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Plants prepackage beneficial microbes in their seeds

Plants may package their commensal bacteria inside of seeds; thus ensuring that sprouting plants are colonized from the beginning

WASHINGTON, DC - Plants have a symbiotic relationship with certain bacteria. These 'commensal' bacteria help the pants extract nutrients and defend against invaders – an important step in preventing pathogens from contaminating fruits and vegetables. Now, scientist have discovered that plants may package their commensal bacteria inside of seeds; thus ensuring that sprouting plants are colonized from the beginning. The researchers, from the University of Notre Dame, presented their findings today at the 5th ASM Conference on Beneficial Microbes.

Plants play host to a wide variety of bacteria; the plant microbiome. Just as in humans, the plant microbiome is shaped by the types of bacteria that successfully colonize the plant's ecosystem. Most of these bacteria are symbiotic, drawing from and providing for the plant in ways such as nitrogen-fixing and leaf-protection. Pathogenic bacteria may also colonize a plant. Pathogens can include viruses and bacteria that damage the plant itself or bacteria like the Shiga-toxin producing E. coli O104:H4. In 2011, Germany, France and the Netherlands experienced an outbreak of E. coli that was ultimately traced to the consumption of contaminated sprouts, which was thought to be caused by feral pigs in the growing area. Such opportunistic contamination is hard to guard against as most growing takes place in open, outdoor spaces with little opportunity for control.

The hypothesis behind this research is that the best way to defend against pathogenic contamination is with a healthy microbiome colonized by bacteria provide protection from invasive pathogens. Just as with babies, early colonization is crucial to establishing a beneficial microbiome. The researchers, led by Dr. Shaun Lee, looked inside sterilized mung beans and were able to isolate a unique strain of Bacillus pumilus that provides the bean with enhanced microbial protection.

"This was a genuine curiosity that my colleague and I had about whether commensal bacteria could be found in various plant sources, including seed supplies" said Dr. Lee. "The fact that we could isolate and grow a bacterium that was packaged inside a seed was quite surprising."

The researchers first sterilized and tested the outer portion of a sealed, whole seed. When that was determined to be sterile, they sampled and plated the interior of the seeds and placed them in bacterial agar, which they incubated. What they found was the new strain of Bacillus pumilus, a unique, highly motile Gram-positive bacterium capable of colonizing the mung bean plant without causing any harm. Genome sequencing revealed that the isolated B. pumilus contained three unique gene clusters for the production of antimicrobial peptide compounds known as bacteriocins.

Dr. Lee and his colleagues theorize that their findings could have a wide impact, both on our understanding of plants and in creating food-safe antimicrobials. The finding that plant seeds can be pre-colonized may be an important mechanism by which a beneficial plant microbiome is established and sustained. Moreover, the team is now isolating and studying the bacteriocins, which Dr. Lee says "have tremendous potential".

http://www.eurekalert.org/pub_releases/2014-09/giom-ahg092814.php

Ancient human genome from southern Africa throws light on our origins

What can DNA from the skeleton of a man who lived 2,330 years ago in the southernmost tip of Africa tell us about ourselves as humans?

A great deal when his DNA profile is one of the 'earliest diverged' – oldest in genetic terms – found to-date in a region where modern humans are believed to have originated roughly 200,000 years ago.

The man's maternal DNA, or 'mitochondrial DNA', was sequenced to provide clues to early modern human prehistory and evolution. Mitochondrial DNA provided the first evidence that we all come from Africa, and helps us map a figurative genetic tree, all branches deriving from a common 'Mitochondrial Eve'.

When archaeologist Professor Andrew Smith from the University of Cape Town discovered the skeleton at St. Helena Bay in 2010, very close to the site where 117,000 year old human footprints had been found – dubbed "Eve's footprints" – he contacted Professor Vanessa Hayes, a world-renowned expert in African genomes. At the time, Hayes was Professor of Genomic Medicine at the J. Craig Venter Institute in San Diego, California. She now heads the Laboratory for Human Comparative and Prostate Cancer Genomics at Sydney's Garvan Institute of Medical Research.

The complete 1.5 metre tall skeleton was examined by Professor Alan Morris, from the University of Cape Town. A biological anthropologist, Morris showed that the man was a 'marine forager'. A bony growth in his ear canal, known as 'surfer's ear', suggested that he spent some time diving for food in the cold coastal waters, while shells carbon-dated to the same period, and found near his grave, confirmed his seafood diet. Osteoarthritis and tooth wear placed him in his fifties.

Due to the acidity of the soil within the region, acquiring DNA from skeletons has proven problematic. The Hayes team therefore worked with the world's leading laboratory in ancient DNA research, namely that of paleogeneticist Professor

Svante Pääbo at the Max Planck Institute for Evolutionary Anthropolgy in Leipzig, Germany, who successfully sequenced a Neanderthal.

The team generated a complete mitochondrial genome, using DNA extracted from a tooth and a rib. The findings provided genomic evidence that this man, from a lineage now presumed extinct, as well as other indigenous coastal dwellers like him, were the most closely related to 'Mitochondrial Eve'.

The study underlines the significance of southern African archaeological remains in defining human origins, and is published in the journal Genome Biology and Evolution, now online. "We were thrilled that archaeologist Andrew Smith understood the importance of not touching the skeleton when he found it, and so did not contaminate its DNA with modern human DNA," said Professor Hayes. "I approached Svante Pääbo because his lab is the best in the world at DNA extraction from ancient bones. This skeleton was very precious and we needed to make sure the sample was in safe hands." "Alan Morris undertook some incredible detective work. He used his skills in forensics and murder cases to assemble a profile of the man behind the St Helena skeleton."

"Alan helped establish that this man was a marine hunter-gatherer - in contrast to the contemporary inland hunter-gatherers from the Kalahari dessert. We were very curious to know how this man related to them."

"We also know that this man pre-dates migration into the region, which took place around 2,000 years ago when pastoralists made their way down the coast from Angola, bringing herds of sheep. We could demonstrate that our marine hunter-gatherer carried a different maternal lineage to these early migrants – containing a DNA variant that we have never seen before." "Because of this, the study gives a baseline against which historic herders at the Cape can now be compared."

While interested in African lineages, and how they interact with each other, Professor Hayes is especially keen for Africa to inform genomic research and medicine worldwide.

"One of the biggest issues at present is that no-one is assembling genomes from scratch – in other words, when someone is sequenced, their genome is not pieced together as is," she said. "Instead, sections of the sequenced genome are mapped to a reference genome. Largely biased by European contribution, the current reference is poorly representative of indigenous peoples globally."

"If we want a good reference, we have to go back to our early human origins."

"None of us that walk on this planet now are pure anything - we are all mixtures. For example 1-4% of Eurasians even carry Neanderthal DNA"

"We need more genomes that don't have extensive admixture. In other words, we need to reduce the noise."

"In this study, I believe we may have found an individual from a lineage that broke off early in modern human evolution and remained geographically isolated. That would contribute significantly to refining the human reference genome."

http://www.eurekalert.org/pub_releases/2014-09/bumc-hgo092914.php

Higher gun ownership rates linked to increase in non-stranger homicide, BU study finds

States with higher estimated rates of gun ownership experience a higher incidence of non-stranger firearms homicides

A new study led by a Boston University School of Public Health researcher has found that states with higher estimated rates of gun ownership experience a higher incidence of non-stranger firearms homicides – disputing the claim that gun ownership deters violent crime, its authors say.

The study, published in the American Journal of Public Health, found no significant relationship between levels of gun ownership and rates of stranger-on-stranger homicide. But it did find that higher levels of gun ownership were associated with increases in non-stranger homicide rates, including those involving guns.

The study, led by Dr. Michael Siegel, professor of community health sciences at the BU School of Public Health, is the first to look at the association between gun ownership and rates of stranger vs. non-stranger homicides. Last year, Siegel and colleagues reported that U.S. states with higher estimated rates of gun ownership had higher overall numbers of firearms-related homicides.

The new study found that, for each one-percentage point increase in state-level gun ownership, the state's non-stranger homicide rate increased by 0.9 percent, with firearm homicides increasing by 1.4 percent.

Siegel said the aim of the new study was to examine the links between increased gun ownership and the two kinds of homicides, in order to inform public policy regarding deterrents to firearm violence. "Our findings refute the argument that gun ownership deters strangers from committing homicide," he said. "Instead, these findings suggest that gun ownership actually increases the risk of violent death, as it is associated with higher rates of non-stranger homicide."

The study also revealed that over the past three decades, only about one-fifth of firearm homicides were committed by strangers. "Despite widespread media attention to mass shootings committed by estranged people, the majority of homicides are committed by individuals known to the victims," the researchers wrote.

Previous studies of the relationship between gun ownership and homicide have grouped all homicides together, without separately examining those committed by

strangers and those by acquaintances. Siegel and colleagues used data from the FBI's Supplemental Homicide Report, which classifies homicides by the relationship between the offender and victim. Using data on gun ownership and homicide rates in all 50 states during the period 1981-2010, the investigators explored the relationship between state-level gun ownership and stranger vs. non-stranger homicide rates, while controlling for a wide range of state-level factors.

The study has two important limitations. First, it relied on proxy, rather than survey measurements, of household gun ownership, because of a lack of data on gun ownership at the state level. Instead, the study used a well-validated method for estimating household gun ownership, based on the extent to which guns are used in suicides.

The proxy correlates highly with survey measures of household firearm ownership, the authors said. Also, Siegel noted, the study did not determine causation, allowing for the possibility that people living in states with higher rates of non-stranger homicide may be more likely to acquire guns.

The authors said the study was "the first to our knowledge to report that a higher proportion of household gun ownership at the state level is associated with statistically significant increased rates of non-stranger total and firearm homicides. By contrast, we found no robust, statistically significant association between household gun ownership and stranger homicides."

Siegel's co-authors were Craig Ross, of Fiorente Media, and Charles King III of Pleiades Consulting Group.

The study is available: http://ajph.aphapublications.org/doi/abs/10.2105/AJPH.2014.302042

http://www.eurekalert.org/pub_releases/2014-09/nsf-coc092914.php

Cause of California drought linked to climate change

Extreme atmospheric conditions responsible for drought more likely to occur in current global warming

The atmospheric conditions associated with the unprecedented drought in California are very likely linked to human-caused climate change, researchers report. Climate scientist Noah Diffenbaugh of Stanford University and colleagues used a novel combination of computer simulations and statistical techniques to show that a persistent region of high atmospheric pressure over the Pacific Ocean--one that diverted storms away from California--was much more likely to form in the presence of modern greenhouse gas concentrations.

The result, published today in the Bulletin of the American Meteorological Society, is one of the most comprehensive studies to investigate the link between climate change and California's ongoing drought.

"Our research finds that extreme atmospheric high pressure in this region--which is strongly linked to unusually low precipitation in California--is much more likely to occur today than prior to the emission of greenhouse gases that began during the Industrial Revolution in the 1800s," says Diffenbaugh.

The exceptional drought crippling California is by some measures the worst in state history. Combined with unusually warm temperatures and stagnant air conditions, the lack of precipitation has triggered a dangerous increase in wildfires and incidents of air pollution across the state. The water shortage could result in direct and indirect agricultural losses of at least $2.2 billion and lead to the loss of more than 17,000 seasonal and part-time jobs in 2014 alone.

Such effects have prompted a drought emergency in the state; the federal government has designated all 58 California counties as natural disaster areas.

"In the face of severe drought, decision-makers are facing tough choices about the allocation of water resources for urban, agricultural and other crucial needs," says Anjuli Bamzai, program director in the National Science Foundation's (NSF) Division of Atmospheric and Geospace Sciences, which funded the research. "This study places the current drought in historical perspective and provides valuable scientific information for dealing with this grave situation. "

Scientists agree that the immediate cause of the drought is a particularly tenacious "blocking ridge" over the northeastern Pacific--popularly known as the Ridiculously Resilient Ridge, or "Triple R"--that prevented winter storms from reaching California during the 2013 and 2014 rainy seasons. Blocking ridges are regions of high atmospheric pressure that disrupt typical wind patterns in the atmosphere.

"Winds respond to the spatial distribution of atmospheric pressure," says Daniel Swain of Stanford, lead author of the paper. "We have seen this amazingly persistent region of high pressure over the northeastern Pacific for many months, which has substantially altered atmospheric flow and kept California largely dry." The Triple R was exceptional for both its size and longevity.

While it dissipated briefly during the summer months of 2013, it returned by fall 2013 and persisted through much of the winter, California's wet season.

"At its peak in January 2014, the Triple R extended from the subtropical Pacific between California and Hawaii to the coast of the Arctic Ocean north of Alaska," says Swain, who coined the term "ridiculously resilient ridge" to highlight the persistent nature of the blocking ridge.

Like a large boulder that has tumbled into a narrow stream, the Triple R diverted the flow of high-speed air currents known as the jet stream far to the north, causing Pacific storms to bypass not only California, but also Oregon and Washington. As a result, rain and snow that would normally fall on the West Coast were instead re-routed to Alaska and as far north as the Arctic Circle.

An important question for scientists and decision-makers has been whether human-caused climate change has influenced the conditions responsible for California's drought.

Given the important role of the Triple R, Diffenbaugh and colleagues set out to measure the probability of such extreme ridging events. The team first assessed the rarity of the Triple R in the context of the 20th century historical record.

Analyzing the period since 1948, for which comprehensive atmospheric data are available, the researchers found that the persistence and intensity of the Triple R in 2013 were unrivaled by any previous event.

To more directly address the question of whether climate change played a role in the probability of the 2013 event, the team collaborated with scientist Bala Rajaratnam, also of Stanford. Rajaratnam applied advanced statistical techniques to a large suite of climate model simulations.

Using the Triple R as a benchmark, Rajaratnam compared geopotential heights--an atmospheric property related to pressure--between two sets of climate model experiments.

One set mirrored the present climate, in which the atmosphere is growing increasingly warmer due to human emissions of carbon dioxide and other greenhouse gases.

In the other set of experiments, greenhouse gases were kept at a level similar to those that existed just prior to the Industrial Revolution.

The researchers found that the extreme heights of the Triple R in 2013 were at least three times as likely to occur in the present climate as in the preindustrial climate.

They also found that such extreme values are consistently tied to unusually low precipitation in California, and to the formation of atmospheric ridges over the northeastern Pacific.

"We've demonstrated with high statistical confidence that large-scale atmospheric conditions similar to those of the Triple R are far more likely to occur now than in the climate before we emitted large amounts of greenhouse gases," Rajaratnam says.

"In using these advanced statistical techniques to combine climate observations with model simulations, we've been able to better understand the ongoing drought in California," Diffenbaugh adds.

"This isn't a projection of 100 years in the future. This is an event that is more extreme than any in the observed record, and our research suggests that global warming is playing a role right now."

The research was also supported by the National Institutes of Health. Rajaratnam was also supported in part by DARPA, the Air Force Office of Scientific Research and the UPS fund.

http://bit.ly/1rRlsWX

Know the Jargon: "Human Shield Effect"

Animals aren't as vigilant for predators when they know humans are around

Sep 16, 2014 |By Jason G. Goldman

One morning in South Africa's mountainous Lajuma Research Center, an adult female samango monkey came down from the trees to search for peanuts in an experimental food dispenser. Every once in a while she scanned her surroundings for predators, but she never bothered to look behind her once she realized that Katarzyna Nowak was there.

Animals that are not at the top of their food chains are adept at avoiding their predators. Samango monkeys, for example, stay up in trees. But to retrieve peanuts from the center's dispensers, they have to be on the ground - and that makes them vulnerable. Only when it is certain that no predators are around will a monkey spend time looking for food. So why did this one stop checking for danger behind her? Nowak, a biological anthropologist at Durham University in England and at South Africa's University of the Free State, suspects that the monkey figured that if a human was around, then a leopard was probably not. "[It was] as if she was thinking that I had that area covered," Nowak says.

Nowak put her suspicion to the test. She and her colleagues watched 100 individuals in all and found that they ate more food available on the ground when humans were present than when humans were absent (and observing them via camera). "Researchers were perceived as shields against terrestrial predators," the team writes in the journal Behavioral Ecology.

Although researchers have purported to see many animals change their behavior while being watched by humans - from zebras on the African savanna to moose in North American forests - Nowak's study is one of the first to subject the "observer effect" to scientific scrutiny.

http://bit.ly/1yCawkS

Prehistoric volcanic eruption leaves intercontinental footprint

A volcanic eruption 1,200 years ago scattered ash from Alaska to Europe

A new study led by University of Alberta researchers has shown that a volcanic eruption 1,200 years ago scattered ash from Alaska to Europe - a discovery that will help researchers understand how future eruptions could affect the world.

Britta Jensen and Duane Froese in the U of A's Faculty of Science led the research, which showed that a distinct deposit of white, sand-sized grains of volcanic ash visible just below the modern forest floor over much of the Yukon and southern Alaska is present not only near the originating Mount Bona-Churchill in Alaska, but also in the Greenland Ice Sheet and across northwestern Europe.

The deposit, commonly known as the White River Ash, is so prominent that locals sometimes refer to it as "Sam McGee's Ashes" in reference to the Robert Service poem.

As part of the study, samples of the White River Ash, along with ash previously assumed to be from Iceland, were gathered from northern Canada, eastern North America, Greenland, Northern Ireland and Germany. By comparing characteristic features of these samples, the researchers showed that all of the ash originated from the same large prehistoric volcanic eruption in Alaska about 1,200 years ago.

Ash beds, known as tephra, are important to researchers because they take just days to weeks to deposit - which creates precise links between geologic records. As a result, each ash bed represents a specific moment in time, and provides important insights into the frequency and effects of moderate to large volcanic eruptions.

Although it was generally thought that only rare "super eruptions" were capable of spreading volcanic ash across more than one continent - only the exceptional eruption of Toba (Indonesia), which occurred 75,000 years ago, has a proven ash distribution equal to the White River Ash - Jensen says this research illustrates that more frequent and moderate-sized eruptions can also lead to intercontinental distribution.

"It's possible that the perceived lack of other similar intercontinental correlations is not because they are rarer, but because scientists simply have not expected relatively smaller eruptions to be capable of distributing ash on this scale," she says. "This has direct implications for volcanic dispersal studies with the correlation of widely distributed geologic records and volcanic hazard assessment. "Given the social and economic impact of the 2010 eruption of Eyjafjallajökull, it is critical to more effectively integrate geologic records of past eruptions in volcanic hazard assessments to understand the potential for impact."

More information: Britta J.L. Jensen, Sean Pyne-O'Donnell, Gill Plunkett, Duane G. Froese, Paul D.M. Hughes, Michael Sigl, Joseph R. McConnell, Matthew J. Amesbury, Paul G. Blackwell, Christel van den Bogaard, Caitlin E. Buck, Dan J. Charman, John J. Clague, Valerie A. Hall, Johannes Koch, Helen Mackay, Gunnar Mallon, Lynsey McColl, and Jonathan R. Pilcher "Transatlantic distribution of the Alaskan White River Ash," Geology, October 2014, v. 42, p. 875-878, DOI: 10.1130/G35945.1

http://bit.ly/1yCawkS

First evidence that reptiles can learn through imitation

New research has for the first time provided evidence that reptiles could be capable of social learning through imitation.

The ability to acquire new skills through the 'true imitation' of others' behaviour is thought to be unique to humans and advanced primates, such as chimpanzees.

Scientists draw an important distinction between imitation and emulation when studying the cognitive abilities of animals. In true imitation, the individual 'copying' another's behaviour not only mimics what they see, but also understands the intention behind the action. In emulation, an animal copies a behaviour without understanding its deeper significance: for example, a parrot reciting the words of its owner. There is considerable debate about the extent to which non-primates are capable of true imitation.

Now researchers from the UK and Hungary have presented the first compelling scientific evidence that reptiles could be capable of social learning through imitation.

They set out to investigate whether the bearded dragon (Pogona vitticeps) is capable of imitating another bearded dragon through a simple experiment using a wooden board which contained a doorway.

All subjects successfully copied the actions of the demonstrator lizard, suggesting for the first time that reptiles exhibit social learning through imitation equivalent to that observed in 'higher' species.

Lead researcher Dr Anna Wilkinson from the School of Life Sciences, University of Lincoln, UK, said: "The ability to learn through imitation is thought to be the pinnacle of social learning and long considered a distinctive characteristic of humans. However, nothing is known about these abilities in reptiles. This research suggests that the bearded dragon is capable of social learning that cannot be explained by simple mechanisms - such as an individual being drawn to a certain location because they observed another in that location or through observational learning. The finding is not compatible with the claim that only humans, and to a lesser extent great apes, are able to imitate."

Reptiles and mammals evolved from a common ancestor and the investigation of similarities and differences in their behaviour is essential for understanding the evolution of cognition, Dr Wilkinson explained. Recent advances in the field of reptile cognition have found evidence of sophisticated abilities in this group.

The latest research, published in the academic journal Animal Cognition, involved 12 bearded dragons which had not previously been involved in cognition experiments.

One lizard was trained to act as a 'demonstrator', opening a wire door which covered a hole in a wooden board. The door could be moved horizontally along sliding rails to left or right by use of the head or the foot. The demonstrator was then rewarded with food (a mealworm) on the other side of the door.

The subjects were divided into an experimental group and a control group. The experimental group watched the demonstrator lizard approaching the test apparatus and opening the door with a sliding head movement.

All eight experimental subjects went on to successfully open the sliding door, pushing it to the same side they had observed. None of the control group subjects did this.

A key difference between the control and experimental groups was that, while sliding head movement occurred in the case of all experimental subjects, it was never observed in the control subjects. As this was the movement that the demonstrator performed in order to open the sliding door, this suggests that experimental subjects imitated an action that was not part of their spontaneous behaviour.

Dr Wilkinson concluded: "This, together with differences in behaviour between experimental and control groups, suggests that learning by imitation is likely to be based on ancient mechanisms. These results reveal the first evidence of imitation in a reptile species and suggest that reptiles can use social information to learn through imitation."

More information: "Social learning by imitation in a reptile (Pogona vitticeps)" Anna Kis, Ludwig Huber, Anna Wilkinson. Animal Cognition, September 2014. link.springer.com/article/10.1… 07/s10071-014-0803-7

http://www.eurekalert.org/pub_releases/2014-09/uosd-nms093014.php

New material steals oxygen from the air

We do fine with the 21 per cent oxygen in the air around us.

But sometimes we need oxygen in higher concentrations; for example lung patients must carry heavy oxygen tanks, cars using fuel cells need a regulated oxygen supply. Perhaps one day in the future even sunlight-driven “reversible” fuel cells will be made. With these we will have to separate oxygen from hydrogen in order to recombine them in order to get energy.

Now Professor Christine McKenzie (center in photo) and postdoc Jonas Sundberg, Department of Physics, Chemistry and Pharmacy at the University of Southern Denmark have synthesized a material that absorb oxygen in large quantities and store it.

"In the lab, we saw how this material took up oxygen from the air around us”, says Christine McKenzie. The new material is crystalline, and using x-ray diffraction the researchers have studied the arrangement of atoms inside the material when it was filled with oxygen, and when it was emptied of oxygen.

Oxygen comes and goes in many places

The fact that a substance can react with oxygen is not surprising. Lots of substances do this - and the result is not always desirable: Food can go rancid when exposed to oxygen. On the other hand a wine’s taste and aroma is changed subtly when we aerate it - but not with too much oxygen! Our bodies cannot function if we do not breathe.

"An important aspect of this new material is that it does not react irreversibly with oxygen - even though it absorbs oxygen in a so-called selective chemisorptive process. The material is both a sensor, and a container for oxygen - we can use it to bind, store and transport oxygen - like a solid artificial hemoglobin", says Christine McKenzie. A bucket full (10 litres) of the material is enough to suck up all the oxygen in a room.

"It is also interesting that the material can absorb and release oxygen many times without losing the ability. It is like dipping a sponge in water, squeezing the water out of it and repeating the process over and over again", Christine McKenzie explains.

Once the oxygen has been absorbed you can keep it stored in the material until you want to release it. The oxygen can be released by gently heating the material or subjecting it to low oxygen pressures.

Heat and pressure releases the stored oxygen

“We see release of oxygen when we heat up the material, and we have also seen it when we apply vacuum. We are now wondering if light can also be used as a trigger for the material to release oxygen – this has prospects in the growing field of artificial photosynthesis", says Christine McKenzie.

The key component of the new material is the element cobalt, which is bound in a specially designed organic molecule.

"Cobalt gives the new material precisely the molecular and electronic structure that enables it to absorb oxygen from its surroundings. This mechanism is well known from all breathing creatures on earth: Humans and many other species use iron, while other animals, like crabs and spiders, use copper. Small amounts of metals are essential for the absorption of oxygen, so actually it is not entirely surprising to see this effect in our new material", explains Christine McKenzie.

Depending on the atmospheric oxygen content, temperature, pressure, etc. it takes seconds, minutes, hours or days for the substance to absorb oxygen from its surroundings. Different versions of the substance can bind oxygen at different speeds. With this complexity it becomes possible to produce devices that release and/or absorb oxygen under different circumstances – for example a mask containing layers of these materials in the correct sequence might actively supply a person with oxygen directly from the air without the help of pumps or high pressure equipment.

"When the material is saturated with oxygen, it can be compared to an oxygen tank containing pure oxygen under pressure - the difference is that this material can hold three times as much oxygen," says Christine McKenzie.

"This could be valuable for lung patients who today must carry heavy oxygen tanks with them. But also divers may one day be able to leave the oxygen tanks at

home and instead get oxygen from this material as it "filters" and concentrates oxygen from surrounding air or water. A few grains contain enough oxygen for one breath, and as the material can absorb oxygen from the water around the diver and supply the diver with it, the diver will not need to bring more than these few grains".

The material has been designed and synthesized at University of Southern Denmark. Some of the gas uptake measurements have been made with special equipment by colleagues at the University of Sydney, Australia.

This press release has been corrected October 1st at 16.15 PM.

See a film about the new material here:
http://www.youtube.com/watch?v=gJbG9FvgX0U&feature=youtu.be
Oxygen chemisorption / desorption in a reversible single-crystal-to-single-crystal transformation. Jonas Sundberg, Lisa J. Cameron, Peter D. Southon, Cameron J. Kepert and Christine J. McKenzie.

http://www.eurekalert.org/pub_releases/2014-09/foas-nbt093014.php

New blood test determines whether you have or are likely to get cancer

New research in The FASEB Journal suggests that white blood cells exposed to UVA light in agar, to induce DNA damage, can predict if one has or is at risk for cancer

A new research report published in the October 2014 issue of The FASEB Journal may make the early detection of cancer as easy as a simple blood test. This test, called the "lymphocyte genome sensitivity" (LGS) test, could not only detect some cancers earlier than ever before, but it may eliminate the need for some types of biopsies, as well as identify those more likely to develop cancer in the future.

"The test could allow earlier cancer detection, so helping to save peoples' lives," said Diana Anderson, a researcher involved in the work from the School of Life Sciences at the University of Bradford in West Yorkshire, United Kingdom.

To develop this test, Anderson and colleagues took blood samples from a group of people that included healthy individuals, cancer patients and people believed to be at a higher risk than normal to develop cancer. White blood cells (lymphocytes) in these samples were examined in a Comet test, by embedding the cells in a jelly-like substance, called agar, on a microscope slide. In this test, damage to the genetic material (DNA) of the cells was caused by treatment with ultraviolet (UVA) light. This damage was observed in the form of DNA pieces being pulled within the agar in an electric field toward the positive end of the field. This caused a comet-like tail, and the longer the tail the more DNA damage. Different thicknesses of the agar were applied to the slides. In healthy people, as different thicknesses were added, DNA-damaged tail responses returned to normal levels. In cancer patients, DNA-damaged tail responses remained high and in those people who might develop pre-cancerous diseases, tail responses were in between. This means that people with cancer have DNA which is more easily damaged by UVA than do other people, so the test shows the sensitivity to damage of all the genome in a cell. The LGS test has been used to examine blood samples from cancer patients with melanoma, colon cancer and lung cancer, and all gave the same outcomes.

"A blood test to detect cancer and determine one's risk for cancer is a game-changer," said Gerald Weissmann, M.D., Editor-in-Chief of The FASEB Journal. "A test like this – which is sophisticated in design and simple to perform - could make effective cancer screening available in places where traditional medical technology might not be available."

Diana Anderson, Mojgan Najafzadeh, Rajendran Gopalan, Nader Ghaderi, Andrew J. Scally, Stephen T. Britland, Badie K. Jacobs, P. Dominic Reynolds, Justin Davies, Andrew L. Wright, Shariff Al-Ghazal, David Sharpe, and Morgan C. Denyer. Sensitivity and specificity of the empirical lymphocyte genome sensitivity (LGS) assay: implications for improving cancer diagnostics. FASEB J. fj.14-254748; doi:10.1096/fj.14-254748 ; http://www.fasebj.org/content/28/10/4563.abstract

http://www.eurekalert.org/pub_releases/2014-09/uoc--ng092914.php

New genetic 'operating system' facilitated evolution of 'bilateral' animals

Analogous to a new computer operating system, it paved the way for new animal body plans

The evolution of worms, insects, vertebrates and other "bilateral" animals - those with distinct left and right sides - from less complex creatures like jellyfish and sea anemones with "radial" symmetry may have been facilitated by the emergence of a completely new "operating system" for controlling genetic instructions in the cell.

That's the hypothesis of molecular biologists at UC San Diego. They report in the October 1 issue of the journal Genes & Development that this new system of controlling gene networks, analogous to a new computer operating system, paved the way for new animal body plans, just as different operating systems allow the development of new kinds of computer apps.

One key player in this theory is an ancient protein termed "TATA box-binding protein," or TBP, which is found in organisms ranging from archaebacteria to humans. A billion years ago, TBP served as the core of a single "operating system" for gene expression.

The UC San Diego scientists focused their attention on a more recent protein related to TBP termed "TBP-related protein 2," or TRF2. They found that TRF2 is present in bilateral animals, and is absent in animals that lack bilateral symmetry, such as jellyfish, sea anemones and sponges. This observation inspired the idea that the emergence of TRF2 provided animals with an entirely new operating system with new gene expression programs ("apps") that facilitated the evolution of bilateral organisms.

While their hypothesis initially seemed far-fetched, the UC San Diego scientists continued to analyze TRF2 in greater detail. They found that the new facts were like interlocking pieces of a jigsaw puzzle that fit together into a coherent picture. For example, bilateral animals have three germ layers - ectoderm, mesoderm and endoderm - in the embryo, whereas more primitive radial animals, such as jellyfish and sea anemones, possess only two germ layers - an ectoderm and endoderm.

"It turns out that TRF2 appears to be important for the formation of the mesoderm, the germ layer that is missing in radial organisms and is present in bilateral organisms," said Jim Kadonaga, a biology professor at UC San Diego who headed the study "In this manner, the pieces of this scientific jigsaw puzzle fell into place." "The emergence of TRF2 essentially doubled the regulatory capacity of the organisms because TBP and TRF2 can function mostly independently of each other," he explained.

The scientists began studying TRF2 while conducting research on a related project, which they published this past June in Genes & Development. In that study, they reported the discovery that TRF2 plays a key role in the production of the 80 proteins that make up the ribosome - the protein factory of the cell.

"Those findings revealed that TRF2 can support the transcription of a specific network of genes independently of TBP, and suggested the existence of two operating systems based on TBP or TRF2," said Kadonaga.

Sascha Duttke, a graduate student in Kadonaga's laboratory trained in evolutionary biology, was curious as to how and why this second system of transcription evolved. So he examined the presence or absence of TRF2 among different animal groups with the help of Russell Doolittle, one of the world's experts on protein evolution and an emeritus professor of biology and chemistry at UC San Diego. This led to the finding that TRF2 is in bilaterians but not non-bilaterian animals.

"In our current model, there was originally only a single TBP-based operating system, and then the emergence of the new TRF2-based operating system led to new gene networks ('apps') that facilitated the emergence of bilateria," said Kadonaga. "These new gene networks included those that are involved in the development of the body plan and the mesoderm. We postulate that the new TRF2-based networks provided the extra diversity of regulatory function that led to the evolution of more complex organisms - specifically the bilateria, which constitute about 99 percent of living animals."

In addition to Duttke and Doolittle, the UC San Diego team included Yuan-Liang Wang, a biologist in Kadonaga's lab. Their study was funded by a grant from the National Institutes of Health's National Institute of General Medical Sciences (R01 GM041249).

http://www.wired.com/2014/09/zooplankton-biomixing/

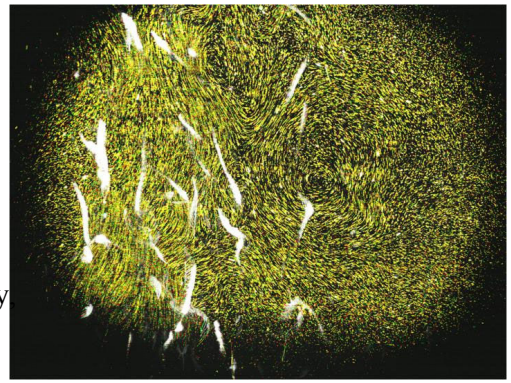
There Are So Many Tiny Animals in the Sea That They May Affect Currents

The wind and tides are major drivers of the ocean's global circulation, moving its waters all over the planet and mixing up its temperature, salinity, and nutrients.

By Annie Sneed

But according to new research, there might be another crucial force in ocean circulation that scientists haven't accounted for: the billions upon billions of small marine animals that live in its depths.

Throngs of tiny organisms called zooplankton inhabit the ocean - everything from microscopic protozoans to krill to jellyfish. Many of these animals live deep underwater during the day to avoid predators, and migrate en masse, sometimes hundreds of meters, to the surface to feed at night. Caltech fluid dynamicist John Dabiri thinks zooplankton's daily collective movements may have a profound influence on ocean dynamics by mixing up its waters, and his new study published in Physics of Fluids, backs up this theory.



Tiny zooplankton (white) create swirling currents in seawater, visualized in this lab experiment by particles illuminated by laser light (yellow dots). **M. Wilhelmus and J.O. Dabiri/Caltech**

To mimic zooplankton migration in the ocean, Dabiri and his research partner, Monica Wilhelmus, devised an automated laser robot that shoots moving blue light through a water tank filled with thousands of brine shrimp. The shrimp (the same creatures sold to curious kids as Sea Monkeys) followed the laser light as it swept from the bottom of the tank to the top, and as they swam, they kicked back water behind them.

Individually, a sea monkey's kick doesn't move much water, but as Dabiri discovered, their collective migration creates large eddies. In the ocean, this could potentially mix up the nutrients and salinity of warmer surface saltwater with cold brine from deeper depths. Dabiri thinks that when untold numbers of zooplankton migrate up and down the ocean's water column every day, they may have an effect on circulation as substantial as the wind and tides by adding about a trillion watts of energy to the ocean system.

Many physical oceanographers are skeptical of this theory (called 'biomixing'), particularly since zooplankton migration is much harder to measure in the real world than the wind and tides. "It's hard to go from a lab experiment in a tank and extrapolate to the ocean," said physical oceanographer André Visser of the Technical University of Denmark. "I'm not convinced that this is a credible mechanism in ocean mixing."

But Dabiri thinks his lab experiments prove the physics of the phenomenon. "The ocean is much bigger than the tank in our lab, but the tank had only a few thousand of these organisms versus billions and billions of them in the ocean," he said.

If zooplankton do, in fact, move ocean waters as Dabiri predicts, this might help scientists model climate change more precisely. The ocean is Earth's largest carbon sink, soaking up more than a quarter of CO2 that human activity emits, and zooplankton may play a key role in that process. "We may need to rethink our models of the ocean," he said. "Perhaps there are significant factors we're missing right now."

http://bit.ly/1vFg4Hx

Enterovirus Now in 40 States, Paralysis Investigated

An unusual strain of enterovirus-D68 has been confirmed in 277 children in 40 states and the District of Columbia, according to the Centers for Disease Control.

Sep 30, 2014 12:15 PM ET // by Paul Heltzel

In Colorado the CDC is now investigating the cases of 10 kids who have been experiencing muscle weakness -- eight of those children were tested for the uncommon respiratory virus, and six came back positive.

"We don't know, at this point, if there is any association between the enterovirus EV-D68 that's circulating and the paralytic conditions some of the children in Colorado are experiencing," CDC spokesman Tom Skinner said.

Eight of the 10 children in Colorado have up-to-date vaccinations, so health ***officials don't believe polio is the cause. Reports CNN:***

Something is affecting the children's motor nerves, causing weakness primarily in their shoulders, triceps, biceps and hips, says Dr. Joyce Oleszek, a pediatric rehabilitation specialist at Children's Hospital Colorado. Doctors are also seeing some weakness in the neck and facial muscles in these patients.

"It seems to be attacking the spinal cord and brain stem," Oleszek said at a press conference Monday.

Enterovirus symptoms may include fever, runny nose, sneezing and muscle aches, the CDC reports. Serious symptoms including wheezing and problems breathing. Infants, children and teenagers are most likely at risk due to a lack of immunity to the virus.

http://bit.ly/1vxmgiw

How Climate Change May Have Shaped Human Evolution

Evidence is building that past climate change may have forged some of the defining traits of humanity

By Brian Handwerk

Earth's climate has always been in a state of flux. Ever since our ancestors branched off the primate evolutionary tree millions of years ago, the planet has faced drastic swings between moist and dry periods, as well as long-lived glacial freezes and thaws.

It's clear that early humans were able to survive such changes - our existence confirms their success. But a growing number of scientists think that major climate shifts may have also forged some of the defining traits of humanity.

In particular, a few large evolutionary leaps, such as bigger brains and complex tool use, seem to coincide with significant climate change. "I think, to be fair, all we have at the moment is coincidence," said Peter B. deMenocal of Columbia University's Lamont-Doherty Earth Observatory. But he and other researchers are exploring several lines of evidence, from ancient teeth to seafloor sediments, to see if a more concrete link can be supported.

This skull of an Australopithecus afarensis child found in Ethiopia dates back to about 3.3 million years ago. **(EUAN DENHOLM/X01999/Reuters/Corbis)**

The data is also helping scientists sift through the possible theories for just how climate might have triggered evolutionary advances.

For instance, one idea is that big leaps forward were not driven by adaptation to a specific habitat change, but by a series of frequent changes. In other words, humans evolved to live with uncertainty. Rick Potts at the Smithsonian Institution's Human Origins Program calls this idea "variability selection", and it's

possible at least two major evolutionary events can be linked to periods of climate instability.

"Roughly between 3 and 2.5 million years ago, the lineage of 'Lucy' [*Australopithecus afarensis*] became extinct and the first members of our own genus, *Homo*, appeared. The first simple stone tools also appeared with those fossils, which featured some modern traits like bigger brains," deMenocal says. "Then, between 2 million and 1.5 million years ago, we see *Homo erectus.*" That bigger-brained hominin had a skeleton very much like our own, more sophisticated tools like double-bladed axes and new behaviors that led early humans out of Africa for the first time.

Both of these events happened at times when the local climate was undergoing dramatic shifts. We know, for instance, that some 3 million years ago - around the time the first *Homo* species appeared - Africa was switching from wooded areas to open grasslands as the climate dried out.

This straightforward change in scenery may be part of why early humans evolved away from climbing and toward walking upright. But recent evidence collected from the seafloor gives an even more detailed look at the climate change during this period.

For his work, deMenocal drills into the seafloor along Africa's coasts, where sediments that would have been long since dispersed on land remain in orderly tiers. Sediments blown offshore from Africa and Arabia have accumulated here at a rate of some 1.5 inches per 1,000 years, creating a climatic layer cake of alternating light and dark bands. During dryer periods, layers feature the dark, gritty dirt blown out to sea by ancient monsoons. During wet periods, the layers contain light amalgamations of abundant fossilized plankton.

The cores reveal swings between very wet and very dry periods about every 20,000 years. This follows a regular cycle, governed by a wobble in Earth's orbit, that increases and decreases the amount of available sunlight hitting the planet. These periods of oscillation happened very rapidly on geologic time scales. Intriguingly, the most pronounced fluctuations happened 3 to 2.5 million years ago, and again a million years later - during the two major periods of early human advancement.

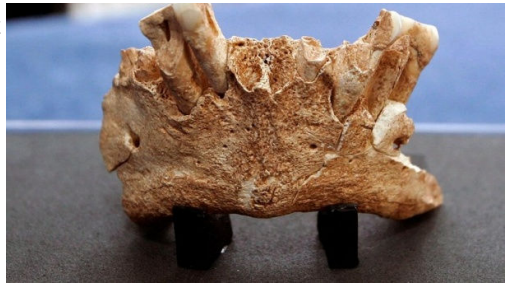
Further evidence of this unstable ancient world can be found in modern Africa. The Great Rift Valley is home to many of the most important fossils in early hominin evolution, so Mark Maslin, a geographer at University College London, studied the valley's paleoclimate record. His team found that lake basins there were very sensitive to the same rapid changes in climate approximately 2.5 million years ago, and at 1.7 million years ago.

"These freshwater lakes can fill up or disappear with changes in rainfall," he says. "We found that these particular periods, or 'pulses', when the lakes come and go correlate directly with major changes in human evolution. The two records are absolutely compatible."

Fossil tooth analysis, rich in carbon isotopic data, helps to further flesh out what our ancestors were eating and drinking during these volatile periods, and what types of environments they called home.

These studies show *Homo* bucking a trend in which earlier peoples passively fed on the expanding grasslands, says deMenocal. This indicates that more successful early humans sought diverse food options during variable periods even as the African landscape was, in the long term, trending toward a more uniform grassland environment.

"Around 2 million years ago, looking at the teeth of *Homo*, you see a diet that's nearly 50-50 split between grasses and other foods," says deMenocal. "So there is increasing geochemical evidence for changes in diet that indicate great flexibility including carcass processing, large migrations and behavioral changes that really seem to indicate a different mode of living." *Homo* bestowed these valuable traits on future lineages while contemporary species with a more limited diet died out.



A piece of jawbone from an early human ancestor, found at a site in Spain that dates back about 1.2 million years. **(Sani Otero/epa/Corbis)**

But just identifying a possible relationship between shifting climate and evolutionary leaps doesn't help scientists figure out exactly what triggered a particular advance, Maslin says.

"My thinking is that there are lots of intriguing theories of human evolution, but each could actually be right," he says. "So you could pick any period in this changing landscape and it may have affected a different trait." For example, it's plausible to theorize that our ancestors' brains might have expanded when the lakes were highly variable, because hominins had to become smarter to determine where their next meals would come from, Maslin says.

"On the other hand, it could be that in wet periods, when there are lots of resources, sexual selection kicks in and the most clever females are saying, Whichever of the males is controlling the group, I'm having him as a partner."

Studies of later periods such as the Middle Stone Age (about 80,000 to 40,000 years ago) link rapid climate change that created wet conditions in South Africa to

innovations in language and cultural identity, including symbolic engravings and shell jewelry.

And the rise of agriculture roughly 10,000 years ago coincides with shifting climates after the end of the last glaciation. Some scientists have theorized that the retreating ice made it easier, or perhaps even necessary, for humans to domesticate plants in the Near East. But some mixed signals exist as well.

Later expansions of the early human brain - smaller but still significant leaps - appear to have occurred during periods of relatively stable climate, Maslin says.

Other researchers suggest that ancient climate change acted on humans in a way more akin to evolutionary adaptations seen in other animals and plants. John Stewart of Bournemouth University thinks that shifting climate likely moved people around the landscape of what is now Europe and Asia, isolating some populations and creating conditions that can lead to evolutionary shifts and the rise of new species.

Studies have shown that past ice ages may have forced species such as the hedgehog into smaller areas, or refugia, where they could survive. Those species were not genetically the same when they emerged and expanded as their preferred climate returned.

If these processes acted the same way on hominins, Neanderthals and Denisovans may have arisen from early groups such as *Homo heidelbergensis*, when they became isolated in small, livable pockets of the frigid Northern Hemisphere.

"We've looked at other organisms and how they adapted during the last few interglacial cycles," Stewart says, referring to work done with Chris Stringer of the Natural History Museum, London.

"Some patterns seem to occur when you look at geographic spread and genetics, and we looked at humans in that same light. If we believe in organic evolution, we shouldn't invent new processes for humans or treat them as a special case. We should fit them into this larger picture."

The process might not work the same way in locations closer to the Equator, where climate change was perhaps not as extreme, Stewart adds. And he believes that his theory isn't mutually exclusive with the type of variability selection that Rick Potts, Peter deMenocal and others espouse.

"But I do think, to me, variability selection isn't a mechanism to make a new species. It's more of a mechanism to make a successful lineage that can spread and allow it to cope with lots of different scenarios," says Stewart. "To make two species out of one, I think you need that kind of geographic isolation that was driven by climate."

Still, he says, "there's no doubt about it - humans are able to cope with lots of different things, and something in evolution must have made that so."

http://nyti.ms/1rVbh3o

Nigeria's Actions Seem to Contain Ebola Outbreak

Quick and coordinated action by Nigeria appears to have contained its first Ebola outbreak

By DONALD G. McNEIL Jr.SEPT. 30, 2014

With quick and coordinated action by some of its top doctors, Nigeria, Africa's most populous country, appears to have contained its first Ebola outbreak, the United States Centers for Disease Control and Prevention said Tuesday.

As the epidemic rages out of control in three nations only a few hundred miles away, Nigeria is the only country to have beaten back an outbreak with the potential to harm many victims in a city with vast, teeming slums.

"For those who say it's hopeless, this is an antidote - you can control Ebola," said Dr. Thomas R. Frieden, director of the C.D.C.

Local health workers with members of Doctors Without Borders at a hospital in Conakry, Guinea on Thursday. More foreign doctors and nurses are volunteering, but a gap remains.

Ebola Doctor Shortage Eases as Volunteers Step ForwardSEPT. 26, 2014

Although officials are pleased that success was achieved in a country of 177 million that is a major transport and business hub - and whose largest city, Lagos, has 21 million people - the lessons here are not easily applicable to the countries at the epicenter: Guinea, Liberia and Sierra Leone. Public health officials in those countries remain overwhelmed by the scale of the outbreak and are desperate for additional international assistance.

Nigeria's outbreak grew from a single airport case, while in the three other countries the disease smoldered for months in remote rain-forest provinces and spread widely before a serious response was mounted. Ebola, Dr. Frieden said, "won't blow over - you have to make a rapid, intense effort."

While the danger in Nigeria is not over, the health minister, Dr. Onyebuchi Chukwu, said in a telephone interview that his country was now better prepared, with six laboratories able to make diagnoses and response teams and isolation wards ready in every major state.

After the first patient - a dying Liberian-American - flew into Lagos on July 20, Ebola spread to 20 other people there and in a smaller city, Port Harcourt. They have all now died or recovered, and the cure rate - 60 percent - was unusually high for an African outbreak.

Meanwhile, local health workers paid 18,500 face-to-face visits to repeatedly take the temperatures of nearly 900 people who had contact with them. The last confirmed case was detected on Aug. 31, and virtually all contacts have passed the 21-day incubation period without falling ill.

The success was in part the result of an emergency command center financed in 2012 by the Bill & Melinda Gates Foundation to fight polio. As soon as the outbreak began, it was turned into the Ebola Emergency Operations Center. Also, the C.D.C. had 10 experts in Nigeria working on polio and H.I.V., who had already trained 100 local doctors in epidemiology; 40 of them were immediately reassigned to Ebola and oversaw the contact tracing.

The chief of the command center, Dr. Faisal Shuaib, gave credit to a coordinated effort by the Health Ministry, the C.D.C., the World Health Organization, Unicef, Doctors Without Borders and the International Committee for the Red Cross. Also, he noted, Nigeria has significant advantages over poorer countries where the outbreak is out of control.

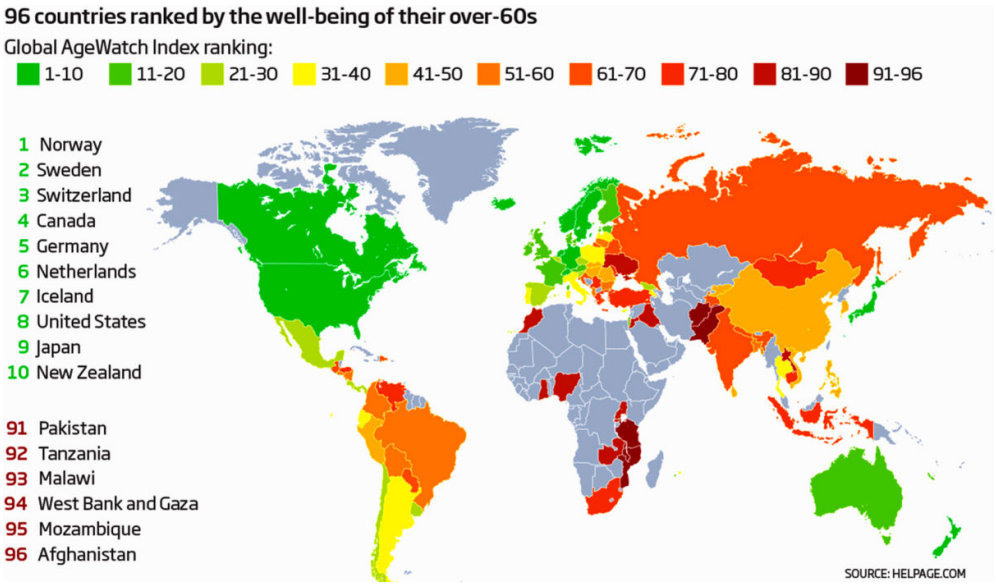
http://bit.ly/1xctjPa

The best and worst countries in the world to be old in

The future is grey. The world's population is ageing, and we aren't prepared for it.

by Fred Pearce

That is the upshot of the Global AgeWatch Index, an assessment of quality of life for people of 60 and over, based on income security, health and living environment from the HelpAge International network.



Ageing is widely seen as a rich-world phenomenon, but it is a global issue. It is a concern because old people tend to have a worse quality of life in poor countries. The index predicts that as the poor world ages, millions face a bleak old age. Afghanistan is the worst place among those surveyed to be old, followed by Mozambique and the Palestinian territories. Norway is the most age-friendly, then Sweden and Switzerland. Worldwide, life expectancy has doubled in the past half century to 66 years. A century ago, Britons could only expect to live to 47; now fewer than a dozen nations do worse than that. Costa Ricans, Taiwanese and Cubans can expect to live as long as Americans.

Cold Turkey

Some countries with increasing wealth ignore their older citizens. Being old in booming Turkey is as bad as it is in Cambodia. Whereas Mexico, a poorer nation than Turkey but with superior pension provision, is now a better place to be old than Italy or Portugal.

Much of the global longevity revolution is down to falling infant death rates. But the future lifespan of those who make it to 60 is also rising fast – in poor nations as much as rich ones. "On average a woman aged 60 today can expect to live until she is 82," says the report. Men can expect to reach 79 years. China already has more old people than any other country, and will probably have 150 million people over 75 by mid-century.

Great resource

As the poor world ages, hundreds of millions face a bleak old age, and will be dependent on their children, says Asghar Zaidi of the Centre for Research on Ageing at the University of Southampton, UK, who compiled the index. In low- and middle-income countries, only one in four people over 65 receives a pension. And despite living longer, women are less likely to get a pension than men.

This neglect leaves ageing populations vulnerable, dependent and far less able to contribute to society than they might otherwise be. A recent German study found that, properly looked after, the old could be a boon to societies – a source of wisdom and experience in the workplace, and even reduce carbon emissions. Zaidi agrees. "Societies have been slow to embrace the positive aspects of longevity, to see older people as a resource," he says, adding that people will have extended working careers as well as more self-reliant, healthy and independent living.

http://nyti.ms/10AugWX

Limb Frailty in Children Is Studied for Link to Enterovirus 68

Officials are trying to figure out if the weakness could be linked to the virus

By CATHERINE SAINT LOUISSEPT. 30, 2014

Driven by a handful of reports of poliolike symptoms in children, federal health officials have asked the nation's physicians to report cases of children with limb weakness or paralysis along with specific spinal-cord abnormalities on a magnetic resonance imaging test. As a respiratory illness known as enterovirus 68 is

sickening thousands of children from coast to coast, officials are trying to figure out if the weakness could be linked to the virus.

The emergence of several cases of limb weakness among children in Colorado put doctors on alert in recent months.

The Centers for Disease Control and Prevention issued an advisory on Friday, and this week, other cases of unexplained muscle weakness or paralysis came to light in Michigan, Missouri and Massachusetts.

The C.D.C. is investigating the cases of 10 children hospitalized at Children's Hospital Colorado with unexplained arm or leg weakness since Aug. 9. Some of the children, who range in age from 1 to 18, also developed symptoms like facial drooping, double vision, or difficulty swallowing or talking.

Four of them tested positive for enterovirus 68, also known as enterovirus D68, which has recently caused severe respiratory illness in children in 41 states and the District of Columbia.

One tested positive for rhinovirus, which can cause the common cold. Two tested negative. Two patients' specimens are still being processed; another was never tested.

It is unclear whether the muscle weakness is connected to the viral outbreak. "It's one possibility we are looking at, but certainly not the only possibility," said Mark Pallansch, director of the C.D.C.'s division of viral diseases.

The C.D.C. grew concerned after hearing about a high number of cases of unexplained limb paralysis at the Colorado hospital in a short period.

"It would be unusual for a hospital to see a patient like that more than once or twice a year," Dr. Pallansch said.

All of the Colorado patients also had spinal cord lesions evident on an M.R.I. test.

On Tuesday, the University of Michigan C. S. Mott Children's Hospital in Ann Arbor confirmed that four children with varying limb weakness had been seen in its emergency department in the past few weeks.

In three cases, "we are concerned it could be related to enterovirus D68, but we don't have confirmatory testing from the C.D.C. as of yet," said Dr. Marie Lozon, the hospital's division director for pediatric emergency medicine.

One infant boy with paralysis has confirmed enterovirus D68. But, Dr. Lozon said, "he didn't come to the hospital for respiratory difficulties, he came to the emergency department because his parents noted he wasn't using a leg correctly."

In this infant's case, Dr. Lozon said, "the limb weakness wasn't just weakness - it was paralysis," ultimately in both legs. He has since been discharged.

Dr. Pallansch from the C.D.C. said any case of limb weakness that met the case definition outlined in Friday's health advisory should be reported. "Let me be clear: We don't even require that the child had a previous respiratory illness," he said.

In Kansas City, Mo., Dr. Mary Anne Jackson, the division director of infectious diseases at Children's Mercy Hospital, said three children developed limb weakness there and had spinal inflammation on M.R.I. tests.

"They can't lift an arm or a leg," she said, adding, "Even a little baby moves both arms at the same time when excited - but they would move only one arm."

Yet none of the three Missouri patients tested positive for enterovirus 68.

"This is a very, very, very rare neurologic manifestation, and we don't even know it's connected to enterovirus D68," Dr. Jackson said.

Her hospital is working with the C.D.C.

On Wednesday, Boston Children's Hospital confirmed it had treated four patients, ages 4 to 15, who had neurological illness with limb weakness, all within a 10-day period last month.

"It's very striking," said Dr. Mark Gorman, a neurologist there. Three of them tested negative for any enterovirus, and one test is pending. All four patients had recently experience respiratory illness, but only one had been hospitalized elsewhere, Dr. Gorman said.

To figure out why children are experiencing limb weakness and who is most at risk, Dr. Pallansch said, the C.D.C. decided to "actively ask the question, 'Have you seen cases similar to this at your hospital?' rather than relying on a passive system where we may not hear about them."

Dr. Samuel Dominguez, an epidemiologist at Children's Hospital Colorado, said that his team had ruled out West Nile virus, polio, herpes virus and enterovirus 71, which sometimes causes paralytic disease.

Not all cases of limb weakness meet the C.D.C.'s case definition.

For example, since Aug. 1, Upstate Golisano Children's Hospital in Syracuse has had two patients with limb weakness associated with respiratory infection, but neither had spinal lesions on an M.R.I., said Dr. Thomas Welch, the medical director.

Health care providers should report patients with limb weakness and specific M.R.I. abnormalities to their local and state health departments, which in turn will work with the C.D.C.

No deaths have been attributed to enterovirus 68. On Monday, a specimen from a preschooler in New Jersey who died last week was sent to the C.D.C. to determine if he had enterovirus 68, according to a spokeswoman for the State Department of Health.

http://www.eurekalert.org/pub_releases/2014-10/cfrn-nas093014.php

New article shows daily use of certain supplements can decrease health-care expenditures

Use of specific dietary supplements can have a positive effect on health care costs through avoided hospitalizations related to Coronary Heart Disease

Washington, D.C.- Use of specific dietary supplements can have a positive effect on health care costs through avoided hospitalizations related to Coronary Heart Disease (CHD), according to a new article published in the Journal of Dietary Supplements[1]. The article, "From Science to Finance - A Tool for Deriving Economic Implications from the Results of Dietary Supplement Clinical Studies," published by Christopher Shanahan and Robert de Lorimier, Ph.D., explores a potential cost-benefit analysis tool that, when applied to a high-risk population (U.S. adults over 55 with CHD) who take dietary supplements, specifically omega-3 fatty acid or B vitamin dietary supplements, can result in the reduction of the individuals' odds of experiencing a costly medical event.

Hospitalizations for all U.S. adults over the age of 55 with CHD cost the United States over $64 billion in 2012[2], and the amount spent on the treatment of CHD, rather than the prevention, is burdensome on both the societal and individual - control the burden of CHD costs is to minimize the number of costly inpatient procedures," the authors said. "Many dietary supplement products are available in the market today that have been shown to have positive effects on heart health through associated clinical studies...Thus, the potential decrease of total health care expenditures in the United States is a strong argument for the daily use of dietary supplements." According to the authors' analysis of all U.S. adults over the age of 55 diagnosed with CHD:

If every high-risk person in the target population were to take omega-3 supplements at preventive intake levels daily, there would be an average of $2.1 billion in avoided expenditures per year and a cumulative of $16.5 billion in avoided expenditures between 2013 – 2020

If every high-risk person in the target population were to take B vitamins at preventive intake levels daily, there would be an average of $1.5 billion in avoided expenditures per year and a cumulative of $12.1 billion in avoided expenditures between 2013 – 2020

"This is a relatively low-technology, yet smart, approach that can be used by consumers, physicians, employers, and policymakers as a means to reduce personal and societal health care costs," the authors concluded.

The cost-savings model presented in this article was first presented in a report, "Smart Prevention - Health Care Cost Savings Resulting from the Targeted Use of Dietary Supplements," in which Frost & Sullivan conducted a systematic review of scientific research in peer-reviewed, published studies that looked separately at relationships between omega-3 supplement intake and the risk of a CHD-attributed event, and B vitamins intake and the risk of a CHD-attributed event. The firm then projected the rates of CHD-attributed medical events across U.S. men and women over the age of 55 with CHD and applied a cost benefit analysis to determine the cost savings if people in this targeted population took omega-3 supplements or B vitamin supplements at preventive intake levels. The report was funded through a grant from the CRN Foundation.

The article published in the Journal of Dietary Supplements can be found here. The full Frost & Sullivan economic report and accompanying materials, including omega-3 supplement and B vitamin supplement infographics, are available for free at http://www.supplementforsmartprevention.org.

[1] Shanahan, C. and de Lorimier, R. (2014). From Science to Finance—A Tool for Deriving Economic Implications from the Results of Dietary Supplement Clinical Studies. Journal of Dietary Supplements.

[2] Agency for Healthcare Research and Quality. (2010). Medical Expenditure Panel Survey (MEPS). Retrieved February 2013, from http://meps.ahrq.gov/mepsweb/

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http://www.eurekalert.org/pub_releases/2014-10/e-pcc100114.php

Power can corrupt even the honest

New research, published in The Leadership Quarterly, highlights the influence of power in leader corruption

When appointing a new leader, selectors base their choice on several factors and typically look for leaders with desirable characteristics such as honesty and trustworthiness. However once leaders are in power, can we trust them to exercise it in a prosocial manner?

New research published in The Leadership Quarterly looked to discover whether power corrupts leaders. Study author John Antonakis and his colleagues from the University of Lausanne explain, "We looked to examine what Lord Acton said over 100 years ago, that 'Power corrupts and absolute power corrupts absolutely.'" To investigate this the authors used experimental methods to distinguish between the situational and individual component; and determine if power corrupts or if corrupt individuals are drawn to power.

After completing psychometric tests to measure various individual differences, including honesty, participants played the 'dictator game' where they were given complete control over deciding pay-outs to themselves and their followers. The

leaders had the choice of making prosocial or antisocial decisions, the latter of which resulted in reduced total pay-outs to the group but increased the leader's own earnings.

The findings showed that those who measured as less honest exhibited more corrupt behaviour, at least initially; however, over time, even those who initially scored high on honesty were not shielded from the corruptive effects of power.

"We think that strong governance mechanisms and strong institutions are the key to keeping leaders in check," concludes Antonakis. "Organisations should limit how much leaders can drink from the seductive chalice of power."

Watch this video to find out more: ***http://youtu.be/JoLLPNZLBAo***

"Leader corruption depends on power and testosterone" DOI: 10.1016/j.leaqua.2014.07.010 and appears in The Leadership Quarterly, published by Elsevier.

http://www.eurekalert.org/pub_releases/2014-10/miot-ndc100114.php

New drug-delivery capsule may replace injections

Novel drug capsule coated with tiny needles can inject drugs directly into the lining of the stomach

Written by Anne Trafton, MIT News Office

CAMBRIDGE, MA -- Given a choice, most patients would prefer to take a drug orally instead of getting an injection. Unfortunately, many drugs, especially those made from large proteins, cannot be given as a pill because they get broken down in the stomach before they can be absorbed.

To help overcome that obstacle, researchers at MIT and Massachusetts General Hospital (MGH) have devised a novel drug capsule coated with tiny needles that can inject drugs directly into the lining of the stomach after the capsule is swallowed. In animal studies, the team found that the capsule delivered insulin more efficiently than injection under the skin, and there were no harmful side effects as the capsule passed through the digestive system.

"This could be a way that the patient can circumvent the need to have an infusion or subcutaneous administration of a drug," says Giovanni Traverso, a research fellow at MIT's Koch Institute for Integrative Cancer Research, a gastroenterologist at MGH, and one of the lead authors of the paper, which appears in the Journal of Pharmaceutical Sciences.

Although the researchers tested their capsule with insulin, they anticipate that it would be most useful for delivering biopharmaceuticals such as antibodies, which are used to treat cancer and autoimmune disorders like arthritis and Crohn's disease. This class of drugs, known as "biologics," also includes vaccines, recombinant DNA, and RNA.

"The large size of these biologic drugs makes them nonabsorbable. And before they even would be absorbed, they're degraded in your GI tract by acids and enzymes that just eat up the molecules and make them inactive," says Carl Schoellhammer, a graduate student in chemical engineering and a lead author of the paper.

Safe and Effective Delivery

Scientists have tried designing microparticles and nanoparticles that can deliver biologics, but such particles are expensive to produce and require a new version to be engineered for each drug.

Schoellhammer, Traverso, and their colleagues set out to design a capsule that would serve as a platform for the delivery of a wide range of therapeutics, prevent degradation of the drugs, and inject the payload directly into the lining of the GI tract. Their prototype acrylic capsule, 2 centimeters long and 1 centimeter in diameter, includes a reservoir for the drug and is coated with hollow, stainless steel needles about 5 millimeters long.

Previous studies of accidental ingestion of sharp objects in human patients have suggested that it could be safe to swallow a capsule coated with short needles. Because there are no pain receptors in the GI tract, patients would not feel any pain from the drug injection.

To test whether this type of capsule could allow safe and effective drug delivery, the researchers tested it in pigs, with insulin as the drug payload. It took more than a week for the capsules to move through the entire digestive tract, and the researchers found no traces of tissue damage, supporting the potential safety of this novel approach.

They also found that the microneedles successfully injected insulin into the lining of the stomach, small intestine, and colon, causing the animals' blood glucose levels to drop. This reduction in blood glucose was faster and larger than the drop seen when the same amount of glucose was given by subcutaneous injection.

"The kinetics are much better, and much faster-onset, than those seen with traditional under-the-skin administration," Traverso says. "For molecules that are particularly difficult to absorb, this would be a way of actually administering them at much higher efficiency."

Further Optimization

This approach could also be used to administer vaccines that normally have to be injected, the researchers say.

The team now plans to modify the capsule so that peristalsis, or contractions of the digestive tract, would slowly squeeze the drug out of the capsule as it travels through the tract. They are also working on capsules with needles made of degradable polymers and sugar that would break off and become embedded in the gut lining, where they would slowly disintegrate and release the drug. This would further minimize any safety concern.

Avi Schroeder, a former Koch Institute postdoc, is also a lead author of the paper. The senior authors are Robert Langer, the David H. Koch Institute Professor at MIT and a member of the Koch Institute, the Institute for Medical Engineering and Science (IMES), and the Department of Chemical Engineering; Daniel Blankschtein, the Herman P. Meissner Professor of Chemical Engineering; and Daniel Anderson, the Samuel A. Goldblith Associate Professor of Chemical Engineering and a member of the Koch Institute and IMES.
The research was funded by the National Institutes of Health.

http://www.eurekalert.org/pub_releases/2014-10/p-dat092514.php

Decreased ability to identify odors may predict 5-year mortality

Olfactory dysfunction may be a signal of mortality for older adults

For older adults, being unable to identify scents may be a predictor of mortality within five years, according to a study published October 1, 2014, in the journal PLOS ONE by Jayant Pinto from The University of Chicago and colleagues.

The study was part of the National Social Life, Health and Aging Project (NSHAP), the first in-home study of social relationships and health in a large, nationally representative sample of men and women ages 57 to 85. Researchers first surveyed 3,000 participants in 2005-06, assessing their ability to identify five distinct common odors, one at a time, from a set of four choices. The five odors, in order of increasing difficulty, were peppermint, fish, orange, rose and leather.

In the second survey, during 2010-11, the team confirmed which participants were still living. During that five-year gap, 430 (12.5%) of the original 3005 study subjects had died; 2,565 were still alive.

Thirty-nine percent of study subjects who failed the first smelling test died before the second survey, compared to 19 percent of those with moderate smell loss and just 10 percent of those with a healthy sense of smell. For those already at high risk, lacking a sense of smell more than doubled the probability of death. When the researchers adjusted for demographic variables such as age, gender, socioeconomic status (as measured by education or assets), overall health, and race—those with greater smell loss when first tested were substantially more likely to have died five years later. Precisely how smell loss contributes to mortality is unclear, but olfactory dysfunction was better at predicting mortality than a diagnosis of heart failure, cancer or lung disease. Only severe liver damage was a more powerful predictor of death.

"We think loss of the sense of smell is like the canary in the coal mine," said the study's lead author Jayant M. Pinto, MD, associate professor of surgery at the University of Chicago. "It doesn't directly cause death, but it's a harbinger, an early warning system, that something has already gone badly wrong, that damage has been done. Our findings could provide a useful clinical test, a quick and inexpensive way to identify patients most at risk."

Citation: Pinto JM, Wroblewski KE, Kern DW, Schumm LP, McClintock MK (2014) Olfactory Dysfunction Predicts 5-Year Mortality in Older Adults. PLoS ONE 9(9):e107541. doi:10.1371/journal.pone.0107541

http://bbc.in/1n5ocQ3

Moon's hidden valley system revealed

Scientists have identified a huge rectangular feature on the Moon that is buried just below the surface.

By Jonathan Amos Science correspondent, BBC News

The 2,500km-wide structure is believed to be the remains of old rift valleys that later became filled with lava.

Centred on the Moon's Procellarum region, the feature is really only evident in gravity maps acquired by Nasa's Grail mission in 2012.

But knowing now of its existence, it is possible to trace the giant rectangle's subtle outline even in ordinary photos.

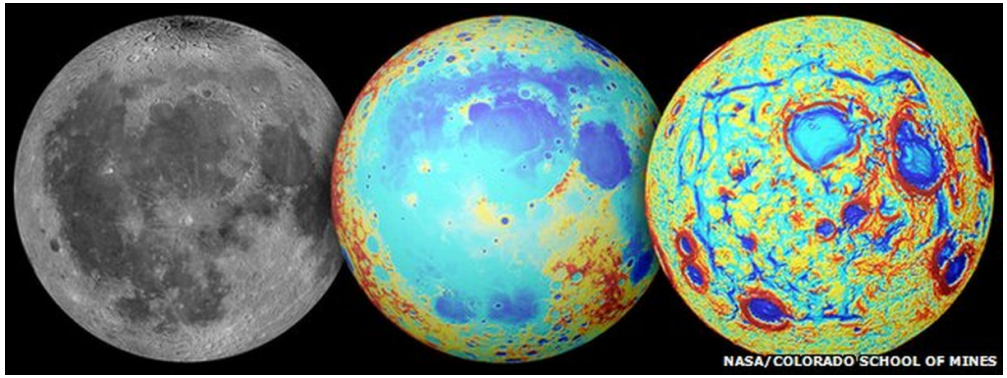
Mare Frigoris, for example, a long-recognised dark stripe on the lunar surface, is evidently an edge to the ancient rift system.

"It's really amazing how big this feature is," says Prof Jeffery Andrews-Hanna. "It covers about 17% of the surface of the Moon. And if you think about that in terms relative to the size of the Earth, it covers an area equivalent to North America, Europe and Asia combined," the Colorado School of Mines scientist told BBC News.

"When we first saw it in the Grail data, we were struck by how big it was, how clear it was, but also by how unexpected it was.

"No-one ever thought you'd see a square or a rectangle on this scale on any planet." The study is reported in Nature magazine.

So how was this extraordinary feature produced?



The Moon as we see it (L), in terms of height variation (C), and from surface gravity variations (R)

Andrews-Hanna and colleagues note that the Procellarum region contains a lot of naturally occurring radioactive elements, such as uranium, thorium and potassium. On the early Moon, these would have heated the crust, which, when it cooled would have contracted. This shrinking, they propose, would have ripped the surface, opening deep valleys. The geometry is the giveaway.

On Earth, cooling and contraction will preferentially produce hexagons containing 120-degree angles.

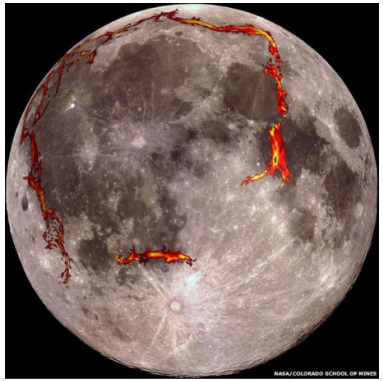
The famous Giant's Causeway in Northern Ireland is a classic example on the small scale, but even in bigger settings, such as in East Africa's rift valleys, geological lines tend to intersect in this way.

Procellarum's giant rectangle does the same, too - because the entire feature is draped over a sphere. This means the angles at the corners are wider than 90 degrees.

"What we're seeing is a clever trick of spherical geometry. For structures on this scale, a polygon with 120-degree angles at the corners actually has four sides instead of six," explained Prof Andrews-Hanna.

The team cannot tell when the rifting occurred, but the dating of Moon rocks brought back by Apollo would suggest the valleys were filled by volcanic lavas about 3.5 billion years ago.

The new study goes some way to resolving arguments over the origins of Procellarum, which looks different to other, more circular mare (dark regions) on the Moon's surface. For these regions, big asteroid impacts were more important in sculpting their forms.



The full Moon as seen from the Earth, with the Procellarum border structure superimposed in red

The study is also further proof of the value of the Grail mission, led from the Massachusetts Institute of Technology.

This comprised two, near-identical satellites that chased each other around the Moon over the course of a year. They mapped changes in the pull of gravity as they flew over areas of differing mass.

Big mountains will have a different signal that is distinct to deep depressions, obviously. But the data also reveals those locations that have discrete rock types and densities.

In the case of Procellarum, the Grail pair sensed an excess of mass stemming from the presence of all the basaltic lava filling the rift valleys.

http://www.jpl.nasa.gov/news/news.php?release=2014-331

Swirling Cloud at Titan's Pole is Cold and Toxic

Southern polar vortex on Saturn's moon Titan is a huge, swirling, toxic cloud

Scientists analyzing data from NASA's Cassini mission have discovered that a giant, toxic cloud is hovering over the south pole of Saturn's largest moon, Titan, after the atmosphere there cooled dramatically. The scientists found that this giant polar vortex contains frozen particles of the toxic compound hydrogen cyanide, or HCN.

"The discovery suggests that the atmosphere of Titan's southern hemisphere is cooling much faster than we expected," said Remco de Kok of Leiden Observatory and SRON Netherlands Institute for Space Research, lead author of the study published today in the journal Nature.

Titan is the only moon in the solar system that is cloaked in a dense atmosphere. Like our home planet, Earth, Titan experiences seasons. As it makes its 29-year orbit around the sun along with Saturn, each season lasts about seven Earth years. The most recent seasonal switch occurred in 2009, when winter gave way to spring in the northern hemisphere, and summer transitioned to autumn in the southern hemisphere.

In May 2012, while Titan's southern hemisphere was experiencing autumn, images from Cassini revealed a huge swirling cloud, several hundred miles across, taking shape above Titan's south pole. This polar vortex appears to be an effect of the change of season.

A puzzling detail about the swirling cloud is its altitude, some 200 miles (about 300 kilometers) above Titan's surface, where scientists thought the temperature was too warm for clouds to form. "We really didn't expect to see such a massive cloud so high in the atmosphere," said de Kok.

Keen to understand what could give rise to this mysterious cloud, the scientists dove into Cassini's observations and found an important clue in the spectrum of sunlight reflected by Titan's atmosphere.

A spectrum splits the light from a celestial body into its constituent colors, revealing signatures of the elements and molecules present. Cassini's visual and infrared mapping spectrometer (VIMS) maps the distribution of chemical compounds in Titan's atmosphere and on its surface.

"The light coming from the polar vortex showed a remarkable difference with respect to other portions of Titan's atmosphere," says de Kok. "We could clearly see a signature of frozen HCN molecules."

As a gas, HCN is present in small amounts in the nitrogen-rich atmosphere of Titan. Finding these molecules in the form of ice was surprising, as HCN can condense to form frozen particles only if the atmospheric temperature is as cold as

minus 234 degrees Farenheit (minus 148 degrees Celsius). This is about 200 degrees Fahrenheit (about 100 degrees Celsius) colder than predictions from current theoretical models of Titan's upper atmosphere.

To check whether such low temperatures were actually possible, the team looked at observations from Cassini's composite infrared spectrometer (CIRS), which measures atmospheric temperature at different altitudes. Those data showed that the southern hemisphere of Titan has been cooling rapidly, making it possible to reach the cold temperature needed to form the giant toxic cloud seen on the south pole.

Atmospheric circulation has been drawing large masses of gas towards the south since the change of season in 2009. As HCN gas becomes more concentrated there, its molecules shine brightly at infrared wavelengths, cooling the surrounding air in the process. Another factor contributing to this cooling is the reduced exposure to sunlight in Titan's southern hemisphere as winter approaches there.

"These fascinating results from a body whose seasons are measured in years rather than months provide yet another example of the longevity of the remarkable Cassini spacecraft and its instruments," said Earl Maize, Cassini project manager at NASA's Jet Propulsion Laboratory in Pasadena, California. "We look forward to further revelations as we approach summer solstice for the Saturn system in 2017."

The Cassini-Huygens mission is a cooperative project of NASA, the European Space Agency and the Italian Space Agency. JPL, a division of the California Institute of Technology, Pasadena, manages the mission for NASA's Science Mission Directorate in Washington. The VIMS team is based at the University of Arizona in Tucson. The CIRS team is based at NASA's Goddard Space Flight Center in Greenbelt, Maryland.

More information about Cassini is available at the following sites:

http://www.nasa.gov/cassini http://saturn.jpl.nasa.gov

http://www.eurekalert.org/pub_releases/2014-10/osu-mol100214.php

Making old lungs look young again

Animal research suggests ibuprofen can reduce lung inflammation in elderly

By Emily Caldwell

COLUMBUS, Ohio – New research shows that the lungs become more inflammatory with age and that ibuprofen can lower that inflammation.

In fact, immune cells from old mouse lungs fought tuberculosis bacteria as effectively as cells from young mice after lung inflammation was reduced by ibuprofen. The ibuprofen had no effect on the immune response to TB in young mice.

This was a rare look at inflammation in the aging lung environment by Ohio State University scientists who study the immune response to TB. The researchers already knew that old mice had a harder time clearing TB from the lungs than young mice, but had not investigated the role of lung inflammation in that response.

"Very few researchers have linked inflammation to infectious disease in old age, even though TB in particular will drive that inflammation even further," said Joanne Turner, associate professor of microbial infection and immunity at Ohio State and senior author of the study.

"The inflammation-associated changes that we saw in the lung were a small finding, but an important finding because the implications are great," Turner said. "We should be able to modify the environment in the lung. If we can reverse the inflammatory environment in a very straightforward way, that is a positive."

The research is published in the Journal of Leukocyte Biology.

Most previous research establishing inflammation's links to aging and disease has tested blood for elevated proteins that signal an inflammatory environment. These researchers found the same proteins in the lungs of old mice.

Research has already established that the inevitable inflammation that comes with aging is linked to such conditions as Type 2 diabetes and heart disease.

Though this line of work might someday support the use of ibuprofen as an adjunct therapy for elderly people with TB, Turner emphasized that she and colleagues are not recommending use of the drug for the purposes of lowering inflammation.

"You can actually reduce your inflammation as you age by being lean, eating well and exercising. And we know that in the elderly, people who are fitter live longer," she said. "Inflammation is associated with sickness and frailty."

Though the research was conducted in mice, Turner co-led a previous study indicating that both mouse and human lungs develop the same profile of pro-inflammatory proteins and fatty molecules with age, creating an environment that impairs the immune response to infection.

More than 9 million people worldwide are estimated to have active TB infections, and about 1.4 million people die of tuberculosis each year.

"The elderly are most likely to die of TB. They get sicker. They're not the biggest population that gets infected with TB, but they can develop the worst cases," said Turner, also an associate director of Ohio State's Center for Microbial Interface Biology (CMIB).

In this new study, the researchers compared lung cells from old and young mice and found that in the old mice, genes that make three classic pro-inflammatory proteins, called cytokines, were more active in the lungs of old mice.

The cytokines are interleukin-1 (IL-1), interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-a). In addition, immune system cells called macrophages in the

lungs from old mice were in an advanced state of readiness to fight an infection – a status that signals inflammation. Macrophages in young mouse lungs were in a normal, resting state.

In test tubes, the scientists exposed mouse lung macrophages to TB bacteria. The macrophages from old mouse lungs were quicker to absorb the bacteria than were immune cells from young mice, but that initial robust immune response from the cells of old mice could not be sustained.

"A primed macrophage in an old mouse has lots of receptors on its surface that can bind to TB, taking it up and trying to kill it. But what it lacks is the ability to increase the response further," Turner said.

"A resting macrophage in a young mouse takes up TB and then can be activated to do something even more effective at killing the bacteria."

Though some elements of the elderly response to TB remain a mystery, this finding suggested that the inflammation in the lungs of elderly mice had the direct effect of reducing the long-term effectiveness of their immune response to TB infection, Turner said.

Old mice in the study were 18 months old – equivalent to about 65 in human years – and young mice were 3 months old, a similar age to human young adults.

The researchers gave old and young mice ibuprofen in their food for two weeks and then examined their lung cells.

After this diet modification, several pro-inflammatory cytokines in the lungs of old mice had been reduced to levels identical to those in the lungs of young mice, and the macrophages in old mouse lungs were no longer in a primed state.

"There's a trend toward reduced inflammation. Essentially, ibuprofen made the lungs of old mice look young. Putting young mice on ibuprofen had no effect because they had no lung inflammation, which implies the ibuprofen reduced the inflammation and changed the immune response in the old mice," Turner said.

"It might be that ibuprofen works on specific pathways to lower inflammation, and that might help with control of TB."

Turner and colleagues have extended the work to test whether ibuprofen affects the elderly mouse immune response to TB infection.

This work was supported by a Julie Martin Mid-Career Award from the American Federation for Aging Research, the Ohio State University Public Health Preparedness for Infectious Diseases Pilot Award and Ohio State's College of Medicine Systems and Integrative Biology Training Program.

Co-authors include Cynthia Canan, Nandan Gokhale (now at Duke University), Bridget Carruthers (now with Ohio State's Office of Environmental Health and Safety), William Lafuse, Larry Schlesinger and Jordi Torrelles, all of Ohio State's Department of Microbial Infection and Immunity and CMIB.

http://www.scientificamerican.com/article/did-cancer-evolve-to-protect-us/

Did Cancer Evolve to Protect Us?

A physics-based, "atavistic" model posits that cancer is a "safe mode" for stressed cells and suggests that oxygen and immunotherapy are the best ways to beat the disease

Oct 2, 2014 |By Zeeya Merali

Could cancer be our cells' way of running in "safe mode," like a damaged computer operating system trying to preserve itself, when faced with an external threat? That's the conclusion reached by cosmologist Paul Davies at Arizona State University in Tempe (A.S.U.) and his colleagues, who have devised a controversial new theory for cancer's origins, based on its evolutionary roots. If correct, their model suggests that a number of alternative therapies, including treatment with oxygen and infection with viral or bacterial agents, could be particularly effective.

At first glance, Davies, who is trained in physics rather than biomedical science, seems an unlikely soldier in the "war on cancer." But about seven years ago he was invited to set up a new institute at A.S.U.—one of 12 funded by the National Cancer Institute—to bring together physical scientists and oncologists to find a new perspective on the disease. "We were asked to rethink cancer from the bottom up," Davies says.

Davies teamed up with Charley Lineweaver, an astrobiologist at The Australian National University in Canberra, and Mark Vincent, an oncologist at the London Health Sciences Center in Ontario. Together they have come up with an "atavistic" model positing cancer is the reexpression of an ancient "preprogrammed" trait that has been lying dormant. In a new paper, which appeared in BioEssays in September, they argue that because cancer appears in many animals and plants, as well as humans, then it must have evolved hundreds of millions of years ago when we shared a common single-celled ancestor. At that time, cells benefited from immortality, or the ability to proliferate unchecked, as cancer does. When complex multicellular organisms developed, however, "immortality was outsourced to the eggs and sperm," Davies says, and somatic cells (those not involved in reproduction) no longer needed this function.

The team's hypothesis is that when faced with an environmental threat to the health of a cell—radiation, say, or a lifestyle factor—cells can revert to a "preprogrammed safe mode." In so doing, the cells jettison higher functionality and switch their dormant ability to proliferate back on in a misguided attempt to survive. "Cancer is a fail-safe," Davies remarks. "Once the subroutine is triggered, it implements its program ruthlessly."

Speaking at a medical engineering conference held at Imperial College London, on September 11, Davies outlined a set of therapies for cancer based on this atavistic model. Rather than simply attacking cancer's ability to reproduce, or "cancer's strength," as Davies terms it, the model exposes "cancer's Achilles' heel." For instance, if the theory is correct, then cancer evolved at a time when Earth's environment was more acidic and contained less oxygen. So the team predicts that treating patients with high levels of oxygen and reducing sugar in their diet, to lower acidity, will strain the cancer and cause tumors to shrink.

The effects of oxygen level on cancer have been independently investigated for many years and appear to support Davies's ideas, says Costantino Balestra, a physiologist at Paul Henri Spaak School and the Free University of Brussels, both in Belgium. In unpublished work that has been submitted for peer review, for instance, Balestra and his colleagues have recently demonstrated that slightly elevated oxygen levels can begin to induce leukemia cell death without harming healthy cells. "It almost looks too easy," Balestra says. "Our preliminary results seem to show that supplying a little extra oxygen for one or two hours a day, in combination with other traditional cancer therapies, would benefit patients without any harsh side effects." Balestra emphasizes, however, that this work was not carried out to test Davies's hypothesis and cannot be taken as proof that the atavistic model is correct.

Davies and his colleagues also advocate immunotherapy—specifically, selectively infecting patients with bacterial or viral agents. Medical researchers are already investigating the promising effects of such an approach for artificially boosting patients' immune systems to aid in their recovery. Immunotherapy has already performed well in treating melanomas, for instance, and its effects on other cancers are being studied. According to the atavistic model, however, in addition to invigorating the immune system, cancer cells should also be more vulnerable than healthy cells to being killed by infectious agents because they lose higher protective functionality when they "reboot into safe mode," Davies says. Recent studies injecting clostridium spores in rats, dogs and a human patient also appear to support this interpretation, he says.

Some scientists, such as David Gorski, a surgical oncologist at Wayne State University, remain skeptical. "The 'predictions' of atavism are nothing that scientists haven't come to by other paths," he says.

Davies and his colleagues have already begun a more direct test of their theory, in answer to such criticisms. "The key to our theory is looking at the ages of the genes responsible for cancer," Davies explains. The atavistic model claims that with the onset of cancer, cells revert to a more primitive mode and more recently evolved functions are switched off. The team therefore predicts that as cancer progresses, more recently evolved genes should lose function, whereas ancient genes become active.

To check if this hypothesis is correct, Davies and his colleagues are currently cross-referencing data from the cancer genome atlas, which identifies the genes that are involved in cancer, with various databases that classify the genes that we have in common with other species. The latter data set enables biologists to trace back genes' ages. Any correlation that exists between the gene age and cancer will be a boost to the atavistic model. "Combining the two data sets hasn't been done before," Davies says. "But it's essentially a data-mining exercise that doesn't take much money and it's something we're working on now."

Brendon Coventry, a surgical oncologist and immunotherapist at the University of Adelaide in Australia, sees value in physicists working with oncologists to piece together existing medical evidence to try to understand cancer's origins.

"Enormous amounts of money and the brightest minds in biological and medical science have failed to make a big impact in the war on cancer, so maybe it's time for a new paradigm," Coventry says, adding: "A cosmologist can look at the cell as an 'internal universe' to be explored in a new way."

http://www.eurekalert.org/pub_releases/2014-10/labr-mua100214.php

Marijuana use associated with lower death rates in patients with traumatic brain injuries

LA BioMed researchers surveyed emergency patients tested for THC levels

LOS ANGELES – Surveying patients with traumatic brain injuries, a group of Los Angeles Biomedical Research Institute (LA BioMed) researchers reported today that they found those who tested positive for THC, the active ingredient in marijuana, were more likely to survive than those who tested negative for the illicit substance.

The findings, published in the October edition of The American Surgeon, suggest THC, or tetrahydrocannabinol, may help protect the brain in cases of traumatic brain injury, the researchers said. The study included 446 patients who suffered traumatic brain injuries and underwent a urine test for the presence of THC in their system. The researchers found 82 of the patients had THC in their system. Of those, only 2.4% died. Of the remaining patients who didn't have THC in their system, 11.5% died.

"Previous studies conducted by other researchers had found certain compounds in marijuana helped protect the brain in animals after a trauma," said David Plurad, MD, an LA BioMed researcher and the study's lead author. "This study was one of the first in a clinical setting to specifically associate THC use as an independent predictor of survival after traumatic brain injury."

The researchers noted that the timing of their study was "pertinent" because of current efforts to decriminalize marijuana and other research that has shown THC can increase appetite, reduce ocular pressure, decrease muscle spasms, relieve pain and alleviate symptoms associated with irritable bowel disease. But they noted that their study has some significant limitations.

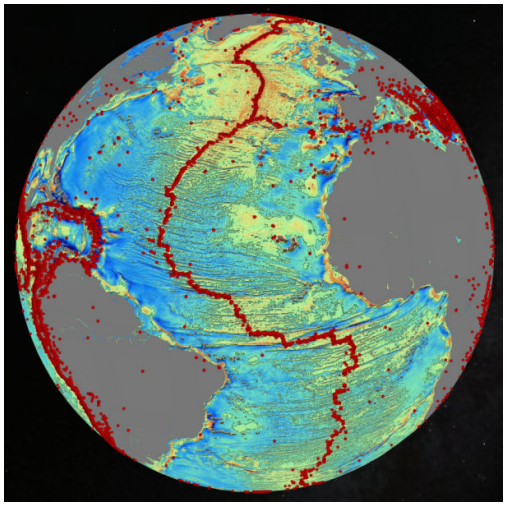
"While most – but not all – the deaths in the study can be attributed to the traumatic brain injury itself, it appears that both groups were similarly injured," Dr. Plurad said. "The similarities in the injuries between the two groups led to the conclusion that testing positive for THC in the system is associated with a decreased mortality in adult patients who have sustained traumatic brain injuries."

http://bit.ly/1rNxuiz

New Map Exposes Previously Unseen Details of Seafloor

Mysteries of the deep come alive as satellite data bring thousands of uncharted sea mountains and new clues about deep ocean structures into focus

Accessing two previously untapped streams of satellite data, scientists at Scripps Institution of Oceanography at UC San Diego and their colleagues have created a new map of the world's seafloor, creating a much more vivid picture of the structures that make up the deepest, least-explored parts of the ocean. Thousands of previously uncharted mountains rising from the seafloor and new clues about the formation of the continents have emerged through the new map, which is twice as accurate as the previous version produced nearly 20 years ago.



A new seafloor map reveals new details on earthquakes (red dots), seafloor spreading ridges, and faults.

Developed using a scientific model that captures gravity measurements of the ocean seafloor, the new map extracts data from the European Space Agency's (ESA) CryoSat-2 satellite, which primarily captures polar ice data but also operates continuously over the oceans, and Jason-1, NASA's satellite that was redirected to map the gravity field during the last year of its 12-year mission. Combined with existing data and drastically improved remote sensing instruments, the new map, described in the journal Science, has revealed details of thousands of undersea mountains, or seamounts, extending a kilometer or more from the ocean bottom. The new map also gives geophysicists new tools to investigate ocean spreading centers and little-studied remote ocean basins.

"The kinds of things you can see very clearly now are abyssal hills, which are the most common land form on the planet," said David Sandwell, lead scientist of the paper and a geophysics professor in the Cecil H. and Ida M. Green Institute of Geophysics and Planetary Physics (IGPP) at Scripps.

The authors of the study say the map provides a new window into the tectonics of the deep oceans. Previously unseen features in the map include newly exposed continental connections across South America and Africa, and new evidence for seafloor spreading ridges at the Gulf of Mexico that were active 150 million years ago and are now buried by mile-thick layers of sediment.

"One of the most important uses of this new marine gravity field will be to improve the estimates of seafloor depth in the 80 percent of the oceans that remains uncharted or is buried beneath thick sediment," the authors say in the report.

"Although CryoSat-2's primary mission is in the cryosphere, we knew as soon as we selected its orbit that it would be invaluable for marine geodesy, and this work proves the point," said Richard Francis, a coauthor of the paper and project manager for the development of CryoSat-2 at the European Space Agency, and honorary professor in the Department of Earth Sciences at University College London.

The new map also provides the foundation for the upcoming new version of Google's ocean maps to fill large voids between shipboard depth profiles.

"The team has developed and proved a powerful new tool for high-resolution exploration of regional seafloor structure and geophysical processes," says Don Rice, program director in the National Science Foundation's (NSF) Division of Ocean Sciences. "This capability will allow us to revisit unsolved questions and to pinpoint where to focus future exploratory work."

"The use of satellite altimeter data and Sandwell's improved data processing technique provides improved estimates of marine gravity and bathymetry world-wide, including in remote areas," said Joan Cleveland, Office of Naval Research (ONR) deputy director, Ocean Sensing and Systems Division. "Accurate bathymetry and identifying the location of seamounts are important to safe navigation for the U.S. Navy."

In addition to Sandwell and Francis, coauthors of the paper include R. Dietmar Muller of the University of Sydney, Walter Smith of the NOAA Laboratory for Satellite Altimetry, and Emmanuel Garcia of Scripps.

The study was supported by NSF, ONR, the National Geospatial-Intelligence Agency, and ConocoPhillips.

http://www.eurekalert.org/pub_releases/2014-10/cp-use092514.php

Unexpectedly speedy expansion of human, ape cerebellum

A new study published in the Cell Press journal Current Biology on October 2 could rewrite the story of ape and human brain evolution.

While the neocortex of the brain has been called "the crowning achievement of evolution and the biological substrate of human mental prowess," newly reported evolutionary rate comparisons show that the cerebellum expanded up to six times faster than anticipated throughout the evolution of apes, including humans.

The findings suggest that technical intelligence was likely at least as important as social intelligence in human cognitive evolution, the researchers say.

"Our results highlight a previously unappreciated role of the cerebellum in ape and human brain evolution that has the potential to refocus researchers' thinking about how and why the brains in these species have become distinct and to shift attention away from an almost exclusive focus on the neocortex as the seat of our humanity," says Robert Barton of Durham University in the United Kingdom.

The cerebellum had been seen primarily as a brain region involved in movement control, adds Chris Venditti of the University of Reading. But more recent evidence has begun to suggest that the cerebellum has a broader range of functions. The cerebellum also contains an intriguingly large number of densely packed neurons.

"In humans, the cerebellum contains about 70 billion neurons—four times more than in the neocortex," Barton says. "Nobody really knows what all these neurons are for, but they must be doing something important."

The neocortex had gotten most of the attention in part because it is such a large structure to begin with. As a result, in looking at variation in the size of various brain regions, the neocortex appeared to show the most expansion. But much of that increase in size could be explained away by the size of the animal as a whole. Sperm whales have a neocortex that is proportionally larger than that of humans, for example.

By using a comparative method that controlled for those differences in the way the two brain structures correlate, Barton and Venditti uncovered a striking pattern: both nonhuman apes and humans depart from the otherwise tight correlation in size between the cerebellum and neocortex found across other primates due to relatively rapid evolutionary expansion of the cerebellum.

Barton and Venditti say that the cerebellum seems to be particularly involved in the temporal organization of complex behavioral sequences, such as those involved in making and using tools, for instance. Interestingly, evidence is now emerging for a critical role of the cerebellum in language, too.

While plenty of work remains, the new study establishes the cerebellum as "a new frontier for investigations into the neural basis of advanced cognitive abilities," the researchers say.

Current Biology Barton et al.: "Rapid evolution of the cerebellum in humans and other great apes."

http://www.eurekalert.org/pub_releases/2014-10/uoo-hpo093014.php

HIV pandemic's origins located

Pandemic spread almost certainly began in Democratic Republic of the Congo

The HIV pandemic with us today is almost certain to have begun its global spread from Kinshasa, the capital of the Democratic Republic of the Congo (DRC), according to a new study.

An international team, led by Oxford University and University of Leuven scientists, has reconstructed the genetic history of the HIV-1 group M pandemic, the event that saw HIV spread across the African continent and around the world, and concluded that it originated in Kinshasa. The team's analysis suggests that the common ancestor of group M is highly likely to have emerged in Kinshasa around 1920 (with 95% of estimated dates between 1909 and 1930).

HIV is known to have been transmitted from primates and apes to humans at least 13 times but only one of these transmission events has led to a human pandemic. It was only with the event that led to HIV-1 group M that a pandemic occurred, resulting in almost 75 million infections to date. The team's analysis suggests that, between the 1920s and 1950s, a 'perfect storm' of factors, including urban growth, strong railway links during Belgian colonial rule, and changes to the sex trade, combined to see HIV emerge from Kinshasa and spread across the globe.

A report of the research is published in this week's Science.

'Until now most studies have taken a piecemeal approach to HIV's genetic history, looking at particular HIV genomes in particular locations,' said Professor Oliver Pybus of Oxford University's Department of Zoology, a senior author of the paper. 'For the first time we have analysed all the available evidence using the latest phylogeographic techniques, which enable us to statistically estimate where a virus comes from. This means we can say with a high degree of certainty where and when the HIV pandemic originated. It seems a combination of factors in Kinshasa in the early 20th Century created a 'perfect storm' for the emergence of HIV, leading to a generalised epidemic with unstoppable momentum that unrolled across sub-Saharan Africa.'

'Our study required the development of a statistical framework for reconstructing the spread of viruses through space and time from their genome sequences,' said Professor Philippe Lemey of the University of Leuven's Rega Institute, another senior author of the paper. 'Once the pandemic's spatiotemporal origins were clear

they could be compared with historical data and it became evident that the early spread of HIV-1 from Kinshasa to other population centres followed predictable patterns.'

One of the factors the team's analysis suggests was key to the HIV pandemic's origins was the DRC's transport links, in particular its railways, that made Kinshasa one of the best connected of all central African cities.

'Data from colonial archives tells us that by the end of 1940s over one million people were travelling through Kinshasa on the railways each year,' said Dr Nuno Faria of Oxford University's Department of Zoology, first author of the paper.

'Our genetic data tells us that HIV very quickly spread across the Democratic Republic of the Congo (a country the size of Western Europe), travelling with people along railways and waterways to reach Mbuji-Mayi and Lubumbashi in the extreme South and Kisangani in the far North by the end of the 1930s and early 1950s. This helped establishing early secondary foci of HIV-1 transmission in regions that were well connected to southern and eastern African countries. We think it is likely that the social changes around the independence in 1960 saw the virus 'break out' from small groups of infected people to infect the wider population and eventually the world.'

It had been suggested that demographic growth or genetic differences between HIV-1 group M and other strains might be major factors in the establishment of the HIV pandemic. However the team's evidence suggests that, alongside transport, social changes such as the changing behaviour of sex workers, and public health initiatives against other diseases that led to the unsafe use of needles may have contributed to turning HIV into a full-blown epidemic – supporting ideas originally put forward by study co-author Jacques Pepin from the Université de Sherbrooke, Canada.

Professor Oliver Pybus said: 'Our research suggests that following the original animal to human transmission of the virus (probably through the hunting or handling of bush meat) there was only a small 'window' during the Belgian colonial era for this particular strain of HIV to emerge and spread into a pandemic. By the 1960s transport systems, such as the railways, that enabled the virus to spread vast distances were less active, but by that time the seeds of the pandemic were already sown across Africa and beyond.'

The team says that more research is needed to understand the role different social factors may have played in the origins of the HIV pandemic; in particular research on archival specimens to study the origins and evolution of HIV, and research into the relationship between the spread of Hepatitis C and the use of unsafe needles as part of public health initiatives may give further insights into the conditions that helped HIV to spread so widely.

http://bit.ly/1nVsBFZ

Archaeologists Think They've Found the Dungeon Where Dracula Was Kept

Vlad the Impaler was likely held captive in Turkey's Tokat Castle

By Rachel Nuwer

Before Vlad the Impaler gained a reputation for his cruelty and might in battle - and long before he became the inspiration for Bram Stoker's Dracula - he was a young prince held captive in a fortress in Turkey. When Vlad was about 12 years old, he and his brother fell into the Ottoman's hands. Some scholars credit that traumatic experience for Vlad's later blood lust for the Ottomans and say that it perhaps triggered his sadistic tendencies - namely, impaling - later in life.

The ruins of Tokat Castle in northern Turkey. **Avi Dolgin**

Now, archeologists in Turkey say they have found the Turkish dungeon where Vlad and his brother were first locked up.

Excavations at the ruins of Tokat Castle in northern Turkey revealed secret tunnels and two dungeons, Turkey's Hurriet Daily News reports.

As Ibrahim Çetin, one of the archeologists behind the discovery, told Hurriet: "The castle is completely surrounded by secret tunnels. It is very mysterious."

The Turkish archeologists say they have evidence to believe that Vlad spent time in one of those dungeons, though as Hurriet points out, they did not elaborate on the nature of that proof.

After his release, Vlad went on to fight the Ottomans for most of his adult life. In one such battle, the International Business Times reports, he supposedly impaled 20,000 defeated enemies as a show of his power and a deterrent for future attacks. Eventually, however, the Ottomans got the upper hand.

While details surrounding Vlad's death are hazy, most scholars agree that he died in battle with the Turks.

In any event, his decapitated head was sent to Constantinople in a barrel of honey, proving that the Impaler had finally fallen - though his legendary place in popular lore had only just begun.

http://www.eurekalert.org/pub_releases/2014-10/uoc--mob100214.php

Making oxygen before life

Where did abiotic oxygen come from?

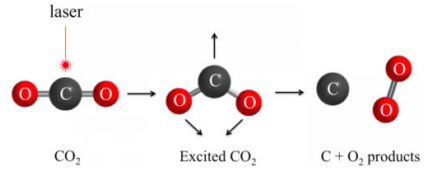
About one-fifth of the Earth's atmosphere is oxygen, pumped out by green plants as a result of photosynthesis and used by most living things on the planet to keep our metabolisms running. But before the first photosynthesizing organisms appeared about 2.4 billion years ago, the atmosphere likely contained mostly carbon dioxide, as is the case today on Mars and Venus.

Over the past 40 years, researchers have thought that there must have been a small amount of oxygen in the early atmosphere. Where did this abiotic ("non-life") oxygen come from? Oxygen reacts quite aggressively with other compounds, so it would not persist for long without some continuous source.

Now UC Davis graduate student Zhou Lu, working with professors in the Departments of Chemistry and of Earth and Planetary Sciences, has shown that oxygen can be formed in one step by using a high energy vacuum ultraviolet laser to excite carbon dioxide. (The work is published Oct. 3 in the journal *Science*).

"Previously, people believed that the abiotic (no green plants involved) source of molecular oxygen is by CO_2 + solar light → CO + O, then O + O + M → O_2 + M (where M represents a third body carrying off the energy released in forming the oxygen bond)," Zhou said in an email. "Our results indicate that O_2 can be formed by carbon dioxide dissociation in a one step process. The same process can be applied in other carbon dioxide dominated atmospheres such as Mars and Venus."

Zhou used a vacuum ultraviolet laser to irradiate CO_2 in the laboratory. Vacuum ultraviolet light is so-called because it has a wavelength below 200 nanometers and is typically absorbed by air. The experiments were performed by using a unique ion imaging apparatus developed at UC Davis.



New work from UC Davis shows that carbon dioxide can be split by vacuum ultraviolet laser to create oxygen in one step. The discovery may change how we think about the evolution of atmospheres. **Zhou Lu, UC Davis**

Such one-step oxygen formation could be happening now as carbon dioxide increases in the region of the upper atmosphere, where high energy vacuum ultraviolet light from the Sun hits Earth or other planets. It is the first time that such a reaction has been shown in the laboratory. According to one of the scientists who reviewed the paper for *Science*, Zhou's work means that models of the evolution of planetary atmospheres will now have to be adjusted to take this into account.

Coauthors on the paper are, in the UC Davis Department of Chemistry, postdoctoral researcher Yih Chung Chang, Distinguished Professor Cheuk-Yiu Ng and Distinguished Professor emeritus William M. Jackson; and Professor Qing-Zhu Yin, Department of Earth and Planetary Sciences. The work was principally funded by NASA, NSF, and the U.S. Department of Energy.

http://www.eurekalert.org/pub_releases/2014-10/hasf-tms100214.php

Too many stroke patients miss out on the window to regain crucial functions

Study shows inpatient rehabilitation could help 40 percent, but only 16 percent get access

Too many stroke patients in Canada are not getting the rehabilitation they need to return to a healthy, active life, according to a new study which will be presented at the Canadian Stroke Congress in Vancouver tomorrow. The research findings strongly suggest that such decisions are being made based on what services are available in the health system rather than what patients really need. It found that overall just 16 per cent of patients with stroke were discharged to inpatient rehabilitation but that the rates varied widely by province (1% to 26%) and hospital (0% to 48%). Meanwhile, some of the people who do get rehabilitation don't need it. And those who do get rehabilitation don't always get the right amount of services.

Stroke experts agree that about 40 per cent of stroke patients would benefit from rehabilitation which takes place in a specialized rehabilitation unit where patients stay for one to several weeks following discharge from acute care.

"The study suggests there are a large number of Canadian stroke patients who are not getting the help they need at hospital discharge to get back to an active life," says Dr. Michael Hill, director of the stroke unit at the Foothills Medical Centre in Calgary and one of the study authors.

"We found that access to and the use of inpatient rehabilitation after stroke is highly variable, so variable that it likely depends upon practice patterns and resources, rather than patient disability and needs."

"Stroke patients are falling through the cracks," says Dr. Mark Bayley, co-chair of the Canadian Stroke Congress and a physiatrist (rehabilitation specialist). "This has huge implications for their future quality of life and use of healthcare and social service resources."

He adds that the study highlights the need for more formal assessment and triage processes to better match patients and their needs to finite rehabilitation services.

The study examined the database of hospital discharge information maintained by the Canadian Institute of Health Information (CIHI), focusing on the nearly

60,000 stroke or transient ischemic attack (TIA or mini stroke) patients discharged from Canadian hospitals over a two-year period ending in March 2013.

The hospital discharge data are important, says Dr. Hill, because it is crucial for stroke patients to get rehabilitation promptly after their stroke. "There is a window when rehabilitation after stroke is maximally effective," he says. "We need to pay attention to getting people help within this window – before the opportunity for improvement has decreased – if we want to get people back to being as fully functioning as possible in their daily activities and jobs."

He adds that people with moderate and moderately severe disability are the ones that can benefit most from timely access to the right level of rehabilitation services.

Hot Topic in Stroke: Access to Stroke Rehabilitation

A majority of people who have a stroke report that they need some amount of help afterwards and 80 per cent experience restrictions to their daily activities.

Recovery from a stroke can continue for years. "Lack of adequate rehabilitation resources means patients and families are denied the opportunity to have as much function restored as possible," says Ian Joiner, director of stroke for the Heart and Stroke Foundation. "Our health and social services systems ultimately pay more because patients do not meet their recovery potential and end up needing more services. It simply makes sense to make stroke rehabilitation a priority." While there have been improvements over the past decade in how quickly stroke survivors are getting access to inpatient rehabilitation, there's still work to be done.

"The Heart and Stroke Foundation recommends that governments explore opportunities to enhance post-stroke rehabilitation services," says Joiner. "In addition to the variation in access to inpatient rehabilitation services, community-based rehabilitation programs are not available in many communities, and those that do exist are not equitably covered by provincial health insurance programs."

Research Creates Survivors

Growing up, Janel Nadeau had a passion for science and imagined travelling to another province to pursue her university studies. At the age of 19, a sudden stroke seemingly robbed her of that dream.

Janel spent six weeks in hospital, where she was one of the lucky ones who received a full complement of rehabilitation support, including occupational, physical and speech therapy. Yet when she got home, the first-year Honour's student at Queen's University was still struggling to relearn the alphabet.

Her mom took four months off work so she could accompany Janel to weekly physical therapy sessions at the hospital and help her with exercises at home. They sought out opportunities in the community, including the local gym for strength training, swimming and yoga, cooking classes through adult education and massage therapy.

The support she received through her recovery allowed her to eventually return to her studies. Today, she is a resident physician who works alongside the doctors who saved her life at Foothills Medical Centre, including Dr. Michael Hill.

Investments in stroke rehabilitation and increased rehabilitation availability will result in more survivors thriving, like Janel.

Stroke's Impact by the Numbers

62,000 strokes occur in Canada each year – one every nine minutes.
315,000 Canadians are living with the effects of stroke.
60 per cent of people who have a stroke report that they need help afterwards.
Stroke costs the Canadian economy $3.6 billion a year.
Stroke is a leading cause of death and disability among adults.

The Canadian Stroke Congress is a joint initiative of the Heart and Stroke Foundation and the Canadian Stroke Consortium. It is being held in Vancouver from October 4 to 7.

Statements and conclusions of study authors are solely those of the study authors and do not necessarily reflect HSF or CSC policy or position. The Heart and Stroke Foundation and the Canadian Stroke Consortium make no representation or warranty as to their accuracy or reliability.

http://phys.org/news/2014-10-global-income-equality-1820s-oecd.html

Global income equality now back at 1820s levels: OECD

The gap between the haves and the have-nots globally is now at the same level as in the 1820s, the OECD said Thursday, warning it was one of the most "worrying" developments over the past 200 years.

In a major report on global well-being over the past two centuries, the Organisation for Economic Cooperation and Development noted inequality shot up after globalisation took root in the 1980s.

Researchers studied income levels in 25 countries, charted them back in time to 1820 and then collated them as if the world were a single country.

The results showed that income inequality dropped sharply in the middle of the 20th century—which the OECD put down to what it called an "egalitarian revolution", notably with the rise of Communism in Eastern Europe—but then spiked more recently. By 2000, global levels of income inequality were at the same levels as in 1820, according to the report.

"This is very striking," said Guido Alfani, from Bocconi University, who participated in the survey. "The enormous increase of income inequality on a global scale is one of the most significant—and worrying—features of the

development of the world economy in the past 200 years," concluded the OECD in the 269-page report presented to the media.

Dutch economist Jan Luiten van Zanden said the report painted a similar picture to the stark warning in the controversial but best-selling book about global income inequality by French economist Thomas Piketty, "Capital in the Twenty-First Century". "We are telling similar stories ... we are sharing the same concerns about global inequalities," said van Zanden. "Piketty is comparing mostly western countries. His method should be analysed on a global scale," suggested the economist.

For the landmark study, researchers looked at trends in factors such as health, education, inequality, the environment and personal security over the past 200 years in order to build a picture of global well-being. The conclusion: "People's well-being has generally progressed since the early 20th century across a large part of the world." Life expectancy worldwide has shot up from less than 30 years in 1880 to almost 70 in 2000. Literacy too has risen dramatically. Less than 20 percent of people could read in 1820; now the figure is around 80 percent.

http://bit.ly/1BGKuJv

The Only Primate With a Toxic Bite Might Have Evolved to Mimic Cobras

Slow lorises have snake-like markings, postures and a hiss that all resemble the speckled cobra

By Marissa Fessenden

Slow lorises are known for their cuteness. Nocturnal primates that live in Southeast Asia, the lorises have round heads, big eyes, fuzzy fur, and - if they lick a gland under their arms and combine the secretion there with their saliva—a less-than-adorable toxic bite.

That bite, combined with a hiss-like vocalization, sinuous movements, and a distinctive defensive posture in which the loris raises its arms above its head, make the primate look remarkably like a spectacled cobra ready to strike. Which raises the question: Did the loris evolve to mimic poisonous snakes?

Yes, argues a paper published in the Journal of Venomous Animals and Toxins including Tropical Diseases last year. To back up this idea, the researchers noted that cobras and slow lorises lived and migrated through the same part of Asia about eight million years ago. Quick climate changes in the region stripped the Malay Peninsula of tropical forests and replaced them with drier woodlands. That opened up the loris's habitat more and could have provided pressure to mimic a poisonous snake.

As a result, the researchers suggest, the loris's markings resemble those of the snake, especially if the animal is encountered in the dusk of twilight, as one naturalist found out. John Still was living in Sri Lanka in 1905 when he heard a strange sound from his room:

With the breathing sound came the occasional quick hiss of a strike. So I got up and took a stick , for I thought that a cobra might be attacking my Loris, who was not in his cage, but only tethered to the top of it. The sound came from my room, where, although it was dusk, there was plenty of light to kill a snake.

As I went into the room I looked at the cage, which was on the floor, and on the top of it I saw the outline of a cobra sitting up with hood expanded, and threatening a cat who crouched about six feet away. This was the Loris, who, with his arms and shoulders hunched up, was a sufficiently good imitation of a cobra to take me in, as he swayed on his long legs, and every now and then let out a perfect cobra's hiss. As I have said, it was dusk at the time, but the Loris is nocturnal, so that his expedient would rarely be required except in the dusk or dark ; and the sound was a perfect imitation. I may mention that I have kept snakes, including a cobra, and am therefore the less likely to be easily deceived by a bad imitation.

"Few people have ever researched loris venom, so few hypotheses have been generated," lead author Anna Nekaris, the director of Oxford Brookes University's Little Fireface Project, told mongabay.com. "We are hoping that people would like to test the cobra hypothesis - it does have some scientific basis. But of course there are other hypotheses."

For instance, the primates are called slow lorises for a reason. Toxin might help them subdue the birds, bats, lizards and even tarsiers they are known to eat. But observations suggest that lorises can take down these animals and eat them fairly quickly - no paralysis needed.

Nekaris et al. Journal of Venomous Animals and Toxins including Tropical Diseases 2013 19:21

Maybe the toxin helps protect against predators and parasites. Or, like the male platypus's spur, it could have evolved to be used as a weapon during fights with other lorises. None of these explain the snake-like movements (an extra vertebrate in their spine gives lorises this ability), hiss and markings, but they certainly could have sped along the evolution of a poisonous bite.

http://bit.ly/ZJnRs8

Aliens May be Out There, but Too Distant for Contact

The Milky Way may be home to some 3,000 extraterrestrial civilizations but the vast distances between our galactic cousins will make contact extremely rare, a new study concludes.

by Irene Klotz

Dr. Ian O'Neill, space producer for Discovery News, steps in to discuss some of the ways scientists are working to detect signs of life on other worlds.

Data collected by NASA's Kepler space telescope and other observatories scouting for planets beyond the solar system indicate Earth is one of some 40 billion potentially habitable worlds in the galaxy, with about one new life-friendly planet forming every year, astronomer Michael Garrett, head of the Dutch astronomy research foundation ASTRON, said at the International Astronomical Congress in Toronto.

Sounds promising, until you consider the sheer size of the Milky Way, which spans more than 100,000 light-years in diameter. Light travels at about 186,000 miles per second, but a signal will still take more than 4 years to reach neighboring system Alpha Centauri and 100,000 years to travel from one end of the galaxy to the other.

"On average, you'd expect the civilizations to be separated by at least 1,000 light-years in the Milky Way. That's a large distance, and for communication purposes you need to allow for twice the travel distance, so you're talking about civilizations that have to be around for at least a few thousand years in order to have the opportunity to talk to each other," Garrett said.

"We don't really know the time scales in which civilizations persist," he added. The one example available -- Earth -- indicates that life essentially developed as soon as the conditions were right, but intelligent life arose comparatively late.

"It's really just essentially in the last few minutes of the overall evolution of life on the planet," Garrett said. "I don't want to be too negative about this, but ... my basic conclusion is that SETI signals will be rare in the Milky Way."

That doesn't mean astronomers shouldn't look, he added. Quite the contrary, given the huge technological leaps in radio astronomy and in data processing techniques compared to what was available for Search for Extraterrestrial Intelligence, or SETI, programs 60 years ago.

SETI also is benefitting from sister radio astronomy projects, such as the ongoing quest to find the source of mysterious transient radio bursts.

"SETI is not easy, but it's a pursuit that is well worth doing. The question is so important," Garrett said. "Everyone is interested, not just scientists and space enthusiasts. People in the street are interested to know what else is out there."

http://bit.ly/Zit09V

One Human Year Does Not Equal Seven Dog Years

No one knows where the dog years myth came from, but experts agree that it's simply not true

By Rachel Nuwer

No one knows where the dog years rule came from, though virtually all dog owners know it. According to that popular myth, every year a dog spends on the planet is equivalent to seven years for a human. So if a dog lives to be 15 years old, she's actually 105 in human years. No one knows where this piece of common knowledge came from, Priceonomics writes, though there are some indications that monks at Westminster Abbey in the 13th century were the first to put forth a similar figure (9:1, in that case).

The problem with this simple ratio is that it's not reflective of reality. As Priceonomics writes, "if this ratio had any truth to it, humans would be capable of reproducing by age seven, and high percentages of us would live to be 150." Researchers and others who have simply taken the time to think about the ratio have recognized its illogic for decades. In 1953, for example, a French researcher published a more nuanced version of the rule, based on emperical evidence: dogs age 15 to 20 times faster than humans do during their first year of life, but that ratio soon tapers off to about one dog year being the equivalent of five human years, Priceonomics writes.

Things quickly got more complicated than that, however. As most dog owners know, dog life spans are not equivalent. Larger breeds tend to pass away well before smaller ones. As aging researchers calculated, a ten-year-old small dog is about 56 in equivalent human years, for example, whereas a large dog is 66 and a super-big dog is 78. To further complicate things, Preceonomics points out, some breeds, like beagles, demonstrate different aging ratios than their equivalent-sized counterparts of different breeds.

So the take home is pretty clear: the 7:1 ratio is a gross oversimplification of how dogs age. But it will probably be dog's years before that popular myth goes away.

http://bit.ly/1CN2jZJ

Microbes and Pathogen Genes Fill New York City Soil

New York's soil is as full of life as soils in tropical rain forests and rich grasslands

By Mark Fischetti | October 3, 2014 |

With all the attention to the Ebola virus and other pathogens floating around in bodily fluids and the air, we may not be aware that the dirt beneath our feet is home to thousands of bacteria and other microorganisms. Even the soil in New York City, which we might think is somewhat lifeless given the preponderance of

concrete and pollution, is as full of life as soils in tropical rain forests and rich grasslands. It is also home to more pathogenic genes than any of those places.

Those surprising conclusions come from a creative study published this week in Proceedings of the Royal Society B. A team of scientists took soil samples at 596 sites across New York's famous (and large) Central Park—all in a single, 12-hour blitz. They brought their dirt back to the lab and analyzed the genetic makeup of every bit of lifelike material they could find. They uncovered an astounding 167,000 different kinds of bacteria, archaea (single-celled organisms that do not have cell nuclei) and eukaryotes (organisms whose cells contain nuclei).

They then compared the genetics of their critters to those living in soils from 52 places around the world. The Central Park soil had as much or more biodiversity than soils from rain forests in Hawaii and Peru, woodlands in California, and the Mojave Desert and valleys in Antarctica. "The amount of biodiversity in Central Park, and how comparable it is to soils around the globe, was surprising," says team leader and microbial ecologist Kelly Ramirez, who was at Colorado State University when the samples were taken and is now a postdoctoral scholar at the Netherlands Institute of Ecology in Wageningen.

Ramirez also emphasized that "we know so little" about what's living in the universe beneath our feet. Although the park soil had tremendous biodiversity, only 16 percent of the bacteria and archaea gene sequences matched those in soils from around the world in the Greengenes database. Only 8.5 percent of the eukaryotes matched those from global soils in the SILVA database. Ramirez is eager to add the New York City results to the Global Soil Biodiversity Initiative, which is trying to broaden the world's knowledge of dirt.

She also emphasized that scientists know very little about how organisms in soil interact with one another, which is crucial to maintaining soil health. "We are only beginning to unravel what each group of organisms' role is," she says. Healthy soil is crucial for robust plant life, and therefore for healthy ecosystems. Soil can also be a help or harm to human health. Therein lies perhaps the biggest surprise of the Central Park study. Although the researchers did not find many complete human pathogens in the soil, they found an abundance of genetic sequences that were close matches—more than twice as many as in soils around the globe. In particular, they found high levels of close matches to Staph, Salmonella and Citrobacter bacteria—all causes of prevalent and potentially serious human diseases—as well as anthrax spores (which occur naturally in addition to weaponized forms).

The paper contains a careful note about that: "We want to stress that the presence of potential pathogen sequences does not indicate the presence of a disease-causing organism in the soil, rather this finding highlights a significant difference between soil bacterial communities found in more natural systems and those found in Central Park." Ramirez says her team cannot explain for sure why the pathogen sequences are higher, but she assumes it is because so many people are crisscrossing the park each day.

Ramirez hopes the Central Park results "wave the flag" that scientists are only beginning to understand what roles the many soil organisms play in maintaining biodiversity. More insight could help farmers tweak soil to reduce pathogens that can destroy crops, and help scientists track whether soils can migrate as climate changes, how much plants determine the traits of soils, and whether plants can change soils to help themselves as they, too, migrate to warmer, wetter or drier places.

http://bit.ly/ZiPs2L

NASA Eyes Crew Deep Sleep Option for Mars Mission

A NASA-backed study explores an innovative way to dramatically cut the cost of a human expedition to Mars -- put the crew in stasis.

Oct 3, 2014 12:00 PM ET // by Irene Klotz

Last year, NASA announced the discovery of water on Mars. This posed a question to scientists: Could we grow plants in the soil of Mars? Trace explains what is necessary to grow crops on Earth, and if Mars is able to sustain life.

The deep sleep, called torpor, would reduce astronauts' metabolic functions with existing medical procedures. Torpor also can occur naturally in cases of hypothermia.

"Therapeutic torpor has been around in theory since the 1980s and really since 2003 has been a staple for critical care trauma patients in hospitals," aerospace engineer Mark Schaffer, with SpaceWorks Enterprises in Atlanta, said at the International Astronomical Congress in Toronto this week. "Protocols exist in most major medical centers for inducing therapeutic hypothermia on patients to essentially keep them alive until they can get the kind of treatment that they need."

Coupled with intravenous feeding, a crew could be put in hibernation for the transit time to Mars, which under the best-case scenario would take 180 days one-way. So far, the duration of a patient's time in torpor state has been limited to about one week.

"We haven't had the need to keep someone in (therapeutic torpor) for longer than seven days," Schaffer said. "For human Mars missions, we need to push that to 90 days, 180 days. Those are the types of mission flight times we're talking about."

Economically, the payoff looks impressive. Crews can live inside smaller ships with fewer amenities like galleys, exercise gear and of course water, food and clothing. One design includes a spinning habitat to provide a low-gravity environment to help offset bone and muscle loss.

SpaceWorks' study, which was funded by NASA, shows a five-fold reduction in the amount of pressurized volume need for a hibernating crew and a three-fold reduction in the total amount of mass required, including consumables like food and water. Overall, putting a crew in stasis cuts the baseline mission requirements from about 400 tons to about 220 tons. "That's more than one heavy-lift launch vehicle," Schaffer said.

The study looked at a two-part system for putting Mars-bound astronauts in stasis and bringing them out. The cooling would be done through an internasal system, which Schaffer admits is "not very comfortable," but inhaling a coolant has several advantages over reducing body temperatures with external cooling pads. Cooled from the outside, the body is more susceptible to shivering and possible tissue damage, Schaffer notes.

The so-called RhinoChill System lowers body temperature about 1 degree Fahrenheit per hour. Reaching torpor state -- between 89 degrees and 93 degrees Fahrenheit -- takes about six hours.

Simply stopping the flow of coolant will bring a person out of stasis, though the SpaceWorks study included rewarming pads as a backup and to speed up the waking process in case of an emergency.

An alternative to having the whole crew in stasis is to have one person awake for two to three days, then hibernate for 14 days. By staggering the shifts, no one person would be in stasis for more than 14 days at a time and one crewmember would be awake to monitor the ship, conduct science experiments and handle maintenance chores.

Schaffer also points to a potential psychological advantage to stasis. "Rather than being stuck in a can for 180 days, you go to sleep, you wake up and you're there," he said.

More research is needed to assure prolonged stasis is safe, but initial results are promising, Schaffer added. "We have not seen any show-stoppers on the medical side or on the engineering side," he said.

http://www.medscape.com/viewarticle/832777

Let's Stop the Unnecessary Treatment of Heart Disease

There are many reasons doctors suffer from burnout and compassion fatigue. One of the least-mentioned of these reasons is that much of what we do is so damned unnecessary.

John Mandrola

Editor's Note: *This blog entry originally posted at* drjohnm.org.

In the US, the land of excess everything, caregivers, especially cardiologists, spend most of our time treating human beings who didn't need to have disease. Let's be clear and honest: Lifestyle-related disease is largely unnecessary.

These days, there is so much unnecessary disease that caregivers, especially cardiologists, rarely see it. We look past the obesity right to the cholesterol number and ECG. And then we pull out the prescription pad for the guideline-directed pills. Just typing that causes me angst.

A man gets referred for AF ablation for symptomatic AF. Indeed, he has many AF episodes. But he also drinks alcohol excessively, weighs 300 pounds, and refuses to wear his sleep-apnea mask. You refuse to do a $100 000 procedure, and soon the reputation arrives: you are too conservative an ablationist. Mandrola won't do procedures.

My interventional-cardiology colleagues have it much worse. They are roused from sleep and family time to rush in and save people from mostly unnecessary MIs. One way to see the chorus of emergency PCI treatment of acute MI is with awe. Another is with utter frustration—because in most cases it was unnecessary.

The Study

A recent population-based prospective study of Swedish men suggested almost four of five MIs in men could be preventable.[1] (That's not a typo.) Researchers from the Institute of Environmental Medicine in Stockholm, Sweden, followed 20 721 men from 1997 to 2009. They specifically asked about five modifiable lifestyle behaviors: a healthy diet, moderate alcohol consumption, no smoking, being physically active, and having no abdominal fat (waist circumference.) There were 1361 cases of MI in the 11-year follow-up period.

heart*wire* journalist **Michael O'Riordan** recaps the details of the study here. The short story was that each of the five low-risk behaviors independently reduced the chance of having a heart attack. Not smoking was the strongest risk reducer. Men who combined all five behaviors were 86% less likely than those who had zero behaviors to have a heart attack.

The wake-up call

I realize everyone knows lifestyle is important to prevent heart disease. It's so obvious that we (patients and doctors) have grown numb to it. But pause for a moment and think about the finding that four of five heart attacks could be prevented with simple achievable lifestyle behaviors. That is something.

My electrophysiology colleague **Dr Prash Sanders** (Adelaide, Australia) stands in front of audiences of doctors and says risk-factor modifications, such as weight loss and blood-pressure control, are easy. The key word, he says, is motivation. The challenge for caregivers, especially us cardiologists, is to stop suppressing the idea that heart disease can't be prevented—that people won't do it. The first definition of the noun *motivation* is the reason or reasons one has for acting or behaving in a particular way. That's our job as caregivers.

My experience in the AF clinic in the past few years of lifestyle-enlightenment is that people can change. I've posted the lifestyle studies in the exam room. I discuss the biology of how lifestyle disease relates to the atria. I make the case that AF is (largely) unnecessary. I talk about atrial stretch and fibrosis, rotors, and inflammation.

We can do the same with vascular disease and diabetes and high blood pressure. Being active, eating well, not smoking, and carrying less body fat work because they favorably affect oxidative stress, inflammation, endothelial function, insulin sensitivity, and blood pressure. These are the reasons people should eat less, move more, and reduce their belt size. Reasons and expectations equal motivation.

The low-hanging fruit is right there. I say we reach up and grab it. Just thinking about doing fewer unnecessary things for unnecessary disease is soothing.

1. Åkesson A, Larsson SC, Discacciati A, Wolk A. Low-risk diet and lifestyle habits in the primary prevention of myocardial infarction in men: A population-based prospective cohort study. J Am Coll Cardiol 2014; 64:1299-1306. Abstract

http://wrd.cm/ZiSKDb

Ebola Explained: What You Should and Shouldn't Worry About

You should be afraid of Ebola—if you live in some parts of West Africa. But here in the United States? Not so much.

By Nadia Drake

With the first case of Ebola diagnosed in the country confirmed earlier this week, people are getting nervous. But Ebola is very unlikely to be a problem or cause a major outbreak here. One of the main reasons is that it is not as easily transmitted as other diseases. It does not travel through the air like influenza—to be infected you must come into contact with fluids from an infected person.

Even more importantly, until a person is showing signs of being sick—with symptoms like fever and nausea—they are NOT contagious.

Still, some are worried about the plane the infected man traveled on before he became symptomatic, and others are worried about coming into contact with his relatives in Dallas who've been in the same house as he has, but don't yet appear to be sick.

To help explain why these fears are unnecessary, we've taken a closer look at what the virus does in the human body, from transmission to infection to illness and death.

Transmission

"The virus doesn't easily go from one person to the next. It seems like it does, maybe, because Ebola is scary. It is unknown and has a high fatality rate and requires isolation or quarantine and has no known cure," said biochemist Sharon Crary, of DePauw University. Crary studies the Ebola virus and worked with the CDC's Viral Special Pathogens Branch, where she was part of the response team for the 2000 Ebola outbreak in Gulu, Uganda.

Ebola isn't anywhere near as contagious as the flu, for example. Or measles, which is much more of a threat in the United States now that people are no longer routinely vaccinating their children. Scientists estimate that one person infected with measles can transmit the disease to as many as 18 others; for Ebola, that number is around two.

This is because unlike influenza or measles, Ebola isn't very stealthy. It can't spread through the air, and it isn't contagious before symptoms first show up, when a person might unknowingly be a walking disease distributor. Rather, the Ebola virus spreads through infected bodily fluids—such as blood, vomit, saliva, semen and feces—which need to come into direct contact with a mucous membrane (such as the inside of your eyelids, mouth, or nose) or a bit of broken skin.

This is why a major outbreak is unlikely in the United States. The hospitals here are equipped to handle a disease like this, and infection control officers are ready to slam the brakes on any potential spread. It should be relatively easy to contain.

Still, if you're a health care worker in West Africa, this is a serious concern, especially because tiny, unnoticed abrasions on the skin can be a portal for viral particles (hence the need for gloves and moon suits). In regions without the necessary supplies, education or infrastructure to halt the spread of the disease, outbreaks can be catastrophic. This is what's happening in the West African countries of Liberia, Guinea, and Sierra Leone, where more than 3,300 people have died since December.

Infection

Though it is not that easily transmitted between people, the Ebola virus (Zaire ebolavirus) is frighteningly deadly: The average fatality rate is around 50 percent, but some strains kill as many as 90 percent of the people infected. There's no specific treatment for Ebola, either. As the virus gradually claims control of a victim, it ignites a hemorrhagic fever that sometimes comes with horrific symptoms, including bloody diarrhea and vomit.

Ebola virus particles are long and skinny, and look like lethal microscopic noodles. When they get inside a person, the particles attack the immune system, liver, kidneys, and the cells that line blood vessels.

Once inside a cell, the virus begins to wage war. First, it makes many copies of its genome. Then, it hijacks the machinery that would normally help the host cell make its own proteins, and turns that into a viral protein production factory. These proteins then self-assemble into mature virus particles, which slip through the cell's membrane and head off in search of more cells to infect.

"This cycle continues so the number of infected cells in a human increases exponentially," Crary said.

The first symptoms of Ebola, such as headache, high fever, aches, and nausea, don't show up until enough cells have been infected with the virus. This can take a while.

And it isn't until these symptoms show up that a person becomes infectious. Scientists aren't quite sure why this is, but studies in primates have shown that there are no viral particles in blood plasma before the onset of symptoms (in monkeys infected with Ebola, this tends to happen around three days post-exposure). Early, pre-symptomatic viral loads were the highest in the spleen and lymph nodes—things that would be very, very tricky to come into contact with.

"It seems to take a lot of virus particles to exist inside a patient before that virus starts entering the bodily fluids to be accessible to another person," Crary said. "And this high virus [concentration] doesn't happen until later in infection, when symptoms are already starting to show."

This is the simple reason you can't catch Ebola by sharing an airplane, or a dinner table, or a house, with someone who isn't showing signs of the disease. However, it appears that some people are worried about riding in the same airplanes that carried the first U.S. Ebola patient from Liberia to Texas, despite the fact that the patient was not sick while he was traveling.

"Even though health officials maintain there is no risk to passengers, if you were a passenger on a plane that had carried an Ebola victim, it might be something you would want to know," claims a story from ABC News

In reality, the information is completely inconsequential.

"The man was not symptomatic," Crary said. "He didn't have enough virus in his body to be able to be shedding any virus from his body. So there is simply no way that there is any virus on that plane that he was on."

Sickness and Death

It wasn't until the patient had been in Texas for several days that he began showing symptoms—about nine days after doctors suspect he was infected. Normal incubation periods range from two days to three weeks, with the majority of patients showing signs of illness between seven and 10 days after exposure, says mathematical epidemiologist Gerardo Chowell-Puente of Arizona State University.

Though these early symptoms can mimic the onset of the flu, what's going on inside a patient's body is very different from what happens with an influenza virus. At this point, an Ebola patient's liver is being attacked, producing severe abdominal pain. Their blood vessels are gradually being broken down, which can lead to massive amounts of both internal and external bleeding. Organ failure might be setting in. As fluids leak from blood vessels and organs and accumulate in the body, blood pressure drops. Usually, it's a deadly combination of abyssal blood pressure, electrolyte imbalance, and organ failure that delivers the final blow.

Nobody knows for sure how long the Ebola virus can survive outside a host. But 2007 study suggests that viral particles can survive for at least six hours at sub-Saharan Africa room temperatures—only in fluids like blood. But what we do know is that the dead are potent viral incubators that remain infectious for days, and disease transmission during traditional funeral rites is one of the ways this West Africa outbreak has persisted.

In the current West Africa outbreak, each infected person transmits the disease to an average of 1.5 or two susceptible people, Chowell-Puente says. This is one of the reasons some experts have a grim forecast for that outbreak, which could top 270,000 cases by the end of the year without proper intervention.

It's easy to see how, in an age where airplanes make continent-hopping as simple as owning a passport and buying a ticket, people worldwide might be frightened about the spread of deadly diseases. And it's not hard to imagine a situation in which the Ebola virus could gain a foothold outside of Africa. But in the United States, there's no reason to be scared of Ebola.

http://nyti.ms/1tqIYGM

A Plan to Use Survivors' Blood for Ebola Treatment in Africa

With no proven drugs to treat Ebola and experimental ones in short supply, the health authorities are planning to turn instead to a treatment that is walking around in the outbreak zone in West Africa.

By ANDREW POLLACK OCT. 3, 2014

That would be the blood of people who have been sickened by the Ebola virus but have since recovered. Their blood should contain antibodies that might help other patients fight off the infection.

The World Health Organization is making it a priority to try such convalescent blood or plasma, as it is called, and is talking with the affected countries about how to do it. This week, the organization issued guidance on how to collect the blood and administer transfusions.

"The concept that this treatment could be efficacious is biologically plausible, as convalescent plasma has been used successfully for the treatment of a variety of infectious agents," the W.H.O. guidance document says.

Plausibility, however, is not proof that such treatments would work for Ebola and There will also be logistical problems carrying this out in West Africa, where blood banks are not well developed. One challenge will be to make sure that the donated blood, even if it helps patients recover from Ebola, does not give them

H.I.V. or hepatitis. “Major questions need to be answered about the safety and efficacy of convalescent therapies, and the feasibility of implementation in countries with shattered health systems and an acute shortage of medical staff,” the W.H.O. said in a separate statement released a week ago.

Still, with the epidemic spiraling out of control, there is a sense that some treatment needs to be offered, even if only to give sick people hope and a reason to go to medical centers, where they can be stopped from spreading the disease to others. And there are really no other good options.

“The attraction is, at least on the surface, it is something that could be implemented readily,” said Dr. Daniel Bausch, an expert on Ebola at Tulane University and an adviser to the health organization.

The Bill & Melinda Gates Foundation and the Wellcome Trust are among the organizations championing convalescent plasma and working on how to put it into effect. “Blood is donated in West Africa every day of the week for surgery and other things and could be safely tested for viruses,” said Dr. Jeremy Farrar, director of the Wellcome Trust.

Such therapies have already been used in the current outbreak. Dr. Kent Brantly, an American aid worker who contracted Ebola in Liberia, received a blood transfusion from a boy who had recovered. After Dr. Brantly survived his bout with the disease, some of his plasma was given to another American aid worker, Dr. Rick Sacra, who also recovered. But it is not known whether the transfusions helped in those cases, since both men also received experimental drugs and excellent supportive care in American hospitals.

Authorities say this approach has been used in Africa, but to a limited extent. There have even been rumors of a black market for the blood of survivors. Dr. Margaret Chan, the director general of the W.H.O., said in a news conference last month that her organization would work to stamp out underground use of blood because such a therapy must be administered properly and safely.

Continue reading the main story

The use of blood or plasma — either from recovered patients or from animals deliberately exposed to a pathogen — dates from the late 1800s, and for decades was a mainstay of treatment for infectious diseases. Emil von Behring, a German physician scientist, won the first Nobel Prize in Physiology or Medicine in 1901 for pioneering the serum approach for diphtheria.

Convalescent therapies were used, apparently with some success, in the Spanish flu pandemic of 1918. And such treatments are still used for rabies, snake bites, hepatitis A and B, and other diseases. But for some viral diseases, like hepatitis C and the human immunodeficiency virus, it has not been shown to work.

Many of the treatments used today are made by pooling the plasma of many donors and processing it to get high concentrations of the desired antibodies. That is probably not going to be feasible in Africa because of a lack of technology and the large-scale facilities to do it, according to executives in the plasma products industry.

The simplest approach would be to use whole blood donated by one person and transfused into another. That has some risk of side effects, like allergic reactions, though not much if the blood types of donor and recipient match.

A better approach, experts say, would be to transfuse only plasma, the clear part of the blood that contains the antibodies. Plasma can be obtained by letting the blood cells settle and drawing off the plasma.

Even better would be to use apheresis machines, which collect only the plasma from the donor. People can donate plasma alone much more frequently than they can donate whole blood, which can be an advantage if there are not many survivors willing to donate. Experts say it would be feasible to bring in such machines for use in the better-equipped treatment centers in West Africa.

One challenge could be testing donated blood to make sure it is truly free of Ebola virus, as well as of H.I.V., hepatitis B, hepatitis C and syphilis.

Albert Farrugia, vice president for global access at the Plasma Protein Therapeutics Association, a trade group, said there are ways to inactivate viruses in donated plasma that might be feasible to deploy in Africa. One such approach treats the plasma with solvents and detergents in a plastic bag.

Convalescent blood or plasma has been tried for Ebola since the virus first emerged in 1976. That year, a woman in the Democratic Republic of Congo, known then as Zaire, received plasma from a person who had recovered from the related Marburg virus, however, she still died, according to the health organization.

In November of that year, a researcher in Britain who was working with material from the African outbreak accidentally pricked himself and got sick. He received two transfusions of serum from survivors in Africa, as well as the antiviral drug interferon. He eventually recovered.

In the 1995 outbreak in Kikwit, also in Congo, seven of eight people who received convalescent whole blood survived, a survival rate far better than the 20 percent for the outbreak as a whole. Still, the patients got a higher than usual standard of care that may have accounted, in part, for the better survival rate.

Testing in primates has not found serum to be effective against Ebola. After one of their negative studies, United States government researchers wrote in a 2007 paper: “Given these discouraging results and the risks of transmitting infection,

whole-blood transfusions, even under desperate epidemic conditions, seem unwarranted."

But now there are desperate conditions and plans are moving ahead. One of the authors of that paper, Dr. Thomas W. Geisbert, now with the University of Texas Medical Branch in Galveston, said that as long as the blood was adequately screened for viruses, the transfusions should do no harm, even if they do not help. The W.H.O. says trying such therapies will have a benefit beyond Ebola by developing the capacity in West Africa to do transfusions in general. That could help in treating injuries, other diseases like malaria and yellow fever, and complications of childbirth.

Correction: October 3, 2014

A previous version of this article misquoted a statement by the World Health Organization. The organization said, in part, "...the feasibility of implementation in countries with shattered health systems...," not "...the feasibility of implantation in countries with shattered health systems..."

http://www.bbc.com/news/health-29343210

Chagas disease - inheriting a silent killer

A silent killer once confined to Latin America now has gone global. **By Gabriela Torres BBC Health Check**

The "assassin bug" - which spreads Chagas disease - thrives in countries like Bolivia. But up to 80,000 migrants from Latin America are now living with the illness in Spain - and no one can predict who will get serious health complications.

Every time Briggitte Jordan remembers the first time she heard of Chagas she becomes tearful. When she was a teenager living in Bolivia, Briggitte's mother told her that she'd tested positive for Chagas. "The doctors didn't give her much information, only that she was another statistic, and what was going to happen was that my mother might die young," she recalls now living in Madrid, nearly 20 years later.

Chagas is spread by the bite of an insect - the "assassin bug" - which infects people with a parasite. If untreated, this can cause organ damage and lead to premature death. But in the early stages there are few or no symptoms, so getting the word out about the disease is essential.

Football is like a magnet for most Latin Americans, so today Briggitte is at a match at Villaverde sports centre in Madrid. She and her colleagues from Mundo Sano (Healthy World) give out balloons and ribbons to spectators. As the whistle blows for half time, traditional Bolivian dance is performed on the pitch, while the talk on the touchline is all about Chagas. They hope myth-busting and accurate information will encourage people to get tested.

And so they should: the parasite *Trypanosoma cruzi* that causes the disease hides inside the muscle fibres of the heart, the digestive system or peripheral nervous system, gradually damaging organs. By the time they notice symptoms, patients may have developed serious complications in the heart or digestive system. Briggitte thought her mother would only live until her 40s or 50s. "That's what you hear in our country."

Dreaded result

The nocturnal insect that spreads Chagas is widespread in the Americas. Officially called *Triatoma infestans*, its habit of biting humans around the mouth gave it another nickname - 'the kissing bug'. Like another 2.3m Latin Americans who have moved abroad, Briggitte and her mother migrated to Spain, where they found out that treatment was available. They also discovered there was a chance Briggitte could have Chagas, since a mother can pass it onto her child before birth.

In parts of the world where the kissing bug doesn't exist, the parasite can still be spread by infected people via blood transfusions, organ transplants, or in the womb. Outside Latin America, the United States has the highest number of cases, followed by Spain. It is estimated that between 40,000 and 80,000 Latin Americans in Spain - mainly from Bolivia - have either the disease or the parasite. And around 90% of those do not know they have it.

It took Briggitte more than a year to overcome her fears and finally get tested. "To be honest, I was afraid. I missed one or two appointments and I think it was at the third one that I finally decided to get screened." After two weeks she got the news that she dreaded: she had tested positive.

Preventing transmission

Even though 70% of people with the Chagas parasite will never develop symptoms, they can still pass it on. That's why preventing transmission from mother to child is a key challenge, according to Dr Miriam Navarro, a researcher from Mundo Sano, an organisation in Spain that helps to control and eliminate neglected diseases.

"It is compulsory to check blood transfusions and organ transplants, but we don't have a protocol to screen all pregnant women who are from Latin America. "Even though at the moment many doctors are aware of Chagas disease, there is still a lack of information."

Altagracia Prieto is another Bolivian woman who tested positive. She saw three specialists before the test was offered to her. "I've always suspected that I had Chagas. We had the insect at home [in Bolivia], but because I never developed symptoms I wanted to believe I didn't have it."

Dr Navarro runs the awareness campaign Madres comprometidas con la enfermedad de Chagas (Mothers against Chagas disease), to get as many people

diagnosed as possible. "The main difficulty that we face is the lack of information from migrants coming from endemic areas." "We have to let people know that a treatment is available for Chagas disease, a treatment that in many patients works well," adds Navarro.

There are just two drugs available to treat the parasite that causes the illness, benznidazole and nifurtimox. Both medicines were developed in the 1970s. They have to be taken for two months and each can have strong side effects - such as allergic dermatitis with benznidazole and polyneuropathy - a disease affecting peripheral nerves - with nifurtimox.

"Relief"

"However, this is what we currently have and they are effective," says Navarro, who also explains that the latest research shows that treatment before pregnancy prevents transmission to the child.

That is what motivated Briggitte to make up her mind to be treated. She was 25 and wanted to have a family, but didn't want to pass the parasite on to her future offspring. Her body rejected benznidazole and she had to go for the second drug option. Five years after the treatment, the levels of antibodies show a significant reduction in the level of parasite infection in her body.

Currently there is no specific test for Chagas, so the only way to detect its presence is by checking the levels of specific antibodies. After the treatment, the patient has to be tested regularly for those levels.

Together with Altagracia and two other Bolivian mothers who have Chagas, Briggitte now takes every opportunity to talk to people in Spain - especially mothers or young women - about this silent killer. They go to churches, football matches and pubs. They have a free help-line for people to call and even accompany them to hospital to get screened - because they know how difficult that first step can be for those fearing the worst.

As for her own condition, Briggitte has learned to be positive about it. "I'm very calm, because watching my daughter and knowing that she doesn't have it is a relief."

http://www.eurekalert.org/pub_releases/2014-10/jhm-cd100214.php

'Unsung' cells double the benefits of a new osteoporosis drug

Added drug testing in mice shows role of preosteoclasts in maintaining bone health

Experiments in mice with a bone disorder similar to that in women after menopause show that a scientifically overlooked group of cells are likely crucial to the process of bone loss caused by the disorder, according to Johns Hopkins researchers. Their discovery, they say, not only raises the research profile of the cells, called preosteoclasts, but also explains the success and activity of an experimental osteoporosis drug with promising results in phase III clinical trials. A summary of their work will be published on Oct. 5 in the journal Nature Medicine.

"We didn't know that the drug affects preosteoclasts, nor did we understand how important preosteoclasts are in maintaining healthy bones," says Xu Cao, Ph.D., the Lee H. Riley Jr., M.D., Professor of Orthopaedic Surgery. "Now drug companies hoping to reverse osteoporosis can look for even more drugs that make use of and target these interesting cells."

The bones of mice, people and all land animals are not only necessary for strength and structure, but also as warehouses for calcium, which cells throughout the body use continuously for everyday tasks like cell-to-cell communication, muscle strength, and even embryo fertilization and hormone balance.

Calcium is taken from digested food and stored in the semihollow space inside bones. To access the stored calcium, the inner bone goes through a process called resorption, in which cells called osteoclasts attach to the bone and dissolve the calcium and other stored minerals. Nearby, specialized blood vessels pick up the calcium and send it throughout the body. They also bring in nutrients needed for new bone formation.

Under normal conditions, bone resorption is carefully balanced with bone rebuilding to maintain bone strength. But in women who have entered menopause, decreases in estrogen can cause bone resorption to overcome bone rebuilding, leading to osteoporosis and frequent bone breaks. In the U.S., an estimated 25 million women have osteoporosis.

"Most osteoporosis drugs on the market slow down bone resorption but do nothing to encourage bone rebuilding," says Cao. Previous data, including that from early clinical trials in humans, indicated that the drug odanacatib decreases bone resorption by hobbling CTSK, one of the enzymes used to resorb bone. What came as a pleasant surprise was that the same drug also increased bone rebuilding, but the question was how it did so, Cao says.

To learn more, Cao and his team studied mice genetically engineered to have neither bone-dissolving osteoclasts nor their precursors, preosteoclasts. Though the inner bones of the mice were abnormal, as expected, the team also found that the outside layers of the bones were thin. Moreover, the specialized blood vessels needed to transport bone-building supplies were in scarce supply, suggesting overall that osteoclasts and their precursors regulate bone building and bone resorption.

The team grew the two cell types separately in the laboratory and collected the liquid around them to test for proteins released by the cells. They found that

preosteoclasts — but not mature osteoclasts — secrete a protein called PDGF-BB, which is a powerful attracter both of cells that make bone-building cells and those that make the specialized blood vessels. As expected, when the preosteoclasts of mice were prevented from making PDGF-BB, the mice had weak bones.

"Before a new building is constructed, the roads have to be in place so that the materials and equipment can be brought in," says Cao. "In a similar way, preosteoclasts call blood vessels into an area before bone-building cells begin to make new bone."

When mice were given L-235, the animal form of odanacatib, the numbers of their preosteoclasts and osteoclasts increased, and they secreted more PDGF-BB. The increased PDGF-BB brought in more cells for making blood vessels and bone, which led to more of the specialized blood vessels and thicker bones.

To see if the drug could help reverse the increased bone resorption and decreased blood vessel formation of postmenopausal osteoporosis, the researchers simulated menopause in female mice by removing their ovaries. At first, the mice had thinner bones and fewer blood vessels, but treatment with the drug increased the concentration of PDGF-BB in the blood, the number of specialized blood vessels both inside and outside of the bones, and the overall thickness and density of the bone.

According to Cao, in addition to slowing bone resorption by blocking CTSK, an osteoclast "weapon," the drug also appears to slow down the maturation of preosteoclasts, lengthening the amount of time they secrete PDGF-BB before becoming osteoclasts. With increased PDGF-BB, more specialized blood vessels are made and more bone-building cells arrive, restoring the balance between bone resorption and bone rebuilding.

Odanacatib is produced by Merck & Co. Inc. and has already gone through phase III clinical trials with good results, according to Cao. "It is unusual to see a single drug that decreases bone resorption and increases bone rebuilding at the same time," says Cao. "Beyond that, we now know just how important preosteoclasts and PDGF-BB are to bone building, which is information we can use in designing future studies."

Other authors of the report include Hui Xie, Zhuang Cui, Long Wang, Zhuying Xia, Yin Hu, Lingling Xian, Changjun Li, Liang Xie, Janet Crane, Mei Wan, Gehua Zhen, Qin Bian, Weizhong Chang and Tao Qiu of the Johns Hopkins University School of Medicine, plus additional authors from other institutions.

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