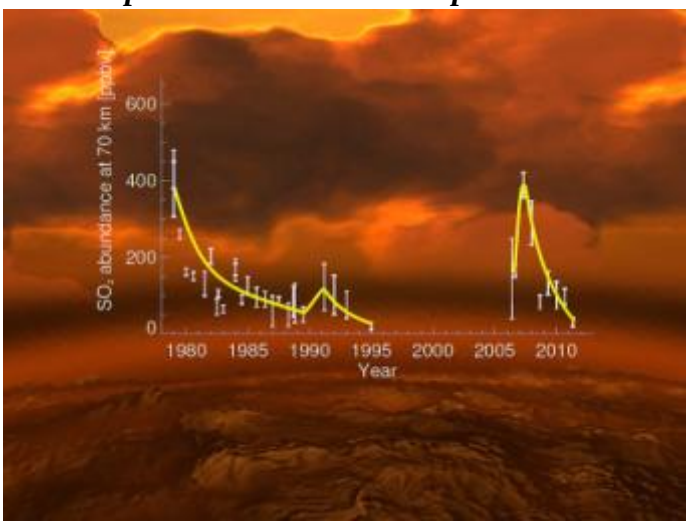
Have Venusian volcanoes been caught in the act?

Six years of observations by ESA's Venus Express have shown large changes in the sulphur dioxide content of the planet's atmosphere, and one intriguing possible explanation is volcanic eruptions.

The thick atmosphere of Venus contains over a million times as much sulphur dioxide as Earth's, where almost all of the pungent, toxic gas is generated by volcanic activity. Most of the sulphur dioxide on Venus is hidden below the planet's dense upper cloud deck, because the gas is readily destroyed by sunlight.

That means any sulphur dioxide detected in Venus' upper atmosphere above the cloud deck must have been recently supplied from below. Venus is covered in hundreds of volcanoes, but whether they remain active today is much debated, providing an important scientific goal for Venus Express. The mission has already found clues pointing to volcanism on geologically recent timescales, within the last few hundreds of thousands to millions of years.



The rise and fall of sulphur dioxide in the upper atmosphere of Venus over the last 40 years, expressed in units of parts per billion by volume. **Data: E. Marcq et al. (Venus Express); L. Esposito et al. (earlier data); background image: ESA/AOES**

A previous analysis of infrared radiation from the surface pointed to lava flows atop a volcano with a composition distinct from those of their surroundings, suggesting that the volcano had erupted in the planet's recent past. Now, an analysis of sulphur dioxide concentration in the upper atmosphere over six years provides another clue.

Immediately after arriving at Venus in 2006, the spacecraft recorded a significant increase in the average density of sulphur dioxide in the upper atmosphere, followed by a sharp decrease to values roughly ten times lower by today.

A similar fall was also seen during NASA's Pioneer Venus mission, which orbited the planet from 1978 to 1992. At that time, the preferred explanation was an earlier injection of sulphur dioxide from one or more volcanoes, with Pioneer Venus arriving in time for the decline.

"If you see a sulphur dioxide increase in the upper atmosphere, you know that something has brought it up recently, because individual molecules are destroyed there by sunlight after just a couple of days," says Dr Emmanuel Marcq of Laboratoire Atmosphères, Milieux, Observations Spatiales, France, and lead author of the paper published in Nature Geoscience. "A volcanic eruption could act like a piston to blast sulphur dioxide up to these levels, but peculiarities in the circulation of the planet that we don't yet fully understand could also mix the gas to reproduce the same result," adds co-author Dr Jean-Loup Bertaux, Principal Investigator for the instrument on Venus Express that made the detections.

Venus has a 'super-rotating' atmosphere that whips around the planet in just four Earth-days, much faster than the 243 days the planet takes to complete one rotation about its axis.Such rapid atmospheric circulation spreads the sulphur dioxide around, making it difficult to isolate any individual points of origin for the gas.

Dr Marcq's team speculate that if volcanism was responsible for the initial increase, then it could come from a relatively gentle increased output of several active volcanoes rather than one dramatic eruption.
"Alternatively, and taking into account the similar trend observed by Pioneer Venus, it's possible that we are seeing decadal-scale variability in the circulation of the atmosphere, which is turning out to be even more complex than we could ever have imagined," he notes.
"By following clues left by trace gases in the atmosphere, we are uncovering the way Venus works, which could point us to the smoking gun of active volcanism," adds Håkan Svedhem, ESA's Project Scientist for Venus Express.

http://www.eurekalert.org/pub_releases/2012-12/jhm-eur120312.php

Experts urge rapid evaluation for swallowing and voice problems after brain surgery

Experts recommend assessment preferably within 24 hours after surgery, for chewing, swallowing and speaking problems, among patients who have had benign tumors removed from the base of the brain

Johns Hopkins experts are recommending early post-surgical assessment - preferably within 24 hours - for trouble chewing and swallowing food, or speaking normally, among patients who have had benign tumors removed from the base of the brain. Such early assessments, they say, may minimize complications associated with the sometimes hazelnut-sized tumors, called vestibular schwannomas. Damage can arise when the tumors themselves press on the nearby cranial nerves - key to controlling the tongue, lips, mouth and throat - or from the surgery itself.
Researchers say their recommendation is based on study results from a trio of surveys the team conducted, the latest of which is to be published in the December edition of the journal The Laryngoscope, showing such complications after brain-tumor surgery were several times more common than previously thought.
They also found that post-surgical dysphagia and vocal cord paralysis were associated with other illnesses, including pneumonia, especially if they necessitated implantation of feeding or breathing tubes. These complications, in turn, led to longer, costlier hospital stays, or additional care at rehabilitation facilities.
"Our results show the tremendous toll post-surgical complications with swallowing and vocal cord paralysis can exact on health and recovery, even though such problems are not well-reported," says laryngologist and study senior co-investigator Lee Akst, M.D. Each year, Akst says, his team treats more than a dozen patients who have voice problems after surgery to remove mostly benign vestibular schwannomas, for which the number of new cases reported annually in the United States is estimated at less than 10,000.
"Physicians and speech therapists really need to closely monitor their patients for early signs and symptoms, such as breathy, whispery voices and trouble keeping food in their mouth while chewing, so that aggressive therapy with exercise, medications or further surgery can be quickly considered," says Akst, an assistant professor at the Johns Hopkins University School of Medicine and director of its Voice Center.
The Johns Hopkins team's latest study findings were based on a review of the hospital records of 17,261 men and women participating in the National Inpatient Survey (NIS). Researchers discovered that swallowing problems, or dysphagia, were reported in 443 patients (or 2.6 percent) who had had a vestibular schwannoma removed. Some 117 (0.7 percent) patients suffered some form of vocal paralysis. Developing either problem was associated with a more than doubling in the time patients needed to recuperate in the hospital: When there were no complications, the average hospital stay was 5.3 days; when dysphagia occurred, the average stay was 11.7 days, and when there was vocal cord paralysis, the average stay was 12.1 days.
Moreover, researchers found, patients who developed swallowing problems were almost twice as likely to be sicker than patients whose swallowing remained normal. Also, dysphagic patients were nearly 18 times more likely to aspirate food into their lungs than non-dysphagic patients (at 7.1 percent and 0.4 percent, respectively), and six times more likely to need immediate, follow-up care and admission to another rehabilitation or chronic care facility (at 48.5 percent versus 7.7 percent). One in five needed a feeding or gastrostomy tube installed, researchers say.
In addition, patients experiencing vocal cord paralysis were four times more likely to be discharged to another health care facility instead of going home (at 32.7 percent versus 7.7 percent). One in eight needed a breathing or tracheostomy tube placed in their throat to enable speech.
Researchers estimated the increased cost of care for such post-surgical problems ranged between $35,000 and $50,000 per patient, and extended the time needed in the hospital by an average 1.7 days.
Two previous studies by Akst and his team, published earlier in the year in the journal Otolaryngology-Head and Neck Surgery, had shown much higher post-surgical complication rates. In studies of 181 patients who had vestibular schwannoma surgery at The Johns Hopkins Hospital between 2008 and 2010, 57 (31 percent) developed swallowing problems and 19 (10 percent) had difficulty speaking.

According to Christine Gourin, M.D., M.P.H., senior co-investigator on the Laryngoscope study and an associate professor at Johns Hopkins, the NIS and Hopkins-specific study numbers are "likely an underestimate of the real problem" because historically, physicians, residents and nurses have not looked for specific post-surgical problems at the outset.
Gourin, director of the Clinical Research Program in Head and Neck Cancer at Johns Hopkins' Kimmel Cancer Center, says rehabilitative therapies, including drug therapies and surgery are available to patients who do develop complications, but these remedies produce their best results when administered early.
Dysphagic patients, Akst says, can often adapt to prevent spillage by drinking with a straw or from a bottle instead of a cup. They can also learn to prevent food from falling out while eating, by tilting their head back slightly or by chewing only on one side. Tongue- and jaw-strengthening exercises can also help recovery. More complicated cases could require injections of calcium beads or other so-called "fillers" into the vocal cords or soft palate to prevent food from going down the "wrong way" or into the nose.
Similar injections in the lip and even surgical implants can also be used to treat damaged lips, says Akst, helping patients to pronounce sharp "b" and "p" sounds and making it easier to force air out of the lungs to project sound. The most common rehabilitation exercises, however, are basic voice lessons to strengthen the cords.
Researchers say the team next plans to study what social and pre-existing medical conditions might put patients at greater risk of post-surgical complications. Volunteers for the study will likely have neurofibromatosis, a genetic nerve condition that often results in vestibular schwannomas. Researchers hope that by monitoring patients before they have surgery, the scientific team can gain a better understanding of who does and does not develop dysphagia and vocal cord paralysis. The team also has plans to evaluate which medical and rehabilitative therapies work best at resolving the problems.
Funding support for this study was provided by The Johns Hopkins Hospital.
In addition to Akst and Gourin, other Johns Hopkins researchers involved in these analyses were Bryan Ward, M.D.; Howard Francis, M.D.; Simon Best, M.D.; Heather Starmer, M.A.; Yuri Agrawal, M.D.; Alexander Hillel, M.D.; Wade Chien, M.D.; and Rafael Tamargo, M.D.

http://www.eurekalert.org/pub_releases/2012-12/uog-rct120312.php

Researchers confirm the 'Pinocchio Effect': When you lie, your nose temperature rises

Thermography reveals heating of the nose with anxiety

The University of Granada researchers are pioneers in the application of thermography to the field Psychology. Thermography is a technique based on determining body temperature.
When a person lies they suffer a "Pinocchio effect", which is an increase in the temperature around the nose and in the orbital muscle in the inner corner of the eye. In addition, when we perform a considerable mental effort our face temperature drops and when we have an anxiety attack our face temperature rises. These are some of the conclusions drawn in this pioneer study conducted at the University of Granada Department of Experimental Psychology, which has introduced new applications of thermography

This shows thermal images obtained with the thermograph. **University of Granada.**

Thermography is a technique based on body temperature that is applied in many fields such as general industry, the building industry and medicine. Thermographic cameras have a wide range of uses such as measuring energy loss in buildings, indicating respiratory diseases in bovine animals or rabies in raccoons. Thermography was developed in the USA during the II World War to detect the enemy (night vision).

Excitement is the Same in Men and Women

The University of Granada researchers Emilio Gómez Milán and Elvira Salazar López have been pioneers in applying thermography to the field of Psychology, and they have obtained very innovative and interesting results. Thus, sexual excitement and desire can be identified in men and women using thermography, since they induce an increase in chest and genital temperature. This study demonstrates that –in physiological terms– men and women get excited at the same time, even although women say they are not excited or only slightly excited. Scientists have discovered that when a mental effort is made (performing difficult tasks, being interrogated on a specific event or lying) face temperature changes.
When we lie on our feelings, the temperature around our nose raises and a brain element called "insula" is activated. The insula is a component of the brain reward system, and it only activates when we experience real feelings (called "qualias"). The insula is involved in the detection and regulation of body temperature.

Therefore, there is a strong negative correlation between insula activity and temperature increase: the more active the insula (the greater the feeling) the lower the temperature change, and vice versa, the researchers state.

The Thermal Footprint of Flamenco

Researchers also determined the thermal footprint of aerobic exercise and different dance modalities such as ballet. When a person is dancing flamenco the temperature in their buttocks drops and increases in their forearms. That is the thermal footprint of flamenco, and each dance modality has a specific thermal footprint, professor Salazar explains.

The researchers have demonstrated that temperature asymmetries in both sides of the body and local temperature changes are associated with the physical, mental and emotional status of the subject. The thermogram is a somatic marker of subjective or mental states and allows us to see what a person is feeling or thinking, professor Salazar states.

Finally, thermography is useful for evaluating emotions (since the face thermal pattern is different) and identifying emotional contagion. For example, when a highly empathic person sees another person having an electric discharge in their forearm, they become infected by their suffering and temperature in their forearm increases. In patients with certain neurological diseases such as multiple sclerosis, the body does not properly regulate temperature, which can be detected by a thermogram. Thermography can also be applied to determine body fat patterns, which is very useful in weight loss and training programs. It can also be applied to assess body temperature in celiac patients and in patients with anorexia, etc.

http://www.sciencedaily.com/releases/2012/12/121203120707.htm

Complex Chemistry Within the Martian Soil: No Definitive Detection of Organics Yet

NASA's Mars Curiosity rover has used its full array of instruments to analyze Martian soil for the first time, and found a complex chemistry within the Martian soil.

ScienceDaily - Water and sulfur and chlorine-containing substances, among other ingredients, showed up in samples Curiosity's arm delivered to an analytical laboratory inside the rover.

Detection of the substances during this early phase of the mission demonstrates the laboratory's capability to analyze diverse soil and rock samples over the next two years. Scientists also have been verifying the capabilities of the rover's instruments.

Curiosity is the first Mars rover able to scoop soil into analytical instruments. The specific soil sample came from a drift of windblown dust and sand called "Rocknest." The site lies in a relatively flat part of Gale Crater still miles away from the rover's main destination on the slope of a mountain called Mount Sharp. The rover's laboratory includes the Sample Analysis at Mars (SAM) suite and the Chemistry and Mineralogy (CheMin) instrument. SAM used three methods to analyze gases given off from the dusty sand when it was heated in a tiny oven. One class of substances SAM checks for is organic compounds - carbon-containing chemicals that can be ingredients for life.

"We have no definitive detection of Martian organics at this point, but we will keep looking in the diverse environments of Gale Crater," said SAM Principal Investigator Paul Mahaffy of NASA's Goddard Space Flight Center in Greenbelt, Md. Curiosity's APXS instrument and the Mars Hand Lens Imager (MAHLI) camera on the rover's arm confirmed Rocknest has chemical-element composition and textural appearance similar to sites visited by earlier NASA Mars rovers Pathfinder, Spirit and Opportunity.

Curiosity's team selected Rocknest as the first scooping site because it has fine sand particles suited for scrubbing interior surfaces of the arm's sample-handling chambers. Sand was vibrated inside the chambers to remove residue from Earth. MAHLI close-up images of Rocknest show a dust-coated crust one or two sand grains thick, covering dark, finer sand. "Active drifts on Mars look darker on the surface," said MAHLI Principal Investigator Ken Edgett, of Malin Space Science Systems in San Diego."This is an older drift that has had time to be inactive, letting the crust form and dust accumulate on it."

CheMin's examination of Rocknest samples found the composition is about half common volcanic minerals and half non-crystalline materials such as glass. SAM added information about ingredients present in much lower concentrations and about ratios of isotopes. Isotopes are different forms of the same element and can provide clues about environmental changes. The water seen by SAM does not mean the drift was wet. Water molecules bound to grains of sand or dust are not unusual, but the quantity seen was higher than anticipated.

SAM tentatively identified the oxygen and chlorine compound perchlorate. This is a reactive chemical previously found in arctic Martian soil by NASA's Phoenix Lander. Reactions with other chemicals heated in SAM formed chlorinated methane compounds - one-carbon organics that were detected by the instrument. The chlorine is of Martian origin, but it is possible the carbon may be of Earth origin, carried by Curiosity and detected by SAM's high sensitivity design.

"We used almost every part of our science payload examining this drift," said Curiosity Project Scientist John Grotzinger of the California Institute of Technology in Pasadena. "The synergies of the instruments and richness of the data sets give us great promise for using them at the mission's main science destination on Mount Sharp."
NASA's Mars Science Laboratory Project is using Curiosity to assess whether areas inside Gale Crater ever offered a habitable environment for microbes. NASA's Jet Propulsion Laboratory in Pasadena manages the project for NASA's Science Mission Directorate in Washington.
For more information about Curiosity and other Mars mission, visit: http://www.nasa.gov/mars

http://www.eurekalert.org/pub_releases/2012-12/esf-mcc120412.php

Moderate coffee consumption may reduce risk of diabetes by up to 25 per cent

Drinking three to four cups of coffee per day may help to prevent type 2 diabetes

Drinking three to four cups of coffee per day may help to prevent type 2 diabetes according to research highlighted in a session report published by the Institute for Scientific Information on Coffee (ISIC), a not-for-profit organisation devoted to the study and disclosure of science related to coffee and health.
Recent scientific evidence has consistently linked regular, moderate coffee consumption with a possible reduced risk of developing type 2 diabetes. An update of this research and key findings presented during a session at the 2012 World Congress on Prevention of Diabetes and Its Complications (WCPD) is summarised in the report.
The report outlines the epidemiological evidence linking coffee consumption to diabetes prevention, highlighting research that shows three to four cups of coffee per day is associated with an approximate 25 per cent lower risk of developing type 2 diabetes, compared to consuming none or less than two cups per day[1]. Another study also found an inverse dose dependent response effect with each additional cup of coffee reducing the relative risk by 7-8 percent[2].
Whilst these epidemiological studies suggest an association between moderate coffee consumption and reduced risk of developing diabetes, they are unable to infer a causal effect. As such, clinical intervention trails are required to study the effect in a controlled setting. One prospective randomized controlled trial[3], tested glucose and insulin after an oral glucose tolerance test with 12g decaffeinated coffee, 1g chlorogenic acid, 500 mg trigonelline, or placebo. This study demonstrated that chlorogenic acid, and trigonelline reduced early glucose and insulin responses, and contribute to the putative beneficial effect of coffee.
The report notes that the association between coffee consumption a reduced risk of type 2 diabetes could be seen as counter intuitive, as drinking coffee is often linked to unhealthier habits, such as smoking and low levels of physical activity. Furthermore, studies have illustrated that moderate coffee consumption is not associated with an increased risk of hypertension, stroke or coronary heart disease[4,5,6]. Research with patients with CVD has also shown that moderate coffee consumption is inversely associated with risk of heart failure, with a J-shaped relationship[7].
Finally, the report puts forward some of the key mechanistic theories that underlie the possible relationship between coffee consumption and the reduced risk of diabetes. These included the 'Energy Expenditure Hypothesis', which suggests that the caffeine in coffee stimulates metabolism and increases energy expenditure and the 'Carbohydrate Metabolic Hypothesis', whereby it is thought that coffee components play a key role by influencing the glucose balance within the body. There is also a subset of theories that suggest coffee contains components that may improve insulin sensitivity though mechanisms such as modulating inflammatory pathways, mediating the oxidative stress of cells, hormonal effects or by reducing iron stores.
Dr. Pilar Riobó Serván, Associate Chief of Endocrinology and Nutrition, Jiménez Díaz-Capio Hospital of Madrid and a speaker at the WCPD session concludes the report, commenting: "A dose-dependent inverse association between coffee drinking and total mortality has been demonstrated in general population and it persists among diabetics. Although more research on the effect of coffee in health is yet needed, current information suggests that coffee is not as bad as previously considered!"
The session report details the key scientific research presented by Dr. Nathan Matusheski , Professor Jaakko Tuomilehto, Dr. Pilar Riobó Serván and Professor Edith Feskens during a session entitled: *Good things in life: Can coffee help in diabetes prevention?* at the World Congress of Diabetes Prevention and Its Complications, which took place on the 12th November in Madrid, Spain.
For more information or to read the report, please visit www.coffeeandhealth.org.

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Scientists find oldest dinosaur - or closest relative yet

Earliest dinosaur is either the oldest dinosaur or the closest relative to dinosaurs that has been found to date.

Researchers have discovered what may be the earliest dinosaur, a creature the size of a Labrador retriever, but with a five foot-long tail, that walked the Earth about 10 million years before more familiar dinosaurs like the small, swift-footed *Eoraptor* and *Herrerasaurus*.

The findings mean that the dinosaur lineage appeared 10 million to 15 million years earlier than fossils previously showed, originating in the Middle Triassic rather than in the Late Triassic period.

"If the newly named *Nyasasaurus parringtoni* is not the earliest dinosaur, then it is the closest relative found so far," according to Sterling Nesbitt, a University of Washington postdoctoral researcher in biology and lead author of a paper published online Dec. 5 in *Biology Letters*, a journal of the United Kingdom's Royal Society.

Artist rendering of Nyasasaurus parringtoni, either the earliest dinosaur or the closest dinosaur relative yet discovered. Nyasasaurus parringtoni was up to 10 feet long, weighed perhaps 135 pounds and is depicted near plant-eating reptiles of the genus Stenaulorhynchus. **(c)Natural History Museum, London/Mark Witton**

"For 150 years, people have been suggesting that there should be Middle Triassic dinosaurs, but all the evidence is ambiguous," he said. "Some scientists used fossilized footprints, but we now know that other animals from that time have a very similar foot. Other scientists pointed to a single dinosaur-like characteristic in a single bone, but that can be misleading because some characteristics evolved in a number of reptile groups and are not a result of a shared ancestry."

The researchers had one humerus – or upper arm bone – and six vertebrae to work with. They determined that the animal likely stood upright, measured 7 to 10 feet in length (2 to 3 meters), was as tall as 3 feet at the hip (1 meter) and may have weighed between 45 and 135 pounds (20 to 60 kilograms).

The fossilized bones were collected in the 1930s from Tanzania, but it may not be correct to say dinosaurs originated in that country. When *Nyasasaurus parringtoni* lived, the world's continents were joined in the landmass called Pangaea. Tanzania would have been part of Southern Pangaea that included Africa, South America, Antarctica and Australia.

"The new findings place the early evolution of dinosaurs and dinosaur-like reptiles firmly in the southern continents," said co-author Paul Barrett at the Natural History Museum, London.

The bones of the new animal reveal a number of characteristics common to early dinosaurs and their close relatives. For example, the bone tissues in the upper arm bone appear as if they are woven haphazardly and not laid down in an organized way. This indicates rapid growth, a common feature of dinosaurs and their close relatives.

"We can tell from the bone tissues that *Nyasasaurus* had a lot of bone cells and blood vessels," said co-author Sarah Werning at the University of California, Berkeley, who did the bone analysis. "In living animals, we only see this many bone cells and blood vessels in animals that grow quickly, like some mammals or birds."

"The bone tissue of *Nyasasaurus* is exactly what we would expect for an animal at this position on the dinosaur family tree," she added. "It's a very good example of a transitional fossil; the bone tissue shows that *Nyasasaurus* grew about as fast as other primitive dinosaurs, but not as fast as later ones."

Another example is the upper arm bone's distinctively enlarged crest, needed to anchor the upper arm muscles. The feature, known as an elongated deltopectoral crest, is also common to all early dinosaurs.

"*Nyasasaurus* and its age have important implications regardless of whether this taxon is a dinosaur or the closest relatives of dinosaurs," Nesbitt said. "It establishes that dinosaurs likely evolved earlier than previously expected and refutes the idea that dinosaur diversity burst onto the scene in the Late Triassic, a burst of diversification unseen in any other groups at that time."

It now appears that dinosaurs were just part of a large diversification of archosaurs. Archosaurs were among the dominant land animals during the Triassic period 250 million to 200 million years ago and include dinosaurs, crocodiles and their kin.
"Dinosaurs are just part of this archosaur diversification, an explosion of new forms soon after the Permian extinction," Nesbitt said.
The specimen used to identify the new species is part of the collection at the Natural History Museum, London. Four vertebrae from a second specimen of *Nyasasaurus*, which were also used in this research, are housed in the South African Museum in Cape Town. The work was funded by the National Science Foundation and the Natural History Museum, London. The fourth co-author on the paper is Christian Sidor, UW professor of biology.
The name *Nyasasaurus parringtoni* is new, but "*Nyasasaurus*" – combining the lake name Nyasa with the term "saurus" for lizard – is not. The late paleontologist Alan Charig, included as a co-author on the paper, named the specimen but never documented or published in a way that was formally recognized. "Parringtoni" is in honor of University of Cambridge's Rex Parrington, who collected the specimens in the 1930s.
"What's really neat about this specimen is that it has a lot of history. Found in the '30s, first described in the 1950s but never published, then its name pops up but is never validated. Now 80 years later, we're putting it all together," Nesbitt said.
"This work highlights the important role of museums in housing specimens whose scientific importance might be overlooked unless studied and restudied in detail," Barrett said. "Many of the more important discoveries in paleontology are made in the lab, or museum storerooms, as well as in the field."
Funding: *Natural History Museum collections improvement grant National Science Foundation (EAR-1024036)*

http://www.bbc.co.uk/news/science-environment-20575250

Fossil raindrops probe ancient atmosphere

The imprints of raindrops preserved in 2.7bn-year-old rock are being used to figure out what the atmosphere was like on the early Earth.

Jonathan Amos By Jonathan Amos Science correspondent, BBC News, San Francisco

Scientists have used the depressions drops left to calculate how fast they were going as they impacted the ground. This has allowed them to determine the density of air in ancient times. This "palaeobarometry" approach, revealed at the AGU Fall Meeting, will help constrain the models that try to simulate conditions in Archaean times.
Earth 2.7 billion years ago was very different from the planet we know today. It spun much faster, the Moon was closer and the Sun was much weaker. And there were no animals or plants in existence back then; the air was simply not breathable.
"There was probably quite a bit of nitrogen in the atmosphere, like today, but there was no oxygen," explained Sanjoy Som from Nasa's Ames Research Center. "The oxygen was likely replaced by greenhouse gases such as carbon dioxide and methane. "My palaeobarometry work cannot tell you precisely what the gases were, but it will assist modellers of atmospheric composition by giving them a constraint," he told BBC News.
Dr Som told the AGU meeting - the largest annual gathering of Earth scientists - that the "fossil raindrops" were discovered in Ventersdorp in the North West Province of South Africa in the 1980s. They consist of lots of pits in the surface of a rock that started out as volcanic ash-fall.
Rain tumbling on to the ash would have dug out small depressions, which were then subsequently covered over by further ash deposits and lithified, or turned to stone. We only see the imprints today because the top layers of the rock have now been eroded back. Dr Som's and colleagues' thinking is that the pits should tell us something about ancient air pressure.

Gathering momentum

Their starting point is that the diameters of the imprints are controlled ultimately by the top speed of the raindrops as they hit the ground. This number - the terminal velocity - is dependent on air density. In the modern atmosphere it is about 9m/s.
"The rationale here is that if the air back then was thicker, the raindrops would fall slower, and the craters in the ash would be smaller; and conversely, if the air was thinner, the drops would fall faster and the craters would be larger," said Dr Som, who is also affiliated to the Blue Marble Space Institute of Science, Seattle.
The confounding factor would be if raindrops were somehow much bigger in Archaean times. Fortunately, it turns out the maximum size a raindrop can reach is independent of air density; it is controlled by aerodynamic forces that are unrelated to the thickness of the air. The fattest drops 2.7bn years ago would have been the same as they are today - about 7mm.

Dr Som's team conducted experiments in which, using a pipette, they dripped small, carefully controlled volumes of water into a tray of volcanic ash from a height of about 25m. This allowed the group to relate the momentum of a raindrop to the size of the imprints made; and then, using theory, to calculate the momentum of a drop of a known size at any air density.
The team concluded that if the biggest imprints in the Ventersdorp rock were formed by the largest raindrops, air pressure in the Archaean could have been no more than twice what it is today.
"But knowing what we do about the spread of raindrop sizes, we know the largest possible size is actually quite rare. "So if it was smaller raindrops that formed the largest imprints at Ventersdorp then the atmospheric density was probably similar to ours, if not less."
The study supports the idea therefore that the ancient atmosphere must have had a strong concentration of greenhouse gases. If air pressure were the same or even lower than it is today, there is no other way to explain why Earth was not thrown into snowball conditions by a substantially weaker Sun. Without extra thickness in the atmosphere to trap heat, the properties of the gases themselves had to provide the blanket.

http://news.discovery.com/human/blog-throw-away-negative-thoughts-121204.html#mkcpgn=rssnws1

Negative Thoughts? Toss 'em

Throwing away or protecting thoughts, influences how those thoughts are used

Analysis by Sheila Eldred

If you've ever been told to imagine releasing negative thoughts, only to find the same thoughts popping into your head minutes later, quit imagining and start physically throwing those thoughts away, researchers recommend following a new study published in Psychological Science.
"At some level, it can sound silly," study co-author Richard Petty of Ohio State University said in a press release. "But we found that it really works -- by physically throwing away or protecting your thoughts, you influence how you end up using those thoughts. Merely imagining engaging in these actions has no effect."
Researchers tested the theory with three separate experiments using high school and college students. When the students wrote down thoughts about body image, throwing them in the trash can seemed to free themselves of the thoughts, whereas those who kept the notes and studied them for editing mistakes rated their bodies in accordance to the thoughts.
The other experiments showed that keeping the thoughts as physically close as possible, such as in a pocket, magnified the thoughts the most.
"The more convinced the person is that the thoughts are really gone, the better," Petty said. "Just imagining that you throw them away doesn't seem to work.... Of course, even if you throw the thoughts in a garbage can or put them in the recycle bin on the computer, they are not really gone -- you can regenerate them. But the representations of those thoughts are gone, at least temporarily, and it seems to make it easier to not think about them."

http://www.sciencedaily.com/releases/2012/12/121204145657.htm

Drug Shows Promise in Prostate Cancer Spread to Bone

Tumors Were Reduced On Bone Scans, Bone Pain Decreased After Patients Received Cabozantinib

A new drug demonstrated dramatic and rapid effects on prostate cancer that had spread to the bone, according to a study reported by University of Michigan Comprehensive Cancer Center researchers.
About two-thirds of patients treated with cabozantinib had improvements on their bone scans, with 12 percent seeing complete resolution of uptake on bone scan. Bone scans assess the degree to which cancer is in the bone; improvements on these scans suggest a response to the drug.
"The effects of cabozantinib on bone scans are unprecedented in the treatment of prostate cancer," says lead study author David C. Smith, M.D., professor of internal medicine and urology at the University of Michigan Medical School.
Cabozantinib is designed to target two important pathways linked to the growth and spread of prostate cancer. The drug had the most effect on tumors that had spread to the bone, which is the major site where prostate cancer spreads. These tumors are typically very challenging to treat once they become resistant to hormone-based therapies.
In addition to the improvements on bone scans, 67 percent of patients with bone pain reported an improvement in pain control and 56 percent decreased or eliminated narcotic painkillers after treatment with cabozantinib. Results of the study appear in the Journal of Clinical Oncology.
The trial enrolled 171 men with castration-resistant prostate cancer, meaning their tumors no longer responded to hormone-based therapies. The study began as a randomized trial in which all patients received cabozantinib for 12 weeks, after which patients were randomized to receive continued cabozantinib or placebo. The

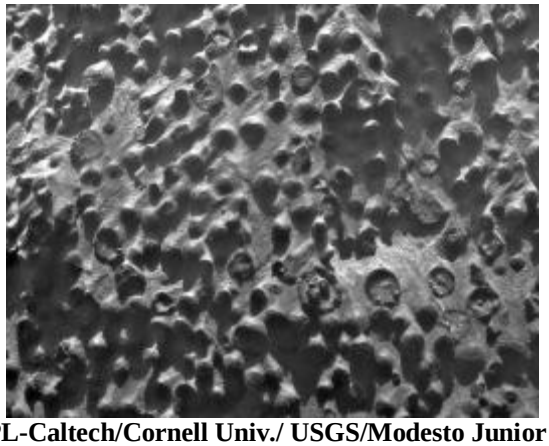
randomization was stopped early because of the dramatic effects on bone scan, and because patients receiving placebo saw their cancer progress much more quickly than those that remained on drug.
Among the 31 patients who were randomized, cancer progressed after a median 23.9 weeks for patients taking cabozantinib, compared with 5.9 weeks for patients on placebo.
"Discontinuing randomization is not common. Stabilization of disease in advanced prostate cancer is rarely due to the natural history of the disease and is in this case due to drug effect," Smith says. "While these initial results are promising, we are still uncertain how cabozantinib will impact the gold standard of survival," he adds.
Phase III studies have begun at some institutions, and U-M researchers are conducting a phase II study to better understand the effect cabozantinib has on bone. This drug is not offered routinely in clinical care at this time.
For information about prostate cancer treatment options or clinical trials currently open at the U-M Comprehensive Cancer Center, call the Cancer AnswerLine at 800-865-1125.
Prostate cancer statistics: 241,740 Americans will be diagnosed with prostate cancer this year and 28,170 will die from the disease, according to the American Cancer Society
D. C. Smith, M. R. Smith, C. Sweeney, A. A. Elfiky, C. Logothetis, P. G. Corn, N. J. Vogelzang, E. J. Small, A. L. Harzstark, M. S. Gordon, U. N. Vaishampayan, N. B. Haas, A. I. Spira, P. N. Lara, C.-C. Lin, S. Srinivas, A. Sella, P. Schoffski, C. Scheffold, A. L. Weitzman, M. Hussain. Cabozantinib in Patients With Advanced Prostate Cancer: Results of a Phase II Randomized Discontinuation Trial. Journal of Clinical Oncology, 2012; DOI: 10.1200/JCO.2012.45.0494

http://www.wired.com/wiredscience/2012/12/opportunity-geologic-puzzle/

Opportunity Rover Finds Mars Minerals That Formed in Life-Friendly Water

Opportunity is examining clays formed in the presence of water favorable for life as we know it

By Adam Mann



The mysterious 'newberries' that Opportunity is now exploring. **NASA/JPL-Caltech/Cornell Univ./ USGS/Modesto Junior College**

SAN FRANCISCO - While attention has been focused on the Mars rover Curiosity, NASA's other active Mars rover, Opportunity, has quietly been going about its business and may have stumbled across an intriguing new geologic puzzle. Opportunity has begun examining ancient clays on Mars that would have formed in the presence of water with neutral acidity, a condition favorable for life as we know it.
"This is our first glimpse ever at an ancient Mars where conditions would be suitable for life," said astronomer Steve Squyres of Cornell University, the lead scientist for Opportunity's mission, here at the American Geophysical Union conference on Dec 4.
Previous minerals that Opportunity and its defunct twin Spirit had found thus far on Mars would have required extremely harsh conditions to form, something akin to battery acid, and not very conducive to life. The clays that the rover is now exploring would have been created billions of years earlier in water with a neutral pH.
"These clays point to water you could drink," said Squyres.
Since it landed on Mars in 2004, Opportunity has roved more than 22 miles. After nine years on Mars, the rover is getting a bit old, with a squeaky right front wheel and a creaky arm joint, though is overall in good condition. Last year, the probe arrived at Endeavor crater, where it discovered the most unambiguous evidence for water on ancient Mars ever found.
Scientists directed Opportunity to Endeavor crater to study the clays, which had been spotted earlier from orbit. Roving around one of the half-buried rims of the crater, Opportunity found a small hill that Squyres described as the "sweet spot" where clays are known to be present. The rover took photos showing two types of rocks. The dominant material is light-toned, flat-lying, and easily eroded by Martian wind. This is the rock that contains the clays and shows a chemistry typical of Martian material. But Opportunity also found a fin sticking up through the dominant rocks made of another material that is dark, gray, and more resistant to erosion.
"What we have stumbled upon is what is turning out to be one of the most delightful geologic puzzles we have ever found on Mars," said Squyres.
When they drove up to the fin, the science team found it covered in a dense concentration of spherical bubbles quite similar looking to the iron-containing Martian "blueberries" that Opportunity has seen before. But when they looked at the chemical composition of these spheres, scientists found they contained no iron.
"It's something totally different, and I've started calling them 'newberries'," said Squyres.
The team doesn't yet know what these newberries are made of and will spend the next few months investigating them. They could be mineral concretions, impact ejecta spherules, or volcanic hailstones. Squyres said that

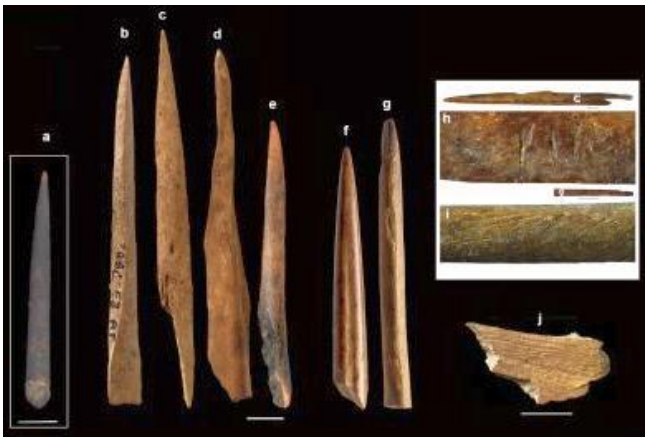
researchers will also examine the clays to determine what conditions on early Mars would have been like. He said many questions remained and Opportunity had a lot of work ahead of it.
"It's like we've been exploring Mars for nine years, and now Mars has given us a final exam," said Squyres.

http://www.eurekalert.org/pub_releases/2012-12/uotw-ahs120512.php

Africa's Homo sapiens were the first techies

A new research paper is the first detailed summary of the Still Bay techno-traditions and the Howiesons Poort techno-tradition

The search for the origin of modern human behaviour and technological advancement among our ancestors in southern Africa some 70 000 years ago, has taken a step closer to firmly establishing Africa, and especially South Africa, as the primary centre for the early development of human behaviour.

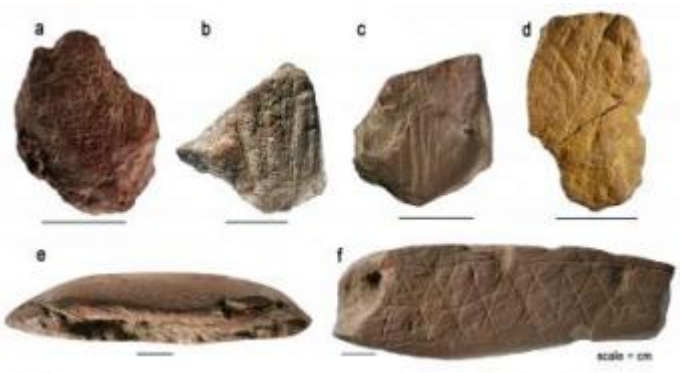


A new research paper by renowned Wits University archaeologist, Prof. Christopher Henshilwood, is the first detailed summary of the time periods he and a group of international researchers have been studying in South Africa: namely the Still Bay techno-traditions (c. 75 000 – 70 000 years) and the Howiesons Poort techno-tradition (c. 65 000 – 60 000 years).

The paper, entitled Late Pleistocene Techno-traditions in Southern Africa: A Review of the Still Bay and Howiesons Poort, c. 75 ka, has been published online in the Journal of World Prehistory on 6 November 2012.

This is a Bone point from the Middle Stone Age levels at Peers Cave. The exact context is unknown (see d'Errico and Henshilwood 2007); b–g Bone tools from the Still Bay levels at Blombos Cave; b–e bone awls; f–g bone points; h–i engraved lines on tools c and g (see Henshilwood et al. 2001a; d'Errico and Henshilwood 2007); j engraved bone fragment (see d'Errico et al. 2001) 220 J World Prehist (2012) 25:205–237 123
Christopher Henshilwood

Henshilwood says these periods were significant in the development of Homo sapiens behaviour in southern Africa. They were periods of many innovations including, for example, the first abstract art (engraved ochre and engraved ostrich eggshell); the first jewellery (shell beads); the first bone tools; the earliest use of the pressure flaking technique, that was used in combination with heating to make stone spear points and the first probable use of stone tipped arrows launched by bow.



"All of these innovations, plus many others we are just discovering, clearly show that Homo sapiens in southern Africa at that time were cognitively modern and behaving in many ways like ourselves. It is a good reason to be proud of our earliest, common ancestors who lived and evolved in South Africa and who later spread out into the rest of the world after about 60 000 years," says Henshilwood.

These are engraved ochres from the Still Bay M1 phase at Blombos Cave (modified after Henshilwood et al. 2009). This shows; a) Two groups of incisions, one on the center and one close to the edge. In the center two joining lines form a 'Y' that is crossed by a few perpendicular parallel lines. Three incisions cross these lines; b) Two lines that cross perpendicularly on the top right margin. Converging lines produced with a single lithic point; c) this piece retains only a small area of the original engraved pattern. Three straight oblique lines incised on the top left with two sinuous lines that cross them; d) three distinct sets of lines engraved on a natural surface. Piece was then knapped and a part of the engraving removed; e) a group of sinuous lines engraved on one face. The opposite face is highly scraped and engraved with a cross-hatched pattern; and f) Cross-hatched pattern incised on one long edge.
Christopher Henshilwood

The research also addresses some of the nagging questions as to what drove our ancestors to develop these innovative technologies. According to Henshilwood answers to these questions are, in part, found in demography and climate change, particularly changing sea levels, which were major drivers of innovation and variability in material culture.

This paper is just the latest to come from Henshilwood and his teams' research on African archaeology that revolutionised the idea that modern human behaviour originated in Europe after about 40 000 years ago. There

is increasing evidence for an African origin for behavioural and technological modernity more than 70 000 years ago and that the earliest origin of all Homo sapiens lies in Africa with a special focus in southern Africa. Henshilwood writes: "In just the past decade our knowledge of Homo sapiens behaviour in the Middle Stone Age, and in particular of the Still Bay and Howiesons Poort, has expanded considerably. With the benefit of hindsight we may ironically conclude that the origins of 'Neanthropic Man', the epitome of behavioural modernity in Europe, lay after all in Africa."

http://www.eurekalert.org/pub_releases/2012-12/nuos-tmm120412.php

The many maps of the brain

Norwegian researchers discover surprising complexities in the way the brain makes mental maps

Your brain has at least four different senses of location – and perhaps as many as 10. And each is different, according to new research from the Kavli Institute for Systems Neuroscience, at the Norwegian University of Science and Technology. The findings, published in the 6 December 2012 issue of Nature, show that rather than just a single sense of location, the brain has a number of "modules" dedicated to self-location. Each module contains its own internal GPS-like mapping system that keeps track of movement, and has other characteristics that also distinguishes one from another.

"We have at least four senses of location," says Edvard Moser, director of the Kavli Institute. "Each has its own scale for representing the external environment, ranging from very fine to very coarse. The different modules react differently to changes in the environment. Some may scale the brain's inner map to the surroundings, others do not. And they operate independently of each other in several ways."

This is also the first time that researchers have been able to show that a part of the brain that does not directly respond to sensory input, called the association cortex, is organized into modules. The research was conducted using rats.

Technical breakthroughs

A rat's brain is the size of a grape, while the area that keeps track of the sense of location and memory is comparable in size to a small grape seed. This tiny area holds millions of nerve cells.

A research team of six people worked for more than four years to acquire extensive electrophysiological measurements in this seed-sized region of the brain. New measurement techniques and a technical breakthrough made it possible for Hanne Stensola and her colleagues to measure the activity in as many as 186 grid cells of the same rat brain. A grid cell is a specialized cell named for its characteristic of creating hexagonal grids in the brain's mental map of its surroundings.

"We knew that the 'grid maps' in this area of the brain had resolutions covering different scales, but we did not know how independent the scales were of each other," Stensola said. "We then discovered that the maps were organized in four to five modules with different scales, and that each of these modules reacted slightly differently to changes in their environment. This independence can be used by the brain to create new combinations - many combinations - which is a very useful tool for memory formation."

After analysing the activity of nearly 1000 grid cells, researchers were able to conclude that the brain has not just one way of making an internal map of its location, but several.

Perhaps 10 different senses of location

Institute director Moser says that while researchers are able to state with confidence that there are at least four different location modules, and have seen clear evidence of a fifth, there may be as many as 10 different modules.

He says, however, that researchers need to conduct more measurements before they will have covered the entire grid-cell area. "At this point we have measured less than half of the area," he says.

Aside from the time and challenges involved in making these kinds of measurements, there is another good reason why researchers have not yet completed this task. The lower region of the sense of location area, the entorhinal cortex, has a resolution that is so coarse or large that it is virtually impossible to measure it.

"The thinking is that the coordinate points for some of these maps are as much as ten metres apart," explains Moser. "To measure this we would need to have a lab that is quite a lot larger and we would need time to test activity over the entire area. We work with rats, which run around while we make measurements from their brain. Just think how long it would take to record the activity in a rat if it was running back and forth exploring every nook and cranny of a football field. So you can see that we have some challenges here in scaling up our experiments."

New way to organize

Part of what makes the discovery of the grid modules so special is that it completely changes our understanding of how the brain physically organizes abstract functions. Previously, researchers have shown that brain cells in

sensory systems that are directly adjacent to each other tend to have the same response pattern. This is how they have been able to create detailed maps of which parts of the sensory brain do what.
The new research shows that a modular organization is also found in the highest parts of the cortex, far away from areas devoted to senses or motor outputs. But these maps are different in the sense that they overlap or infiltrate other. It is thus not possible to locate the different modules with a microscope, because the cells that work together are intermingled with other modules in the same area.
"The various components of the grid map are not organized side by side," explains Moser. "The various components overlap. This is the first time a brain function has been shown to be organized in this way at separate scales. We have uncovered a new way for neural network function to be distributed."

A map and a constant

The researchers were surprised, however, when they started calculating the difference between the scales. They may have discovered an ingenious mathematical coding system, along with a number, a constant. (Anyone who has read or seen "The Hitchhiker's Guide to the Galaxy" may enjoy this.) The scale for each sense of location is actually 42% larger than the previous one.
"We may not be able to say with certainty that we have found a mathematical constant for the way the brain calculates the scales for each sense of location, but it's very funny that we have to multiply each measurement by 1.42 to get the next one. That is approximately equal to the square root of the number two," says Moser.

Maps are genetically encoded

Moser thinks it is striking that the relationship between the various functional modules is so orderly. He believes this orderliness shows that the way the grid map is organized is genetically built in, and not primarily the result of experience and interaction with the environment.
So why has evolution equipped us with four or more senses of location?
Moser believes the ability to make a mental map of the environment arose very early in evolution. He explains that all species need to navigate, and that some types of memory may have arisen from brain systems that were actually developed for the brain's sense of location.
"We see that the grid cells that are in each of the modules send signals to the same cells in the hippocampus, which is a very important component of memory," explains Moser. "This is, in a way, the next step in the line of signals in the brain. In practice this means that the location cells send a different code into the hippocampus at the slightest change in the environment in the form of a new pattern of activity. So every tiny change results in a new combination of activity that can be used to encode a new memory, and, with input from the environment, becomes what we call memories.
The article is a part of doctoral research conducted by Hanne and Tor Stensola, and has been funded through an Advanced Investigator Grant that Edvard Moser was awarded by the European Research Council (ERC).

http://www.eurekalert.org/pub_releases/2012-12/equ-spq120412.php

Scientists pinpoint great-earthquake hot spots

87% of the largest earthquakes of the past century are associated with intersection regions between oceanic fracture zones and subduction zones

"We find that 87% of the 15 largest (8.6 magnitude or higher) and half of the 50 largest (8.4 magnitude or higher) earthquakes of the past century are associated with intersection regions between oceanic fracture zones and subduction zones," says Dietmar Müller, researcher at the University of Sydney in Australia and lead author of the Solid Earth paper. The connection is less striking for smaller earthquakes.
Powerful earthquakes related to these intersection regions include the destructive 2011 Tohoku-Oki and 2004 Sumatra events.
"If the association we found were due to a random data distribution, only about 25% of great subduction earthquakes should coincide with these special tectonic environments. Therefore, we can rule out that the link we found is just due to chance," he adds.
The researchers considered about 1,500 earthquakes in their study. They used a database of significant post-1900 events, as well as geophysical data mapping fracture zones and subduction zones, among others. They analysed information from these databases by using a specific data mining method.
"The method was originally developed for analysing online user data," says Thomas Landgrebe, also involved in the study. "The technique we apply is commonly used to find a few specific items which are expected to be most appealing to an Internet user. Instead, we use it to find which tectonic environment is most suitable for generating great earthquakes."
Since earthquake generation is a very complex process, the scientists don't yet have a complete understanding of why great earthquakes prefer the intersection areas. They suggest that it is due to the physical properties of fracture zones, which result in "strong, persistent coupling in the subduction boundaries," Landgrebe explains.

This means that the subduction fault area is locked and thus capable of accumulating stress over long periods of time.
"The connection we have uncovered provides critical information for seismologists to, in the long run, pinpoint particular tectonic environments that are statistically more prone to strong seismic coupling and great earthquake supercycles," Müller says. An area with earthquake supercycles experiences recurring powerful earthquakes every few centuries or millennia.
Regions that have long earthquake supercycles are usually not picked up as risk areas by seismic hazard maps as these are constructed mainly using data collected after 1900. An example is the area of the 2011 Tohoku-Oki earthquake, which had no record of large earthquakes over the past century and was not predicted to be of significant risk by previous hazard maps.
"The power of our new method is that it does pick up many of these regions and, hence, could contribute to much-needed improvements of long-term seismic hazard maps," Müller explains.
"Even though we don't fully understand the physics of long earthquake cycles, any improvements that can be made using statistical data analysis should be considered as they can help reduce earthquake damage and loss of life."

http://www.eurekalert.org/pub_releases/2012-12/cp-ssa113012.php

Study shows antibody therapy clears Alzheimer's plaques in mice

Findings could aid in the development of medicines to slow or stop Alzheimer's disease progression

Antibodies against amyloid beta (Aβ) protein deposits that are thought to play a role in Alzheimer's disease have shown some success in preventing the buildup of deposits in animals, but they have not been effective at removing preexisting deposits. Now researchers reporting in the December issue of the Cell Press journal Neuron show that a modified antibody was able to clear preexisting Aβ deposits in a mouse model of Alzheimer's disease.
"These findings have important implications for current and future development of antibodies for the treatment of Alzheimer's disease," says first author Ronald DeMattos, PhD, of Eli Lilly and Company.
One of the hallmarks of Alzheimer's disease is the accumulation between nerve cells of hard, insoluble protein fragments called amyloid plaques (or deposits). These plaques consist of Aβ fragments that are normally broken down and eliminated in the healthy brain.
Emerging literature suggests that extensive plaque deposition occurs in Alzheimer's disease patients some 10 years prior to first memory complaint, and by the time of diagnosis, plaque deposition is already reported to be at or near maximal levels.
Immunotherapy for Alzheimer's disease is a promising therapeutic approach that uses antibodies to target and clear Aβ that exists as a soluble peptide or within insoluble deposits. Thus far, many investigators have utilized antibodies that can bind both soluble and insoluble forms of Aβ.
These antibodies are effective in reducing amyloid deposition in mice prone to developing plaques, when given as a preventative measure; however, when given to aged mice with preexisting plaques, they have little or no effect and often cause severe side effects.
Dr. DeMattos and his colleagues hypothesized that these antibodies are unable to remove existing plaques because they become saturated with soluble Aβ when they enter the brain, and as such they are not able to bind to their intended target. To test this hypothesis, they developed a genetically engineered antibody that selectively targets the plaques.
The Lilly researchers found that their plaque-specific antibody crossed the blood-brain barrier, bound to deposited beta amyloid, and caused robust clearance of preexisting plaques in mice without causing microhemorrhage. A comparator antibody that bound to both soluble and insoluble Aβ did not effectively lower existing plaques yet caused an increase in microhemorrhage. "The data suggest that an antibody that binds to only insoluble amyloid beta is likely critical for plaque removal without the associated adverse event of microhemorrhage," says Dr. DeMattos.
The Lilly researchers believe these results are consistent with their original hypothesis. "Target engagement is fundamental for the clearance of deposited plaques, and these results highlight that approaches aimed at increasing antibody binding, or target engagement, will result in significant plaque clearance," says Dr. DeMattos.
The findings may help explain why the Alzheimer's drug bapineuzumab was no better than placebo in two recent late-stage trials in patients who had mild to moderate Alzheimer's disease. Bapineuzumab binds to both soluble and insoluble beta amyloid.
DeMattos et al.: "A plaque-specific antibody clears existing β-amyloid plaques in Alzheimer's disease mice."

http://phys.org/news/2012-12-australian-scientists-coconut-tasting-pineapple.html

Australian scientists develop coconut-tasting pineapple

Australian researchers have developed a "pina colada" pineapple

Australian researchers are working on a new breed of pineapple—one that is not only sweet and juicy but which has the added tropical taste of coconut.

In what is thought to be a world first, the Department of Agriculture in Queensland state is in the final stages of developing the new variety of the fruit, to be known as the AusFestival pineapple.

"Taste tests tell us that AusFestival is a winner—it has this lovely coconut flavour, which you won't find in any other pineapple in Australia," horticulturalist Garth Senewski told the ABC in comments aired Wednesday. "It's sweet, low acid, very juicy."

Senewski said the researchers did not initially intend to create a pineapple that tasted like coconut.

"When we're doing the breeding, we're not actually looking for a coconut-flavoured pineapple or any other particular flavour," he told ABC.

"We're looking for a nice flavoured pineapple. We're looking for a variety that is sweet, low acid and aromatic."

The Department of Agriculture confirmed the development to AFP but said anyone hoping for a "pina colada" pineapple will have to wait as it will be two years before the first trees are planted commercially.

http://www.sciencedaily.com/releases/2012/12/121205102613.htm

Mild Vitamin B12 Deficiency Associated With Accelerated Cognitive Decline

Being mildly vitamin B-12 deficient could be an indication that some older adults are at a greater risk for accelerated cognitive decline

Being mildly vitamin B-12 deficient could be an indication that some older adults are at a greater risk for accelerated cognitive decline, an observational study from researchers at the Jean Mayer USDA Human Nutrition Research Center on Aging (USDA HNRCA) at Tufts University suggests.

Martha Savaria Morris, Ph.D., an epidemiologist in the Nutrition Epidemiology Program at the HNRCA at Tufts University, and colleagues examined data from 549 men and women enrolled in a cohort of the Framingham Heart Study, focusing on scores on the Mini-Mental State Examination (MMSE), a short list of questions and tasks commonly used to screen for dementia. The subjects were divided into five groups, based on their vitamin B-12 blood levels.

Being in the two lowest groups was associated with significantly accelerated cognitive decline, based on an analysis of test scores from 5 MMSE tests given over a period of eight years. The average age at baseline was 75 years-old.

"Men and women in the second lowest group did not fare any better in terms of cognitive decline than those with the worst vitamin B-12 blood levels. Over time, their MMSE scores declined just as rapidly," Morris said. "Rapid neuropsychiatric decline is a well-known consequence of severe vitamin B-12 deficiency, but our findings suggest that adverse cognitive effects of low vitamin B-12 status may affect a much larger proportion of seniors than previously thought."

In the August 2012 issue of the Journal of the American Geriatrics Society, Morris and colleagues write that MMSE scores dropped, on average, 0.24 points per year versus an average drop of 0.35 points annually in the two groups with the lowest vitamin B-12 blood levels. The authors observed an even steeper decline of about 1-point per year in some people in the two lowest groups who also exhibited high blood levels of folate or took supplements containing its synthetic form, folic acid, although their models indicate the additional cognitive decline is potentially related to other health problems in this particular study population.

The subjects in this study were mostly Caucasian women who had earned at least a high school diploma. The authors said future research might include more diverse populations and explore whether vitamin B12 status impacts particular cognitive skills, as the MMSE results provide only a general picture of decline.

"While we emphasize our study does not show causation, our associations raise the concern that some cognitive decline may be the result of inadequate vitamin B-12 in older adults, for whom maintaining normal blood levels can be a challenge," said Paul Jacques, D.Sc., the study's senior author and director of the Nutrition Epidemiology Program.

Animal proteins, such as lean meats, poultry and eggs, are good sources of vitamin B-12. Because older adults may have a hard time absorbing vitamin B-12 from food, the USDA's 2010 Dietary Guidelines for Americans recommend that people over 50 years-old incorporate B-12 fortified foods or supplements in their diets.

Jacob Selhub, Ph.D., director of the Vitamin Metabolism Laboratory at the USDA HNRCA, co-authored the study. Selhub and Jacques are also professors at the Friedman School of Nutrition Science and Policy at Tufts University.

This research is supported by the National Institutes of Health (NIH) (grant# 1 R01 NS062877-01A2) and the U.S. Department of Agriculture (USDA).
Martha Savaria Morris, Jacob Selhub, Paul F. Jacques. Vitamin B-12 and Folate Status in Relation to Decline in Scores on the Mini-Mental State Examination in the Framingham Heart Study. Journal of the American Geriatrics Society, 2012; 60 (8): 1457 DOI: 10.1111/j.1532-5415.2012.04076.x

http://phys.org/news/2012-12-thorium-proliferation-nuclear-wonder-fuel.html

Thorium: Proliferation warnings on nuclear 'wonder-fuel'

Thorium is being touted as an ideal fuel for a new generation of nuclear power plants, but in a piece in this week's Nature, researchers suggest it may not be as benign as portrayed.

The element thorium, which many regard as a potential nuclear "wonder-fuel", could be a greater proliferation threat than previously thought, scientists have warned.

Writing in a Comment piece in the new issue of the journal, Nature, nuclear energy specialists from four British universities suggest that, although thorium has been promoted as a superior fuel for future nuclear energy generation, it should not be regarded as inherently proliferation resistant. The piece highlights ways in which small quantities of uranium-233, a material useable in nuclear weapons, could be produced covertly from thorium, by chemically separating another isotope, protactinium-233, during its formation.

The chemical processes that are needed for protactinium separation could possibly be undertaken using standard lab equipment, potentially allowing it to happen in secret, and beyond the oversight of organisations such as the International Atomic Energy Agency (IAEA), the paper says.

The authors note that, from previous experiments to separate protactinium-233, it is feasible that just 1.6 tonnes of thorium metal would be enough to produce 8kg of uranium-233 which is the minimum amount required for a nuclear weapon. Using the process identified in their paper, they add that this could be done "in less than a year." "Thorium certainly has benefits, but we think that the public debate regarding its proliferation-resistance so far has been too one-sided," Dr Steve Ashley, from the Department of Engineering at the University of Cambridge and the paper's lead author, said.

"Small-scale chemical reprocessing of irradiated thorium can create an isotope of uranium – uranium-233 – that could be used in nuclear weapons. If nothing else, this raises a serious proliferation concern."

Thorium is widely seen as an alternative nuclear fuel source to uranium. It is thought to be three to four times more naturally abundant, with substantial deposits spread around the world. Some countries, including the United States and the United Kingdom, are exploring its potential use as fuel in civil nuclear energy programmes.

Alongside its abundance, one of thorium's most attractive features is its apparent resistance to nuclear proliferation, compared with uranium. This is because thorium-232, the most commonly found type of thorium, cannot sustain nuclear fission itself. Instead, it has to be broken down through several stages of radioactive decay. This is achieved by bombarding it with neutrons, so that it eventually decays into uranium-233, which can undergo fission.

As a by-product, the process also produces the highly radiotoxic isotope uranium-232. Because of this, producing uranium-233 from thorium requires very careful handling, remote techniques and heavily-shielded containment chambers. That implies the use of facilities large enough to be monitored.

The paper suggests that this obstacle to developing uranium-233 from thorium could, in theory, be circumvented. The researchers point out that thorium's decay is a four-stage process: isotopically pure thorium-232 breaks down into thorium-233. After 22 minutes, this decays into protactinium-233. And after 27 days, it is this substance which decays into uranium-233, capable of undergoing nuclear fission.

Ashley and colleagues note from previously existing literature that protactinium-233 can be chemically separated from irradiated thorium. Once this has happened, the protactinium will decay into pure uranium-233 on its own, with little radiotoxic by-product. "The problem is that the neutron irradiation of thorium-232 could take place in a small facility," Ashley said. "It could happen in a research reactor, of which there are about 500 worldwide, which may make it difficult to monitor."

The researchers note that from an early small-scale experiment to separate protactinium-233, approximately 200g of thorium metal could produce 1g of protactinium-233 (and therefore the same amount of uranium-233) if exposed to neutrons at the levels typically found in power reactors for a month. This means that 1.6 tonnes of thorium metal would be needed to produce 8kg of uranium-233. They also point out that protactinium separation already happens, as part of other chemical processes.

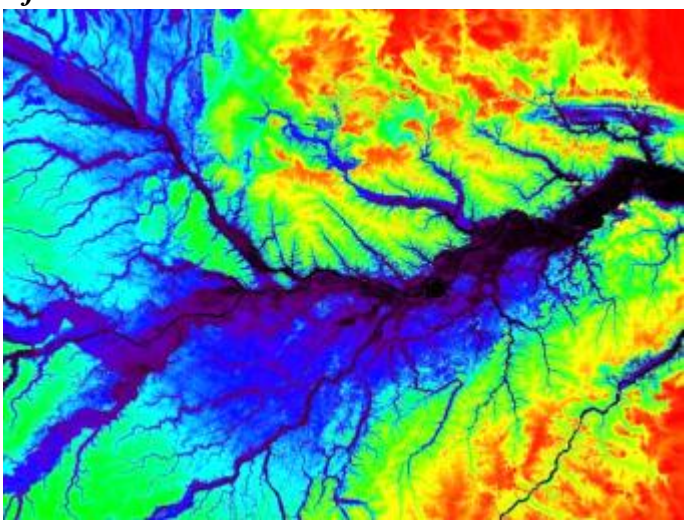
Given the need for access to a research or power reactor to irradiate thorium, the paper argues that the most likely security threat is from potential wilful proliferator states. As a result, the authors strongly recommend that appropriate monitoring of thorium-related nuclear technologies should be performed by organisations like

the IAEA. The report also calls for steps to be taken to control the short-term irradiation of thorium-based materials with neutrons, and for in-plant reprocessing of thorium-based fuels to be avoided.
"The most important thing is to recognise that thorium is not a route to a nuclear future free from proliferation risks, as some people seem to believe," Ashley added. "The emergence of thorium technologies will bring problems as well as benefits. We need more debate on the associated risks, if we want a safer nuclear future."
The researchers are: Dr Stephen F. Ashley and Dr. Geoffrey T. Parks from the University of Cambridge; Professor William J. Nuttall from The Open University; Professor Colin Boxall from Lancaster University; Professor Robin W. Grimes from Imperial College London.
Copies of the comment piece in this week's Nature are available on request. Interviews with Dr Steve Ashley can also be arranged by contacting Tom Kirk.
More information: Nuclear energy: Thorium fuel has risks, DOI: 10.1038/492031a Provided by Open University

http://phys.org/news/2012-12-common-angle-valley-networks.html

Researchers find a common angle and tipping point of branching valley networks

A new 'branch' of math



A topographic map of a section of the central Amazon River Basin near in Manaus, Brazil. **Global Rain Forest Mapping Project/NASA/JPL**

Over the course of decades or even centuries, Earth's landscape can appear relatively static, with mountains and valleys seemingly anchored firmly in place. Viewed over a longer timescale, however—on the order of hundreds of thousands of years—the Earth's topography becomes a rippling, shifting, changing tableau.
Rivers and valleys, in particular, form intricately branching patterns, the shapes of which have inspired a field of mathematical study in which scientists have developed a theoretical understanding of river-network geometry, and how that geometry might change over time. Now two research groups from MIT, in separate efforts, have come up with mathematical explanations for different characteristics of river and valley networks.
In a paper published this week in the Proceedings of the National Academy of Sciences, Dan Rothman and his colleagues formulate a mathematical theory to discover a common angle at which valleys branch. In environments where erosion is driven by the seepage of water out of the ground, the group's theory predicts that rivers branch at an angle of 72 degrees.
Putting the theory to the test, Rothman and his group measured 5,000 branching angles in the Florida Panhandle, a region of soft, sandy soils—finding that the average valley branching was indeed 72 degrees. Rothman, a professor of geophysics in MIT's Department of Earth, Atmospheric and Planetary Sciences (EAPS), says such a mathematical analysis may also be applicable to other systems, such as neuron dendrites and fungal filaments.
Similarly, a team led by Taylor Perron has published a paper this week in Nature in which another mathematical model of river networks has identified a tipping point at which rivers branch. Depending on a river's capacity to erode a landscape—and how quickly creeping soil may fill its valley—the river may give rise to a dense network of tributaries, or remain as a single rivulet.
"We use mathematics to speed up time and help us understand how these systems evolve," says Perron, the Cecil and Ida Green Assistant Professor of Geology in EAPS. "If you could speed up the clock, you would see that the landscape is a lot more dynamic."

Angling for a theory

Near the town of Bristol, along the eastern stretch of the Florida Panhandle, a network of valleys cuts into the landscape, resembling a tree with ever-smaller branches spreading from a main trunk. From an aerial view, one can see midsized branches, or valleys, running with water, and feeding into a wider river. Over time, the very tips of the smallest valleys themselves branch to create an even denser valley network.
To understand how these valleys branch, Rothman and his team—former postdoc Olivier Devauchelle, former graduate student Alexander Petroff and postdoc Hansjoerg Seybold—looked to the mechanics of groundwater flow. Unlike river water that flows over land, groundwater flows under the surface, through material such as porous sand. In an environment such as the Florida Panhandle, groundwater may act to incise, or cut into, a network of valleys: Essentially, groundwater stored in the hills surrounding a valley slowly seeps out, carrying

with it some sand. Over time, the process slowly erodes the surrounding hills, extending a valley and eventually splitting it in two.
To find the angle at which this split occurs, Rothman's group derived a mathematical expression for the paths taken by groundwater as it flows toward a newly split stream. Such paths generally curve either away from each other, when the angle between the streams is small, or toward each other, when the angle is large. However, Rothman's group found that there is a special angle—72 degrees—for which the paths are straight, reasoning that this is the angle at which streams branch. They subsequently confirmed their prediction by examining nearly 5,000 stream junctions in the Florida Panhandle.
"What we show is that because of the properties of groundwater flow, one can understand something about the organization of this pattern," Rothman says. "It opens a world into a really interesting geometry."

A geologic tug-of-war

In contrast to Rothman's work, which focused on the effects of groundwater on valley formation, Perron and his colleagues examined the formation of river networks over land. His group sought to answer one main question: What governs the branching pattern that emerges over time?
To answer that question, the researchers developed a simple mathematical model representing the erosional mechanisms that act on a river network. Through their model, Perron found that the shape a river network takes is governed by a tug of war between two forces: the strength of river incision, or how quickly a river erodes its banks and the underlying material; and the strength of soil creep, or how quickly soil from surrounding hills fills in a river valley.
Running the model on a simulated landscape, the researchers found that as they turned up river incision—or turned down soil creep—a river basin with a single river channel morphs into a network of branching channels at a very specific tipping point. Because river incision is stronger in larger river basins that collect more water, this tipping point explains why larger rivers develop a network of tributaries, whereas small rivers may have no tributaries at all.
Moreover, relating the tipping point to specific erosional mechanisms allowed the group to understand why river basins in landscapes with different bedrock or climates grow tributaries at different scales. They predicted that river basins should branch at a smaller size in environments where river incision is strong—for example, areas with heavy rainfall, or soft bedrock—or where soil creep is weak.
Perron tested this prediction in two locations with similar river networks, but at different scales: the Allegheny Plateau, in southwest Pennsylvania, and Gabilan Mesa, in California's Salinas Valley—a region with similarly-patterned river networks, but at one-quarter the size. The group found that the pattern of river networks in both locations matched predictions from its models, despite their difference in scale and environment.
While Gabilan Mesa has a drier climate than the Allegheny Plateau, its rock is softer and its soil less permeable. On the rare occasions when it does rain hard, the water accumulates faster and cuts more easily into the surface, leading to strong river incision that encourages river branching.
"We tested the model in these two places so we could compare the predicted instability, the breaking point at which rivers should start to branch," Perron says. "That's interesting, because it means we can do that for landscapes where we can't do fieldwork—possibly landscapes on another planet." Mikael Attal, a lecturer in landscape dynamics at the University of Edinburgh, says the results from both Perron's and Rothman's work shed light on what may cause such intricate patterns in rivers and other natural landscapes.
"Understanding how river networks originate and evolve is key to understanding how landscapes have evolved in the past, and how they will evolve in the future," says Attal, who did not participate in the research. "What is fascinating about these two papers is that they provide a physical explanation for the geometry of river networks using some very simple concepts. Studies such as these will help better parameterize models and help make more accurate predictions of what may happen in the future."
More information: www.nature.com/nature/journal/v492/n7427/full/nature11672.html
Provided by Massachusetts Institute of Technology

http://www.eurekalert.org/pub_releases/2012-12/wtsi-np120512.php

Nobody's perfect

Researchers produce a catalog of the deleterious and disease-causing genetic variants in healthy people

Researchers at Cambridge and Cardiff have found that, on average, a normal healthy person carries approximately 400 potentially damaging DNA variants and two variants known to be associated directly with disease traits. They showed that one in ten people studied is expected to develop a genetic disease as a consequence of carrying these variants.
It has been known for decades that all people carry some damaging genetic variants that appear to cause little or no ill effect. But this is the first time that researchers have been able to quantify how many such variants each

of us has, and list them. This figure of 400 is likely to increase as more and more powerful genetic studies discover rare genetic variants more efficiently. Such research brings to the fore ethical questions surrounding anonymous studies and incidental findings.
"For over half a century, medical geneticists have wanted to establish the magnitude of the damage caused by harmful variants in our genomes," says Dr Yali Xue, lead author from the Wellcome Trust Sanger Institute. "Our study finally brings us closer to understanding the extent of these damaging mutations.
"We measured the number of potentially damaging variants in the genomes of apparently normal healthy humans by comparing two different datasets: whole genome sequences from 179 people in the 1000 Genomes Pilot Project, who were unlikely to have any overt genetic disease at the time of sampling, and information from the Human Gene Mutation Database (HGMD), a detailed catalogue of human disease-causing mutations that have been reported in the scientific literature."
In many cases, the disease or damaged variants were single, 'recessive' genetic variants that are unlikely to cause any harm to the carrier. A recessive genetic variant will only exert its effect when two copies – one in each chromosome – are present. In one in ten people, however, the team could point to a potential clinical effect of the genetic variants. This is because these people either carry two copies of a specific recessive disease variant, or alternatively a dominant genetic variant. Dominant disease genetic variants can give rise to a disease trait when even a single copy is present.
"In the majority of people we found to have a potential disease-causing mutation, the genetic condition is actually quite mild, or would only become apparent in the later decades of life," says Professor David Cooper, lead author of the study from Cardiff University. "We now know that normal healthy people can possess many damaged or even completely inactivated proteins without any noticeable impact on their health. It is extremely difficult to predict the clinical consequences of a given genetic variant, but databases such as HGMD promise to come into their own as we enter the new era of personalized medicine."
Catalogues of disease-causing variants such as HGMD have been created over the past two decades but they are still far from complete. Disease variants are generally extremely rare and comprehensive searches for such mutations in many populations have scarcely begun.
The genome samples selected for this study were anonymized so the participants could not receive any information about whether or not they might be at risk for a particular genetic disorder. This is increasingly becoming an ethical issue for medical geneticists.
"Should incidental findings be fed back to people who have volunteered their sample to a study? There is no clear answer to this question," says Dr Chris Tyler-Smith, lead author from the Wellcome Trust Sanger Institute. "All of our genomes contain flaws; some of us will carry deleterious variants but will not be at risk of acquiring the associated disease for one reason or another. For others, there will be health consequences, and early warning could be useful, but might still come as an unwelcome surprise to the participant."
As DNA sequencing becomes more commonplace, geneticists must determine the most ethical way to handle this sensitive information.
Yali Xue, Yuan Chen, Qasim Ayub, et al (2012). 'Deleterious- and Disease-Allele Prevalence in Healthy Individuals: Insights from Current Predictions, Mutation Databases, and Population-Scale Resequencing' Published online in American Journal of Human Genetics on 06 December
Volume: 91; Issue: 6; Manuscript: 1298; DOI: 10.1016/; PII
This study was funded by the Wellcome Trust and BIOBASE GmbH.

http://www.eurekalert.org/pub_releases/2012-12/luhs-tts120612.php

Tamoxifen trial should prompt breast cancer patients to reconsider treatment options

'Exciting and significant new findings'

MAYWOOD, Il. - A groundbreaking clinical trial involving the breast cancer drug tamoxifen should prompt certain breast cancer patients to reconsider their treatment options, according to Loyola University Medical Center breast cancer specialist Dr. Kathy Albain.
The trial is called ATLAS (Adjuvant Tamoxifen Longer Against Shorter). It included women with estrogen receptor-positive breast cancer that had not spread to distant organs. Women who took tamoxifen for 10 years had a lower risk of recurrence and lower mortality rate than women who took the drug for 5 years, which is the current standard of care.
"I think this is going to create a need for women with this type of breast cancer to readdress their treatment options," Albain said.
Dr. Richard Gray, on behalf of the ATLAS trial investigators, announced results Dec. 5 during the San Antonio Breast Cancer Symposium. Albain moderated the opening oral session in which the results were announced and discussed.

A worldwide team of investigators enrolled 6,846 women with estrogen receptor-positive breast cancer who had been taking tamoxifen for five years and were free of recurrence of their breast cancer. Women were randomly assigned to either stop taking tamoxifen, or to continue taking the drug for another five years. During the second decade following diagnosis, women who continued taking tamoxifen had a 25 percent lower recurrence rate and a 29 percent lower breast cancer mortality rate, compared with women who stopped after five years. Overall, taking tamoxifen for 10 years cut the risk of dying of breast cancer in half.
Albain noted there are risks to taking tamoxifen, including a higher risk of endometrial cancer in postmenopausal patients and an increased risk of blood clots. But endometrial cancer generally is curable, and in certain women, the benefits of taking tamoxifen for longer periods may outweigh the risks, Albain said.
Premenopausal women may benefit by taking tamoxifen for 10 years rather than 5 years, Albain said. The picture is more complicated for postmenopausal women. Depending on the patient, a regimen could involve taking tamoxifen for a period of time and an aromatase inhibitor for a period of time.
"Each woman's situation is different, which is why she should consult her doctor on the best course of action in light of these exciting and significant new findings," Albain said.

http://news.discovery.com/tech/intellipaper-121206.html#mkcpgn=rssnws1

Paper USB Drive Is Disposable

Developers create a way to embed a silicon chip into paper to make a disposable paper USB drive

Analysis by Christina Ortiz

Despite a lot of talk about society going paperless, paper is still around. Humans still hand out paper versions of business cards, birthday cards, invitations and resumes. Corporations still send direct mail and catalogs to consumers. Intellipaper is a project on Indiegogo that's looking to add a whole lot of info to that paper, without taking up more space.
The developers have created a way to embed a silicon chip into regular paper to make a disposable paper USB drive. It can be inserted into any computer's USB port to share websites, personal information, images or portfolios. The USB drive can be customized to fit any paper-based item you want, be it greeting cards, business cards or even wedding invites with registry info embedded for easy access. If fully funded on Indiegogo, the project could be a much cooler version of the QR code.
The project is currently seeking funding, but they hope to release a reader/writer device that will be able to create USB drives with whatever content a user wants and read pre-embedded paper. Depending on what tier a pledger chooses they could receive pre-embedded paper and a reader/writer. *Credit: intelliPaper*

http://www.sciencedaily.com/releases/2012/12/121206153646.htm

Treadmill Testing Can Predict Heart Disease in Women

Researchers have found that a treadmill test can accurately predict coronary artery disease in women over the age of 65

Although there is a widespread belief among physicians that the exercise treadmill test (ETT) is not reliable in evaluating the heart health of women, UC Davis researchers have found that the test can accurately predict coronary artery disease in women over the age of 65. They also found that two specific electrocardiogram (EKG) indicators of heart stress during an ETT further enhanced its predictive power.
Published in the December issue of The American Journal of Cardiology, the study can help guide cardiologists in making the treadmill test -- an accessible, economic and easy-to-administer evaluation of patients with heart disease symptoms -- more useful in clinical practice.
"Newer cardiac imaging technologies are more accurate in identifying the presence of heart disease, but those tests are considerably more expensive than ETT and in many cases unnecessary" said Ezra Amsterdam, senior author of the study and UC Davis professor of cardiovascular medicine. "Our study found that the test is a very valuable tool for identifying coronary artery disease in women older than 65, and that it can be used to help select those who may require higher-tech diagnostics."
During ETT, a patient exercises on a treadmill at gradually increasing speed and elevation while undergoing blood pressure monitoring and an EKG to gauge exercise-induced changes in the heart's electrical activity. If signs of heart disease are present, more definitive and invasive evaluations such as coronary angiography may be conducted to determine if any blood vessels are narrowed or blocked by plaque. Coronary angiography, which produces a series of X-rays of the interior of the arteries by injecting dye into them to make them visible, may be recommended when there is evidence of heart disease.
The current study analyzed 111 women who had seen their doctors at UC Davis Medical Center because of chest pain and whose exercise treadmill tests were "positive," indicating they should have further

cardiovascular testing. Coronary angiography was performed on each patient, and the researchers analyzed how often the results showed definite evidence of arterial narrowing.
They found that overall only half of the women with positive treadmill tests had coronary artery disease as determined by coronary angiography. But when test results were evaluated by age, the predictive value of ETT rose. While the treadmill test predicted arterial disease in only 36 percent of the youngest group (aged 35 to 50 years) of study participants, it successfully identified the condition in 68 percent of those aged 65 years and older, when the prevalence of coronary artery disease rises sharply for women.
The investigators also found that two EKG parameters of heart stress due to poor blood flow -- an ST-segment depression greater than 2.0 mm or ST-segment recovery time longer than three minutes -- added to the diagnostic value of ETT. Longer ST-segment recovery time was in fact the best predictor across all age groups of whether a positive treadmill test result was "true" or "false" and accurately identified coronary artery disease in eight out of 10 women older than 65.
"Our results provide physicians with a way to make an old heart disease screening tool more reliable for women," said Amsterdam. "The study also supports the guidelines of the American Heart Association and American College of Cardiology, which recommend that exercise treadmill testing should remain the initial test for both women and men who require evaluation for chest pain."
Additional authors of the study were Jeffrey Levisman and Karen Aspry, who conducted the research during their cardiology fellowships at UC Davis. The study received no external funding.
Jeffrey M. Levisman, Karen Aspry, Ezra A. Amsterdam. Improving the Positive Predictive Value of Exercise Testing in Women for Coronary Artery Disease. The American Journal of Cardiology, 2012; 110 (11): 1619 DOI: 10.1016/j.amjcard.2012.07.027

http://www.bbc.co.uk/news/magazine-20625482

Morphine: The cheap, effective pain-relief drug denied to millions

It's cheap, effective and easy to administer - so why are millions of people around the world dying in pain, without access to morphine?

By Joanne Silberner PRI's The World

In an open ward at Mulago Hospital in Uganda's capital city, Kampala, an elderly woman named Joyce lies in the fifth bed on the left. She has twisted the sheets around herself, her face contorted by pain. Joyce's husband, thin and birdlike, hovers over her. Joyce has cancer - it has spread throughout her body - and until a few days ago, she was on morphine. Then it ran out. "She's consistently had pain," says a nurse. "And she describes the pain to be deep - kind of into her bones."
The Ugandan government makes and distributes its own morphine for use in hospitals, but poor management means the supply is erratic. "We're in a very difficult situation," says Lesley Henson, a British pain specialist on duty at Mulago Hospital. They have patients whose pain has been kept under control with morphine - but they are running out of it.
In many ways, morphine is an excellent drug for use in developing countries. It is cheap, effective, and simple and easy to administer by mouth. Yet according to the World Health Organization, every year more than five million people with cancer die in pain, without access to morphine.
"The fact that what stands between them and the relief of that pain is a drug that costs $2 [£1.25] a week, I think is just really unconscionable," says Meg O'Brien, head of The Global Access to Pain Relief Initiative, a non-profit organisation that advocates for greater access to morphine. O'Brien says in well-off countries, like the UK and United States, there is enough morphine to treat 100% of people in pain - but in low-income countries, it's just 8%.
In many low- and middle-income countries - 150, by some counts - morphine is all but impossible to get. Some governments don't provide it, or strictly limit it, because of concerns that it will be diverted to produce heroin. And many doctors are reluctant to prescribe morphine, fearing their patients will become addicted - something that studies have shown rarely happens.
In India, whether you can get morphine depends largely on where you are treated. Tata Memorial Hospital, a modern and well-equipped medical centre in Mumbai, has no problem getting morphine for patients. "We have all the medicines necessary," says Dr Mary Ann Muckaden, head of pain relief at the hospital. "We never run out." But in other parts of the country, it's a different story. Muckaden estimates only 1% to 2% of Indians with cancer pain get morphine.
Dinesh Kumar Yadav, 28, has come to Tata Memorial - a 30-hour bus ride from his home - to get morphine for his wife. He tells me she is bedridden with pain but can't get morphine in the north Indian state where they live. Dr Muckaden says part of the problem is a stifling bureaucracy. "Many physicians in the north, they don't want to go through the rigorous licensing to store morphine," she explains.

There is a place in India where there are no barriers to morphine. But even at the CIPLA Palliative Care Centre in the city of Pune, in Maharashtra state, there are still challenges.
You don't see the challenges when you walk through the cool courtyard gardens with fountains and manicured walkways, or in the beautiful whitewashed buildings with large airy wards, each named after a flower.
"This is heaven on earth," says Asha Dikshit, whose mother came here last year in the last stages of breast cancer. "She was in agony. Her shoulder had dislocated. It could not be fixed back," says Dikshit. "She had pain in the back, and sometimes there were hallucinations." But she says her mother died - peacefully - on morphine.
Every patient here has cancer, and the care is free. The Indian generic drug manufacturer CIPLA supplies the morphine and pays all the other expenses. But even with all the centre offers, the occupancy rate runs at only about 60%. One big reason, says director Priya Kulkarni, is a result of patients' own concerns about morphine. They often think morphine equals death, and they recoil when doctors suggest it.
Kulkarni says many local oncologists don't want to send patients here for that reason.
"They don't want to give up when it comes to giving them hope," she says. "And saying something like, 'I am going to refer you to a palliative specialist,' is indirectly saying 'There is nothing more I can do for you.'"
Despite all the obstacles to the use of morphine in the developing world, Kulkarni and others say things are starting to move in their direction. In low-income countries, morphine consumption is up tenfold since 1995, according to the International Narcotics Control Board. And several countries where not many years ago there was no morphine - like Uganda - at least have some today, even if the supply is unreliable.
Back at the hospital in Kampala - where the pharmacy ran out of morphine and Joyce, the cancer patient, had to go without - palliative care specialist Leslie Henson finds a bit of luck. After leaving her patient, she steps into an office, glances at a bookshelf, and sees a forgotten bottle of morphine. It's enough to treat two or three people. "Hopefully, we'll go take this to her and see what we can do," she says as she troops back to Joyce's room.
Soon, a doctor administers the morphine. Joyce smiles. Her face untwists. And her husband looks ecstatic. I ask Joyce if she's glad to get the morphine. Her husband answers. "Very much, indeed." Other people in the hospital will remain in pain - there is not enough morphine to go around - but for the next few hours, at least, Joyce will be pain-free.
This series of reports is by PRI's The World with support from the Pulitzer Center on Crisis Reporting.

http://bit.ly/SPCral

Captured: the moment photosynthesis changed the world

BILLIONS of years ago, a tiny cyanobacterium cracked open a water molecule - and let loose a poison that wrought death and destruction on an epic scale.

07 December 2012 by Colin Barras

The microbe had just perfected photosynthesis, a process that freed the oxygen trapped inside water and killed early Earth's anaerobic inhabitants.
Now, for the first time, geologists have found evidence of the crucial evolutionary stage just before cyanobacteria split water. The find offers a unique snapshot of the moment that made the modern world. With the advent of photosynthesis came an atmosphere dominated by oxygen and, ultimately, the diversity of life forms that we know today.
"This was the biggest change that ever occurred in the biosphere," says Kevin Redding at Arizona State University in Tempe. "The extinction caused by oxygen was probably the largest ever seen, but at the same time animal life wouldn't be possible without oxygen."
Photosynthesis uses light and a source of electrons to generate energy and power an organism. In the world as we know it, that source of electrons is water, with oxygen the waste product. But there are no signs that oxygen was being formed when photosynthesis first appeared around 3.4 billion years ago, so early photosynthesisers probably scavenged electrons by splitting other molecules like hydrogen sulphide instead.
That had changed by about 2.4 billion years ago, when deposits of oxidised minerals tell us that oxygen was beginning to accumulate in the atmosphere. Photosynthesis as we know it had evolved.
To help work out how this happened, Woodward Fischer at the California Institute of Technology in Pasadena and his colleagues studied South African rocks that formed just before the 2.4-billion-year mark. Their analysis shows that although the rocks formed in the anoxic conditions that had prevailed since Earth's formation, all of the manganese in the rock was deposited in an oxidised form.
In the absence of atmospheric oxygen, manganese needs some sort of catalyst to help it oxidise - it won't react without a bit of help. The best explanation, say Fischer's team, is that a photosynthetic organism was using manganese as an electron source. That left unstable manganese ions behind, which reacted with water to form

the oxides. Fischer presented the findings at the American Geophysical Union's conference in San Francisco on 6 December.
Every researcher contacted by New Scientist has hailed the significance of the study, in part because the evidence exactly matches what evolutionary theories have predicted.
A close look at today's plants and algae shows that manganese oxidation is still a vital part of photosynthesis. Within their photosynthetic structures are manganese-rich crystals that provide the electrons to drive photosynthesis. The crystals then snaffle electrons from passing water molecules to restore their deficit. It is this electron raid that cracks open water molecules and generates the oxygen we breathe.
This complicated process must have had simpler roots. In 2007, John Allen at Queen Mary, University of London, and William Martin at the University of Düsseldorf, Germany, suggested one scenario (Nature, doi.org/bs65kb). They believe that modern photosynthesis was born when early cyanobacteria by chance floated into a watery environment rich in manganese, and quickly adapted to take advantage of the new source of electrons.
Later, because manganese is a relatively scarce resource that can't be tapped indefinitely, the cyanobacteria evolved a different strategy. They incorporated manganese directly into their photosynthetic structures and used it as a rechargeable battery: draining it of its electrons, but allowing its supplies to be replenished by stealing electrons from another, more plentiful source - water.
What Fischer's team has found is evidence of the initial step in this process: an anoxic environment rich in manganese that has been stripped of electrons and left in an oxidised state, almost certainly by primitive cyanobacteria. "There had to be some intermediate step in the evolutionary process," says Redding.
"This is big news," says Martin. He adds that we can expect publications in the near future that provide more evidence compatible with the theory. "But this somewhat more direct geochemical evidence is really exciting."

http://www.eurekalert.org/pub_releases/2012-12/nu-naa120612.php

New antidepressant acts very rapidly and is long lasting

Drug fights hard-to-treat depression by targeting brain receptors in a new way

A first-of-its-kind antidepressant drug discovered by a Northwestern University professor and now tested on adults who have failed other antidepressant therapies has been shown to alleviate symptoms within hours, have good safety and produce positive effects that last for about seven days from a single dose.
The novel therapeutic targets brain receptors responsible for learning and memory -- a very different approach from existing antidepressants. The new drug and others like it also could be helpful in treating other neurological conditions, including schizophrenia, bipolar disorder, anxiety and Alzheimer's disease.
The results of the phase IIa clinical trial were presented today (Dec. 6) at the 51st Annual Meeting of the American College of Neuropsychopharmacology in Hollywood, Fla.
Also this week, a paper reporting some of the background scientific research that provided the foundation for the clinical development of GLYX-13 was published by the journal Neuropsychopharmacology.
The compound, called GLYX-13, is the result of more than two decades of work by Joseph Moskal, research professor of biomedical engineering at Northwestern's McCormick School of Engineering and Applied Science and director of the University's Falk Center for Molecular Therapeutics. "Our study showed that this compound is capable of eliciting a robust and rapid antidepressant effect without the typical side effects seen with other drugs that also modulate the NMDA receptor," said Moskal, who is founder and chief scientific officer of the Evanston-based biotechnology company Naurex Inc., which conducted the clinical study.
GLYX-13 works by modulating the NMDA (N-methyl-D-aspartate) receptor in the brain, as do current NMDA receptor antagonists such as ketamine, but GLYX-13 does not have their serious and limiting side effects, such as hallucinations and schizophrenia-like effects. (An antagonist is a substance that inhibits the physiological action of another.) Moskal and his team have figured out a new way to target the NMDA receptors that maintains the positive antidepressant properties while eliminating the negative side effects.
In clinical trials administered at 12 sites across the country, a single dose of GLYX-13 resulted in significant reductions in depression symptoms among subjects who had shown little improvement with previous drugs. (Subjects had failed treatment with one or more antidepressant agents.)
The positive effects of GLYX-13 were evident within 24 hours and lasted an average of seven days. The effect size, a measure of the magnitude of the drug's antidepressant efficacy, at both these times after a single dose was nearly double the effect size seen with most other antidepressant drugs after four to six weeks of repeated dosing.
Side effects of GLYX-13 were mild to moderate and were consistent with those observed in subjects receiving a placebo.

GLYX-13 is a four-amino acid peptide that modulates one of a large family of glutamate receptors, the NMDA (N-methyl-D-aspartate) receptor, in the brain. NMDA receptors play a key role in regulating synaptic plasticity -- the quality of the connection between neurons -- and thus are important in regulating learning and memory functions. GLYX-13 is administered intravenously. Moskal said Naurex also is working on an oral drug with similar properties and potential.

Moskal hopes that these positive GLYX-13 results and the research efforts of his team and colleagues will help shepherd in more research and grant support for studying the role of the glutamate-mediated processes in neuropsychiatric disorders. "While the results we are seeing with GLYX-13 are very encouraging, I believe the most important research is yet to come," Moskal said. "We have only scratched the surface of the therapeutic potential of the glutamatergic system."

GLYX-13 currently is undergoing a phase IIb clinical trial at 20 sites across the United States. This trial is evaluating repeated doses of the drug.

The Neuropsychopharmacology paper is titled "GLYX-13, an NMDA Receptor Glycine-Site Functional Partial Agonist, Induces Antidepressant-Like Effects Without Ketamine-Like Side Effects."

The research was supported by grants from the Ralph and Marian Falk Medical Research Trust, the Hope for Depression Research Foundation and the National Institutes of Health (grants MH094835, NS044421 and DA01442).

http://www.eurekalert.org/pub_releases/2012-12/aafc-oao120512.php

Obesity and overeating during menopause together promote breast tumor growth and progression

Obese women may reduce risk for postmenopausal breast cancer by preventing weight gain and controlling the metabolic effects of their obesity during perimenopause

PHILADELPHIA - Obese women might be able to eliminate their increased risk for postmenopausal breast cancer by taking measures during perimenopause to prevent weight gain and to therapeutically control the metabolic effects of their obesity, according to the results of a preclinical study published in Cancer Research, a journal of the American Association for Cancer Research.

"Obese postmenopausal women have increased risk for breast cancer and poorer clinical outcomes compared with postmenopausal women who are lean," said Paul S. MacLean, Ph.D., associate professor of medicine at the University of Colorado Anschutz Health and Wellness Center in Aurora, Colo. "The reasons for this are not fully understood. "Unfortunately you cannot do the studies needed to address this issue in humans. So, we merged rat models of obesity, breast cancer and menopause to best mimic the events that link premenopausal obesity to an increased rate of postmenopausal breast cancer."

During menopause, women often gain weight because they consume more food than their body needs. In a previous study, MacLean and colleagues used their rat model to show that weight gain following surgical ovariectomy, which models menopause, helped promote breast tumor development in obese rats.

In this study, they confirmed that obesity and overfeeding after surgical ovariectomy together drove aggressive tumor growth and progression.

One reason was that obese rats were unable to appropriately handle the excess sources of energy, in the form of glucose and dietary fat, which accumulated as a result of overfeeding after surgical ovariectomy. Lean rats stored the excess glucose and dietary fat from overfeeding in liver, fat, muscle and healthy breast tissue, a normal metabolic response to overfeeding. In contrast, the healthy tissues in obese rats failed to increase uptake of glucose and dietary fat, but the breast tumors dramatically increased uptake of glucose.

A second reason for the enhanced tumor growth and progression in obese rats compared with lean rats was that tumors from the two groups of animals had different molecular profiles. Tumors from obese rats had higher levels of expression of the progesterone receptor (PR), which was related to higher expression of genes involved in energy use and proliferation.

A similar pattern of increased expression of genes involved in energy use and cell growth was seen in human PR-positive breast tumors from postmenopausal women. According to MacLean, a final piece of evidence indicating that obesity and overfeeding during the menopausal transition converge to promote tumor growth and progression was that the antidiabetic drug metformin reduced tumor burden in obese rats after surgical ovariectomy.

"If our findings in rats translate to humans, it means that the perimenopausal period is a critical window of time for determining breast cancer risk later in life," said MacLean. "This, in turn, means that an obese woman's risk for postmenopausal breast cancer and poor clinical outcome could be reduced by perimenopausal lifestyle modifications, such as restricting food consumption and increasing exercise, and/or perimenopausal use of drugs, such as metformin, to improve metabolic control."

MacLean and colleagues are now testing this hypothesis in the rat model.

http://www.eurekalert.org/pub_releases/2012-12/esr-gia120712.php

Group interaction among elderly is the key to significant health outcomes

Health benefits of 'water clubs' in care homes for the elderly owe much to the social nature of the activity

The health benefits of 'water clubs' in care homes for the elderly, where residents gather together regularly to drink water , owe as least as much to the social nature of the activity as to the value of drinking water itself, an investigation by psychologists has shown.

The study, funded by the Economic and Social Research Council (ESRC), supports other findings that interventions aimed at improving individuals' wellbeing and quality of life can be far more effective if they are carried out among groups of people in ways that generate a strong sense of group identity.

A team led by Professor Alex Haslam of the University of Exeter became interested in water clubs when one received widespread publicity. Small groups of residents in a care home met together to discuss the benefits of drinking more water and were encouraged to increase their intake of water. Members of the club reported enhanced wellbeing, fewer falls and better hydration than those who drank water alone

"It is clear from this research and a series of other investigations that we have carried out that when people belong to a group, the sense of 'us-ness' that this creates plays a critically important role in processes of health and wellbeing," said Professor Haslam. "We refer to this as 'the social cure'," collaborator Professor Catherine Haslam said, "and it is far more potent than many of the other treatments that are out there. Whether we are talking about stress, depression, or recovery from stroke, a supportive group life plays a critical role in a person's clinical path."

The researchers, together with another ESRC-funded researcher, Professor Jolanda Jetten, have published their findings in a book, 'The Social Cure', which brings together evidence from around the world showing how groups are central to health and wellbeing. "Humans are social animals – we have evolved for group life," said Professor Jetten, co author of the book .

"Groups can boost our wellbeing but, at times, they can also drag us down and be a social curse. Precisely because group life is such an important determinant of health and wellbeing, we need to better understand these processes and dynamics" Professor Jetten concluded.

http://bit.ly/Z1r1nO

Thoughts on the anniversary of the Montreal Massacre.

He blamed women occupying positions that were traditionally occupied by men

By Janet D. Stemwedel | December 7, 2012

On December 6, 1989, in Montreal, fourteen women were murdered for being women in what their murderer perceived to be a space that rightly belonged to men:

Geneviève Bergeron (born 1968), civil engineering student
Hélène Colgan (born 1966), mechanical engineering student
Nathalie Croteau (born 1966), mechanical engineering student
Barbara Daigneault (born 1967), mechanical engineering student
Anne-Marie Edward (born 1968), chemical engineering student
Maud Haviernick (born 1960), materials engineering student
Maryse Laganière (born 1964), budget clerk in the École Polytechnique's finance department
Maryse Leclair (born 1966), materials engineering student
Anne-Marie Lemay (born 1967), mechanical engineering student
Sonia Pelletier (born 1961), mechanical engineering student
Michèle Richard (born 1968), materials engineering student
Annie St-Arneault (born 1966), mechanical engineering student
Annie Turcotte (born 1969), materials engineering student
Barbara Klucznik-Widajewicz (born 1958), nursing student

They were murdered because their killer was disgruntled that he been denied admission to the École Polytechnique, the site of the massacre, and because he blamed women occupying positions that were traditionally occupied by men for this disappointment, among others. When their killer entered the engineering classroom where the killing began, he first told the men to leave the room, because his goal was to kill the women. In their killer's pocket, discovered after his death, was a list of more women he had planned to kill, if only he had the time.

Most of the people who believe women do not belong in science and engineering classrooms, or in science or engineering jobs, or in other domains that used to be exclusively male, will never pick up a gun to enforce their will.

But, there are plenty who will send women the clear message that they are not welcome as equal participants in these domains.

There are plenty who will assume — and proclaim loudly — that women have unfairly gained access (due to affirmative action or quotas or political correctness), that they cannot possibly perform at the same level as men (despite evidence that the women they scorn are doing just that), that they have taken the place of some anonymous deserving man who really needed that job or that spot in the class.
There are plenty who will remind women, with words and deeds, that they will always be seen primarily in terms of their sexual desirability (or lack thereof) by the men who are their classmates and teachers, their colleagues and bosses. Women in these male precincts who have the temerity to object to leering and ass-grabbing and unwelcome sexual advances can expect to be told that they are sucking all the joy out of the professional or educational environment, and that this is how it has always been (and if you wanted to be part of this world, you should take it as it is rather than ruining it), and that they should just toughen up.
There is no amount of toughening up that would have saved these fourteen women from the bullets that were fired at them for the crime of being female in a male domain.
And, when men speak passionately against women leaving their proper place to invade male dominated fields — when they go beyond placing the burden of proof on women to show they should be allowed to participate (rather than giving them the same opportunity as men to prove themselves) and argue that women's full-scale participation will ruin science and engineering for everyone who matters — we cannot tell, just by looking, which of them may someday feel entitled to act on their convictions with weapons more deadly than words.

http://www.wired.com/wiredscience/2012/12/antiseptics-infect/

Antiseptics Used to Prevent Health Care Infections Might Cause Them. Oops.

FDA warns the country of the possibility of health care infections caused by antiseptics used to disinfect skin before health care

By Maryn McKenna

Well, this is ironic. The Food and Drug Administration is warning the country of the possibility of health care infections caused by the antiseptics used to disinfect skin before health care procedures — that is, to prevent infections. They consider it a serious enough problem that they have scheduled a two-day hearing about it next week.
In this week's New England Journal of Medicine, Drs. Christina Y. Chang and Lesley-Anne Furlong of the FDA's Center for Drug Evaluation and Research explain that pre-operative antiseptics have never been examined for infection risk. They were grandfathered into FDA approval because they were on the market long before the FDA began assessing such products, as a result of expert testimony that they would kill any microbes that contaminated them. That assumption turns out to have been incorrect. The authors say:

The reported outcomes range from localized infections at injection sites to systemic infections resulting in death. The reports implicate all commonly used antiseptic categories, including alcohol, iodophors, chlorhexidine gluconate, and quaternary ammonium products.

Here are just a few of the outbreaks caused recently by contaminated antiseptics:

In 2010-11, patients at a children's hospital developed serious infections from alcohol wipes contaminated with Bacillus cereus.

In 2009, patients at an allergy clinic developed abscesses wherever they got allergy shots, due to Mycobacterium abscessus contamination in a benzalkonium chloride wash used to prep their skin.

Between 1996 and 1999, 28 infants in intensive care were made seriously ill, and one died, as a result of Klebsiella oxytoca that survived in a formaldehyde-based disinfectant used to wash down ICU equipment.
In fact, two review articles, published in different journals in 2003 and 2007, list dozens of cases over decades in which disinfectants and antiseptics were contaminated either during manufacture and packaging, or as a result of being mixed or stored once they reached a health care institution.
And those counts are probably an underestimate. Chang and Furlong say:

Although the scope of nosocomial infections associated with contaminated antiseptic products is difficult to assess, it is most likely broader than has been indicated by postmarketing reports and the medical literature. Several factors may limit the identification of infections related to antiseptic products. Health care providers may not consider these products as a potential source of postprocedural infection because they assume that antiseptic properties preclude microbial survival. Cases of contamination might be under-reported, since epidemiologic investigation and infection workups require a high index of suspicion on the part of the treating clinician. In addition, single-use containers are typically discarded at the conclusion of a surgical procedure, so the residual product may not be available for investigation when an infection becomes apparent.

This issue has obviously been building for a while, but honestly it's new to me, and somewhat jaw-dropping. With all that is truly difficult to accomplish in health care infections, from detecting multi-drug resistant

organisms to instituting surgical checklists, one might think that the safety of things intended to keep patients safe would have been long since assured. But, no. So, credit at least, I guess, for it being taken up now.
The hearing on the issue takes place in Silver Spring, Md. next Wednesday and Thursday. The FDA's page of details on it is here and the Federal Register notice is here. Note, if you have a story to tell of contamination or infection related to such products, and you can get to Silver Spring, you can sign up to speak at the meeting. The deadline for signing up is today, Dec. 7, and the address to email is: CDER-AntisepticPreOpPublicMeeting@fda.hhs.gov.
Cite: Chang, CY and Furlong LA. Microbial Stowaways in Topical Antiseptic Products. N Engl J Med 2012; 367:2170-2173. DOI: 10.1056/NEJMp1212680

http://www.sciencedaily.com/releases/2012/12/121207094325.htm

Patients With ICU Delirium More Likely to Die, Analysis Finds

Delirium is associated with higher mortality rates, more complications, longer ICU stays, and longer hospitalizations.

A new meta-analysis has found that delirium, a condition developed by many patients in hospital intensive care units (ICU), is associated with higher mortality rates, more complications, longer stays in the ICU, and longer hospitalizations.
Patients with ICU related delirium typically suffer from disturbances in consciousness, disorganized thinking or may become delusional. Delirium in the ICU may be caused by underlying medical conditions, and can be triggered by stress, lack of sleep, unfamiliar surroundings, lights and sounds in the unit, or develop as a side effect of medications.
The meta-analysis, which appears in General Hospital Psychiatry, found that ICU patients with delirium were three times more likely to die than patients without delirium and six times more likely to have one or more complications. They were also kept in the ICU for more than seven days longer and were hospitalized more than six days longer than non-delirious patients.
"This is important since it further confirms that delirium is a disease entity that has significant impact on clinical outcome," said lead author Zhongheng Zhang, MM, an intensive care specialist at Jinhua Municipal Central Hospital in Jinhua, Zhejiang, China. Further research can help determine whether control or management of delirium can alter the disease course of critical illness, he said.
Methods of dealing with ICU delirium include adjusting medications and taking steps to keep the patient oriented in reality, which can include having a family member present. "The presence of family members with the patient has never been formally investigated," Zhang said. "But in our experience, for some hyperactive delirium patients, we allow their family members to be with them, and this seems effective in reducing the use of sedatives and [improving] control of delirious symptoms," Zhang said.
ICU delirium is an acute brain failure rather than a mental illness and is reversible in most cases, said Alexandru Serghi, M.D., assistant professor in the department of psychiatry at the University of Hawaii in Honolulu. "Many times, all we need to do is keep the patient and family informed and to treat the underlying medical causes."
ICU delirium is being more widely recognized as a risk factor for death and dementia, he added. "The more severe the delirium, the worse the outcome." Even when reversible, delirium in the ICU can be scary for both the patient and the patient's family, Serghi said. "Being disoriented and having profound impairment in consciousness is a frightening experience."
Zhongheng Zhang, Lifei Pan, Hongying Ni. Impact of delirium on clinical outcome in critically ill patients: a meta-analysis. General Hospital Psychiatry, 2012; DOI: 10.1016/j.genhosppsych.2012.11.003

http://www.wired.com/wiredscience/2012/12/how-maggots-heal-wounds/

How Maggots Heal Wounds

Researchers say they've figured out how the fly larvae work their magic

By Paul Gabrielsen, ScienceNOW

Yes, maggots are creepy, crawly, and slimy. But that slime is a remarkable healing balm, used by battlefield surgeons for centuries to close wounds. Now, researchers say they've figured out how the fly larvae work their magic: They suppress our immune system.
Maggots are efficient consumers of dead tissue. They munch on rotting flesh, leaving healthy tissue practically unscathed. Physicians in Napoleon's army used the larvae to clean wounds. In World War I, American surgeon William Baer noticed that soldiers with maggot-infested gashes didn't have the expected infection or swelling seen in other patients. The rise of penicillin in the 1940s made clinical maggots less useful, but they bounced back in the 1990s when antibiotic-resistant bacteria created a new demand for alternative treatments. In 2004, the U.S. Food and Drug Administration approved maggot therapy as a prescription treatment.

Although anecdotal reports suggested that maggots curb inflammation, no one had scientifically tested the idea. So a team led by surgical resident Gwendolyn Cazander of Leiden University Medical Center in the Netherlands siphoned samples of maggot secretions from disinfected maggots in the lab and added them to donated blood samples from four healthy adults. The researchers then measured the levels of so-called complement proteins, which are involved in the body's inflammatory response.

Every blood sample treated with maggot secretions showed lower levels of complement proteins than did control samples—99.9% less in the best case, the team reports in the current issue of Wound Repair and Regeneration. Looking closer, the researchers found the broken-down remnants of two complement proteins—C3 and C4—in the secretion-treated samples, suggesting that the secretions had ripped the proteins apart. When the team tested blood samples from postoperative patients, whose wounded bodies were already scrambling to heal, they found that maggot secretions reduced the levels of complement proteins by 19% to 55%.

For good measure, the team tested the maggot secretions again after a day, a week, and a month to determine their shelf life. They also boiled some. To their surprise, the secretions were more effective after boiling and lost no potency after sitting on the shelf for a month.

It's not surprising that maggot secretions would suppress the immune system, Cazander says. Otherwise, the larvae would probably be attacked by the body. She says she hasn't yet seen such a reaction, even in patients treated with maggots for more than a year.

Cazander's team is now working to isolate the complement-inhibiting compounds. A clinical drug featuring maggot secretions may be several years away—but if you can't wait, the maggots themselves are available now. The research team's conclusions are spot-on, says Ronald Sherman, pathologist, pioneering maggot researcher, and board chair of the BioTherapeutics, Education and Research Foundation in Irvine, California. Sherman's nonprofit foundation connects patients with doctors willing to handle the crawly critters. Faster wound healing probably arises from several combined maggot effects, he says, such as increasing oxygen concentrations in the wound and enhancing cellular growth. "This research advances our understanding of how and why maggot therapy helps wounds heal faster."

http://www.scientificamerican.com/article.cfm?id=a-gem-of-a-meteor-shower

A "Gem" of a Meteor Shower Is Coming up Next Week

The Geminid Meteor Shower offers stargazers a host of slow, bright fireballs and lasts for two to three days

By Joe Rao and SPACE.com | Friday, December 7, 2012 | 5

If you were disappointed with the meager showing put on by this year's Leonid Meteor Shower, don't fret. What potentially will be the best meteor display of the year is just around the corner, scheduled to reach its peak on Thursday night, Dec. 13: the Geminid Meteors.

The Geminids get their name from the constellation of Gemini, the Twins. On the night of this shower's maximum the meteors will appear to emanate from a spot in the sky near the bright star Castor in Gemini.

The Geminid Meteors are usually the most satisfying of all the annual showers, even surpassing the famous Perseids of August. Studies of past displays show that this shower has a reputation for being rich both in slow, bright, graceful meteors and fireballs as well as faint meteors, with relatively fewer objects of medium brightness. Geminids typically encounter Earth at 22 miles per second (35 kilometers per second), roughly half the speed of a Leonid meteor. Many appear yellowish in hue. Some even appear to travel jagged or divided paths.

The Earth moves quickly through this meteor stream, producing a somewhat broad, lopsided activity profile. Rates of meteors increase steadily for two or three days before maximum, reaching roughly a quarter of its peak strength, then drop off more sharply afterward. Late Geminids, however, tend to be especially bright. Renegade forerunners and late stragglers might be seen for a week or more before and after maximum. [Photos: Geminid Meteor Shower of December 2011]

This year especially good

The Geminids perform excellently in any year, but without a doubt 2012 will be a superb year. Last year's display was seriously compromised by bright moonlight when a glowing gibbous moon came up over the horizon during the late evening hours and washed-out many of the fainter Geminid streaks with its bright light. But this year, the moon will be at new phase on Dec.13, meaning no moon will be visible. This means that the sky will be dark and moonless all through the Geminid's peak night, making for perfect viewing conditions for the shower.

According to Margaret Campbell-Brown and Peter Brown in the Observer's Handbook of the Royal Astronomical Society of Canada, the Geminids are predicted to reach peak activity at 8 p.m. EST Dec. 13 (00:00 UT on Dec. 14). That means those in Europe and North Africa east to central Russia and China are in

the best position to catch the very crest of the shower, when the rates conceivably could exceed 120 meteors per hour!
However, maximum rates persist at only marginally reduced levels for some 6 to 10 hours around the biggest ones, so other locations (such as North America) should enjoy some very fine Geminid activity as well. Indeed, under normal conditions on the night of maximum activity, with ideal dark-sky conditions, at least 60 to 120 Geminid meteors can be expected to burst across the sky every hour on average (light pollution greatly cuts the numbers of visible meteors down significantly).

Viewing tips

Generally speaking, depending on your location, the constellation Gemini begins to come up above the east-northeast horizon right around the time evening twilight is coming to an end. So you might catch sight of a few early Geminids as soon as the sky gets dark. There is a fair chance of perhaps catching sight of some "Earth-grazing" meteors. Earthgrazers are long, bright shooting stars that streak overhead from a point near to even just below the horizon. Such meteors are distinctive because they follow long paths nearly parallel to our atmosphere.
The Geminids will begin to appear noticeably more numerous in the hours after 10 p.m. local time, because the shower's radiant is already fairly high in the eastern sky by then. The best views, however, come around 2 a.m., when their radiant point will be passing very nearly overhead. The higher a shower's radiant, the more meteors it produces all over the sky.
But keep this in mind: at this time of year, meteor watching can be a long, cold business. You wait and you wait for meteors to appear. When they don't appear right away, and if you're cold and uncomfortable, you're not going to be looking for meteors for very long!
The late Henry Neely, who for many years served as a lecturer at New York's Hayden Planetarium, once had this to say about watching for the Geminids: "Take the advice of a man whose teeth have chattered on many a winter's night — wrap up much more warmly than you think is necessary."
Hot cocoa or coffee can take the edge off the chill, as well as provide a slight stimulus. It's even better if you can observe with friends. That way, you can keep each other awake, as well as cover more sky. Give your eyes time to dark-adapt before starting.
Geminids stand apart from the other meteor showers in that they seem to have been spawned not by a comet, but by 3200 Phaethon, an Earth-crossing asteroid. Then again, the Geminids may be comet debris after all, for some astronomers consider Phaeton to really be the dead nucleus of a burned-out comet that somehow got trapped into an unusually tight orbit.

- *Night Sky: Visible Planets, Moon Phases & Events, December 2012*
- *Geminid Meteors And Visible Asteroids: December Skywatching | Video*
- *Night Sky Observing Guide for December 2012 (Gallery)*

http://www.sciencedaily.com/releases/2012/12/121207161458.htm

One Gene Predicts Rapid ALS Progression 80 Percent of the Time

ALS, appear to be increased by a lack of inflammation-reducing T cells

The debilitating symptoms of amyotrophic lateral sclerosis, or ALS, appear to be increased by a lack of inflammation-reducing T cells, report scientists from the Methodist Neurological Institute in an upcoming print issue of the journal EMBO Molecular Medicine. The researchers found that expression of the gene FoxP3 -- which helps control the production of anti-inflammatory T cells -- was an indicator of disease progression in 80 percent of the patients they studied. Low FoxP3 levels were likely in patients whose ALS would develop rapidly, and vice versa.
"This is the first demonstration that regulatory T cells may be slowing disease progression, since low FoxP3 indicates a rapidly progressing disease," said Assistant Professor of Neurology Jenny Henkel, Ph.D., the study's lead author. "Levels of FoxP3 may now be used as a prognostic indicator of future disease progression and survival."
ALS is a neurodegenerative disease that slowly and inexorably causes paralysis, then death. Loss of motor control may begin in the arms or legs, or with impaired speech, and ultimately compromise breathing. ALS is sometimes called Lou Gehrig's disease. About 5 in 100,000 people are affected, and there is no known cure.
The relationship between inflammation and ALS progression is well established in humans and animal models, and many genes influencing disease development have been identified.
"While inflammation exacerbates disease in ALS patients, this inflammation is suppressed in some patients," Henkel said. "The data in our article suggest that regulatory T cells can suppress this inflammation."

In their EMBO paper, Henkel, Professor of Neurology and Chair Stanley Appel, M.D., and their team provided supportive evidence that the genes FoxP3, TGFβ, IL4, and Gata3 are involved in ALS development. But Henkel and Appel's work also suggests FoxP3 is the best indicator of disease progression when ALS symptoms first appear.

"While expression of FoxP3, TGFβ, IL4, and Gata3 may serve as indicators for latter stages of the disease, our work suggests only FoxP3 was a prognostic indicator early in the disease," Henkel said. "After following a group of ALS patients for three and a half years, low FoxP3 levels predicted a rapidly progressing disease 80 percent of the time." Foxp3 and Gata3 are transcription factors that influence production of regulatory T cells, and Th2 "helper" T cells. TGFβ and IL-4 (interleukin 4) are anti-inflammatory cytokines.

Henkel, Appel, and their team studied three patient groups. In the first group, the researchers took blood samples from 54 ALS patients at different stages of the disease and from 33 healthy control volunteers. Flow cytometry and PCR were used to determine the character of white blood cells, specifically regulatory T cells, and to measure the expression levels of genes of interest. A second patient group (102 ALS, 28 healthy) was studied specifically to assess the predictive power of FoxP3 expression in ALS disease development. A third group consisting of deceased persons (affected and healthy) was studied for the purpose of establishing endpoints for T cell production and gene expression. Development of ALS was assessed using the Appel ALS score, a widely used standard that Appel developed.

The relationship between inflammation and ALS progression is complex. Inflammation is an important initial response to injury or microbial attack, Appel says, but prolonged inflammation can actually make the damage worse.

"While this inflammation is tolerable for the short term, when the inflammation persists, the pro-inflammatory cytokines and certain chemicals produced by glial cells called microglia will injure and eventually kill the surrounding neurons," Appel said. "Our research verifies that inflammation is accelerating disease progression, that regulatory T cells and Th2 cells may slow disease progression, and that modifying regulatory T cells appears to be a viable treatment option."

Henkel and Appel said researchers are closing in on specific targets for modifying the inflammation that drives progression of the disease, and that they are closer than ever to developing new treatments for this severely debilitating condition.

This work was supported by grants from the National Institutes of Health, the Muscular Dystrophy Association, and the Texas Methodist Foundation. Henkel and Appel's EMBO coauthors were David Beers, Ph.D., Shixiang Wen, Karen Toennis, Joan Appel, Weihua Zhao, and Suzanne Powell, M.D., of The Methodist Hospital, and Dan Moore, Ph.D., of California Pacific Medical Center.

Jenny S. Henkel, David R. Beers, Shixiang Wen, Andreana L. Rivera, Karen M. Toennis, Joan E. Appel, Weihua Zhao, Dan H. Moore, Suzanne Z. Powell, Stanley H. Appel. Regulatory T-lymphocytes mediate amyotrophic lateral sclerosis progression and survival. EMBO Molecular Medicine, 2012; DOI: 10.1002/emmm.201201544

http://www.eurekalert.org/pub_releases/2012-12/uomh-ndc120612.php

New drug cuts risk of deadly transplant side effect in half

First study in humans shows promise for preventing graft-versus-host disease following bone marrow transplant

ANN ARBOR, Mich. - A new class of drugs reduced the risk of patients contracting a serious and often deadly side effect of lifesaving bone marrow transplant treatments, according to a study from researchers at the University of Michigan Comprehensive Cancer Center.

The study, the first to test this treatment in people, combined the drug vorinostat with standard medications given after transplant, resulting in 21 percent of patients developing graft-vs.-host disease compared to 42 percent of patients who typically develop this condition with standard medications alone. Results of the study will be presented Dec. 9 at the 54th Annual Meeting of the American Society of Hematology.

"Graft-vs.-host disease is the most serious complication from transplant that limits our ability to offer it more broadly. Current prevention strategies have remained mostly unchanged over the past 20 years. This study has us cautiously excited that there may be a potential new way to prevent this condition," says lead study author Sung Choi, M.D., assistant professor of pediatrics at the U-M Medical School.

Vorinostat is currently approved by the U.S. Food and Drug Administration to treat certain types of cancer. But U-M researchers, led by senior study author Pavan Reddy, M.D., found in laboratory studies that the drug had anti-inflammatory effects as well – which they hypothesized could be useful in preventing graft-vs.-host disease, Choi will present data on the first 47 patients enrolled on the study at the University of Michigan Comprehensive Cancer Center and Washington University. Participants were older adults who were undergoing a reduced-intensity bone marrow transplant with cells donated from a relative. Patients received standard

medication used after a transplant to prevent graft-vs.-host disease. They also received vorinostat, which is given as a pill taken orally. The researchers found vorinostat was safe and tolerable to give to this vulnerable population, with manageable side effects. In addition, rates of patient death and cancer relapse among the study participants were similar to historical averages.

The results mirror those found in the laboratory using mice. Reddy, an associate professor of internal medicine at the U-M Medical School, has been studying this approach in the lab for eight years.

"This is an entirely new approach to preventing graft-vs.-host disease," Choi says. Specifically, vorinostat targets histone deacetylases, which are different from the usual molecules targeted by traditional treatments.

"Vorinostat has a dual effect as an anti-cancer and an anti-inflammatory agent. That's what's potentially great about using it to prevent graft-vs.-host, because it may also help prevent the leukemia from returning," Choi says.

The study is continuing to enroll participants. The researchers hope next to test vorinostat in patients receiving a transplant from an unrelated donor, which carries an even greater risk of graft-vs.-host disease. This approach is not currently available outside of this clinical trial.

Note for patients: If you would like more information about the current clinical trial or about other treatment options at the University of Michigan Comprehensive Cancer Center, call the Cancer AnswerLine at 800-865-1125.

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http://ars.to/VyeG3G

Researchers get cardiac muscle cells to grow, repair heart attack damage

Massive search finds micro RNAs that help the heart regrow.

by John Timmer - Dec 10 2012, 3:00am TST

Heart attacks cause both long- and short-term problems. In the short-term, the death of cardiac muscle cells can cause a critical drop in the heart's ability to function. Over the long haul, problems arise because the damage is largely repaired by scar tissue, rather than functional muscle. For the most part, once cardiac muscle cells stop dividing (in most species, this occurs shortly after birth), they don't ever start again. That means that once they're lost in a heart attack the damage is essentially permanent.

That's why stem cells are often proposed as a treatment for damaged hearts—they provide a way to create new cardiac muscle cells, essentially by recapitulating the process that creates them as an embryo is developing. But there is a potential alternative route: restarting cell divisions within the remaining population of cardiac muscle cells. Some researchers at the University of Trieste may have found a way to do precisely that.

The team reasoned that regulatory RNAs are able to control the expression of a number of genes at once and, unlike proteins, they're a lot easier to get into living cells. So, they focused on a class of short sequences called micro-RNAs (these recently found their way into headlines due to their role in human evolution). Reasoning that some of them are probably involved in controlling cell division, the authors set out to find those by testing about as many as they could.

After searching a database for previously identified micro-RNAs, the team synthesized nearly 900 of them and inserted them into rat cardiac muscle cells that were isolated shortly after birth, when the cells still divide a bit. Once the RNA was in place, they waited for several days, then looked for indications that the cells had started dividing again. About 200 of the RNAs passed this initial test (meanwhile, over 300 RNAs were identified that seemed to shut cell division down). They were then tested on mouse cardiac cells to determine whether their effect was likely to be conserved across evolution. Only 40 of the initial 200 passed this second test.

(Given how closely related rats and mice are, this drop suggests both that some of the initial positive results were probably accidents of the experimental procedure and that regulatory RNAs evolve new functions rather quickly. This later point would be in keeping with the findings on human evolution we mentioned just above.)

Next, the authors inserted some of the most effective RNAs into cardiac muscle cells obtained from mature animals, after cell division has stopped entirely. Again, they worked. After a short delay, the cells started dividing again, slowly creating a larger population of cells. Accompanying this, the authors saw some indication that the cells had decreased their specialization and changed the expression of genes that are normally associated with mature cardiac muscle. This shouldn't be enough to cause defects in cardiac function, though, given that they still looked more like specialized cardiac muscle than the cells of a newborn heart, which clearly need to be functional.

Since everything worked well in culture, the authors tested some of the most effective RNAs in the hearts of mature rodents. Again, it seemed to work; cells started showing signs of dividing. More significantly, it worked well on a damaged heart. After subjecting mice to a procedure that mimics a cardiac infarction, the authors induced the remaining cardiac cells to express the RNA. By nearly every measure, the hearts treated with RNAs maintained more of their normal function than controls did and an examination of the hearts revealed many more cardiac muscle cells and far less scar tissue.

The researchers also looked into the changes in gene expression that accompanied this return to proliferation. As expected, they were numerous: over 1,500 genes had altered levels of expression for each of the two RNAs tested. And to a large extent, they didn't overlap, suggesting that the two regulatory RNAs exert their effects by tweaking cells in very different ways. Targeting some of these 1,500 genes individually could boost cell proliferation, but the effect wasn't as strong as when the micro-RNAs were inserted into the cells.

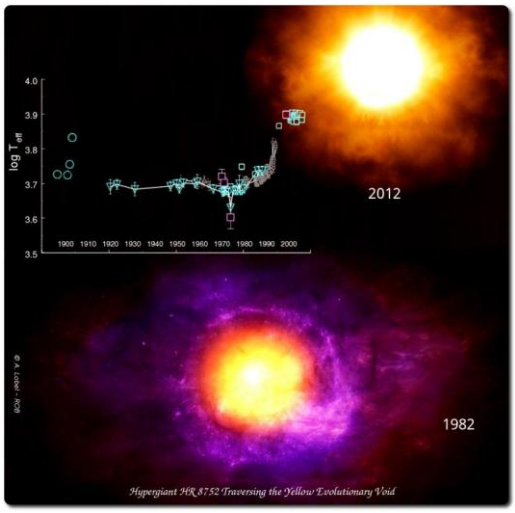
So, clearly the networks downstream of these RNAs are pretty complicated, and it will take some significant effort to sort out. But in the mean time, the RNAs suggest that it might be possible to develop therapies without needing to know how, precisely, they work. The relative rarity of shared function between the mouse and rat suggests that very few (if any) of the RNAs identified in this screen would work in humans. But, with the logic of the screen clearly established, then it should be possible to reproduce it in human cells (presumably those derived from stem cells).

The big hurdle then would probably be safety. It's probably impossible to target these micro-RNAs specifically to heart cells. Inducing cell division in off-target cells is never a good idea, and it's possible that in different tissue these micro-RNAs could cause completely unexpected behavior. It's also clear that the cardiac cells that do pick them up will have somewhat altered function—not necessarily a good thing during the recovery from heart problems. Given those issues, waiting for a better understanding of how these RNAs work might not be a bad thing. *Nature, 2012. DOI: 10.1038/nature11763 (About DOIs).*

http://www.sciencedaily.com/releases/2012/12/121209152537.htm

Hypergiant Star Amazes for 30 Years

A European research team has published the results of a 30-year study of an extraordinary hypergiant star.



They have found that the surface temperature of the super-luminous star HR 8752 increased by about 3000 degrees in less than three decades, while it went through an extremely rare stage called the 'Yellow Evolutionary Void'. The discovery marks an important step closer to unravelling the evolution of the most massive stars.

A team of astronomers from six European countries, including the Royal Observatory of Belgium (ROB), has investigated the hypergiant star HR 8752 for 30 years while it traversed the 'Yellow Evolutionary Void'. The 'Void' is a short stage in the lives of the most massive stars when they become very unstable. The team finds that the surface temperature of HR 8752 rose surprisingly fast from 5000 to 8000 degrees in less than 30 years. The research results were very recently published in the journal Astronomy and Astrophysics. The discovery is an important step forward to resolve the enigma of the hypergiants, the most luminous and massive stars of the Galaxy.

A team of scientists including Dr. Alex Lobel of the ROB, reported they have finalized a thirty years long investigation of a hypergiant star. In that period the surface temperature of this gigantic and extremely bright star quickly rose from five to eight thousand degrees. With this discovery a crucial 'missing link' in the evolution of hypergiant stars has been found. **(Credit: Image courtesy of Royal Observatory of Belgium)**

Hypergiants can shine millions of times brighter than the Sun, and they often have a diameter several hundred times greater. HR 8752 is a quarter million times more luminous than the Sun. The powerhouse is therefore

visible with normal binoculars at large distance from Earth in the Northern constellation of Cassiopeia. There are currently only 12 hypergiants known in our Galaxy.
The 'Yellow Evolutionary Void' is a unique stage in the short life of a hypergiant when its temperature and luminosity can quickly change. The team has discovered that the atmospheres are very unstable inside the Void because outwardly directed forces act equal or sometimes even stronger than the force of gravity. Due to the unstable atmosphere, hypergiants lose tremendous weight in this 'forbidden zone', which can sometimes amount to the mass of the Sun in a year. When a hypergiant enters the 'Evolutionary Void' the star tries to it leave as quickly as possible. That is why almost all hypergiants are found outside the Void.
The team finds that HR 8752 is a very rare hypergiant which has partly traversed the Void. The changes of its atmosphere were closely monitored with regular observations over 30 years.
Alex Lobel, co-author of the study and ROB scientist explains that "HR 8752 was around 1980 identical to the eruptive hypergiant Rho Cas of spectral type F, but then the temperature of HR 8752's atmosphere rapidly increased by 3000 degrees and now shows the spectral properties of a hotter A-type star. We are baffled about the tremendous changes of HR 8752 in that period of time."
Between 1900 and 1980 the atmospheric temperature of HR 8752 stayed almost constant around 5000 degrees, but it rose very rapidly to 8000 degrees between 1985 and 2005. The team calculates that the stellar radius decreased from 750 to 400 times that of the Sun. In 1985 the team embarked on a long-term spectroscopic observing program when it found that the remarkable hypergiant was exactly at the border of the 'Yellow Void' and started to cross over. "HR 8752 had to struggle through the Void which has changed the physical properties of its atmosphere," Lobel adds.
The team further demonstrates that the Void actually consists of two parts in which the atmosphere of the hypergiant is unstable. They result from ionization of large amounts of hydrogen and helium gas in the atmosphere, divided by a small zone around 8000 degrees where it becomes more stable.
The fate of HR 8752 is currently unclear but there are strong hints that these massive hypergiants may perish in a powerful supernova explosion. Or they quickly traverse the Void and transform into a hotter type of erratic stars known as the "Luminous Blue Variables." In either case that will not pass unnoticed according to Kees de Jager and Hans Nieuwenhuijzen, the astronomers of the Netherlands Institute for Space Research in Utrecht who directed the research of HR 8752 over the past three decades.
The discovery is an important new step for explaining the existence of these extreme stars. A number of other hypergiants with similar spectacular properties is expected to exist in the Milky Way. The search for these remarkable stars with dramatic changes over human timescales has just begun, but has been forever put on track.
H. Nieuwenhuijzen, C. De Jager, I. Kolka, G. Israelian, A. Lobel, E. Zsoldos, A. Maeder, G. Meynet. The hypergiant HR 8752 evolving through the yellow evolutionary void. Astronomy & Astrophysics, 2012; 546: A105 DOI: 10.1051/0004-6361/201117166

http://www.nature.com/news/brain-cells-made-from-urine-1.11985

Brain cells made from urine

Human excreta could be a powerful source of cells to study disease, bypassing some of the problems of using stem cells.

Monya Baker 09 December 2012

Some of the waste that humans flush away every day could become a powerful source of brain cells to study disease, and may even one day be used in therapies for neurodegenerative diseases. Scientists have found a relatively straightforward way to persuade the cells discarded in human urine to turn into valuable neurons.
The technique, described online in a study in Nature Methods this week1, does not involve embryonic stem cells. These come with serious drawbacks when transplanted, such as the risk of developing tumours. Instead, the method uses ordinary cells present in urine, and transforms them into neural progenitor cells — the precursors of brain cells. These precursor cells could help researchers to produce cells tailored to individuals more quickly and from more patients than current methods.
Researchers routinely reprogram cultured skin and blood cells2 into induced pluripotent stem (iPS) cells, which can go on to form any cell in the body. But urine is a much more accessible source.
Stem-cell biologist Duanqing Pei and his colleagues at China's Guangzhou Institutes of Biomedicine and Health, part of the Chinese Academy of Sciences, had previously shown that kidney epithelial cells in urine could be reprogrammed into iPS cells3.
However, in that study the team used retroviruses to insert pluripotency genes into cells — a common technique in cell reprogramming. This alters the genetic make-up of cells and can make them less predictable, so in this study, Pei and his colleagues introduced the genes using vectors which did not integrate in the cellular genome.

One of their experiments produced round colonies of reprogrammed cells from urine that resembled pluripotent stem cells after only 12 days — about half the time usually required to produce iPS cells. When cultured further, the colonies took on the rosette shape common to neural stem cells.

Tumour-free

Pei and his colleagues transferred the cells to a growth medium used for neurons, and found that these reprogrammed cells went on to form functional neurons in the lab.

When the team repeated the experiment and transplanted the cells into newborn rat brains, the cells did not form tumours. Instead, when the brains were examined four weeks later, the cells had taken on the shape and molecular markers of neurons.

Neural progenitors proliferate in culture, so researchers can produce plenty of cells for their experiments. Getting enough cells has previously been a problem for such 'direct reprogramming' techniques, which produce neurons more quickly than producing and differentiating iPS cells.

“This could definitely speed things up,” says James Ellis, a medical geneticist at Toronto's Hospital for Sick Children in Ontario, Canada, who makes patient-specific iPS cells to study autism spectrum disorders.

The benefit of sourcing cells in this way is that urine can be collected from nearly any patient, says geneticist Marc Lalande, who creates iPS cells to study neurogenetic diseases at the University of Connecticut Health Center in Farmington, and is particularly intrigued by the possibility of making iPS cells and neural progenitors from the same patient.

“We work on childhood disorders,” he says. “And it's easier to get a child to give a urine sample than to prick them for blood.”

Nature doi:10.1038/nature.2012.11985

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