http://bit.ly/15Gui1Z

Extreme Shrimp May Hold Clues to Alien Life

Shrimp called Rimicaris hybisae at deep hydrothermal vents in the Caribbean seem to have different dietary habits depending on the proximity of other shrimp.

At one of the world's deepest undersea hydrothermal vents, tiny shrimp are piled on top of each other, layer upon layer, crawling on rock chimneys that spew hot water. Bacteria, inside the shrimps' mouths and in specially evolved gill covers, produce organic matter that feed the crustaceans.

Scientists at NASA's Jet Propulsion Laboratory in Pasadena, California, are studying this mysterious ecosystem in the Caribbean to get clues about what life could be like on other planetary bodies, such as Jupiter's icy moon Europa, which has a subsurface ocean. "For two-thirds of the Earth's history, life has existed only as microbial life," said Max Coleman, senior research scientist at JPL. "On Europa, the best chance for life would be microbial."

The particular bacteria in the vents are able to survive in extreme environments because of chemosynthesis, a process that works in the absence of sunlight and involves organisms getting energy from chemical reactions.

In this case, the bacteria use hydrogen sulfide, a chemical abundant at the vents, to make organic matter. The temperatures at the vents can climb up to a scorching 750 degrees Fahrenheit (400 degrees Celsius), but waters just an inch away are cool enough to support the shrimp. The shrimp are blind, but have thermal receptors in the backs of their heads.

"The overall objective of our research is to see how much life or biomass can be supported by the chemical energy of the hot submarine springs," Coleman said.

Hydrogen sulfide is toxic to organisms in high concentrations, but the bacteria feeding the shrimp need a certain amount of this chemical to survive. Nature has worked out a solution: The shrimp position themselves on the very border between normal, oxygenated ocean water and sulfide-rich water so that they and the bacteria can coexist in harmony.

"It's a remarkable symbiotic system," Coleman said.

Coleman was part of a team led by Chris German at the Woods Hole Oceanographic Institution, in Woods Hole, Massachusetts, that discovered these vents in 2009, off the west coast of Cuba. This research, funded under NASA's Astrobiology Science and Technology for Exploring Planets program, detected the vents by picking up the chemical signals of their plumes of water in the ocean. The researchers returned in 2012 on the RV Atlantis with a robotic vehicle called Jason, supported by the National Science Foundation. Scientists collected extensive specimens from two hydrothermal vent fields: The Von Damm field at 7,500 feet (2,300 meters) and Piccard at more than 16,000 feet (4,900 meters), which is the world's deepest.

Coleman and collaborator Cindy Van Dover, marine biologist at Duke University, Durham, North Carolina, examined the shrimp for the first time when the same team returned in 2013 on the RV Falkor, provided by the Schmidt Ocean Institute in Palo Alto, California. Van Dover returned soon after using the robotic vehicle Hercules aboard the Exploration Vessel Nautilus, and did more collections and studies.

A bonus finding from studying this extreme oasis of life is that some of the shrimp, called Rimicaris hybisae, appear to be cannibalistic. The researchers discovered that when the shrimp arrange themselves in dense groups, bacteria seem to be the main food supplier, as the shrimp likely absorb the carbohydrates that the bacteria produce. But in areas where the shrimp are distributed more sparsely, the shrimp are more likely to turn carnivorous, eating snails, other crustaceans, and even each other.

Although the researchers did not directly observe Rimicaris hybisae practicing cannibalism, scientists did find bits of crustaceans in the shrimps' guts. And Rimicaris hybisae is the most abundant crustacean species in the area by far.

"Whether an animal like this could exist on Europa heavily depends on the actual amount of energy that's released there, through hydrothermal vents," said Emma Versteegh, a postdoctoral fellow at JPL.

The group received funding for shrimp-collecting expeditions from NASA's Astrobiology Science and Technology for Exploring Planets (ASTEP) program, through a project called "Oases for Life." That name is especially appropriate for this investigation, Coleman said. "You go along the ocean bottom and there's nothing, effectively," Coleman said. "And then suddenly we get these hydrothermal vents and a massive ecosystem. It's just literally teeming with life."

http://bit.ly/1FAllno

Why Have Our Brains Started to Shrink?

Christopher Stringer, a paleoanthropologist and research leader on human origins at the Natural History Museum in London, replies:

Indeed, skeletal evidence from every inhabited continent suggests that our brains have become smaller in the past 10,000 to 20,000 years. How can we account for this seemingly scary statistic?

Some of the shrinkage is very likely related to the decline in humans' average body size during the past 10,000 years. Brain size is scaled to body size because a larger body requires a larger nervous system to service it. As bodies became smaller, so did brains. A smaller body also suggests a smaller pelvic size in females, so selection would have favored the delivery of smaller-headed babies.

What explains our shrinking body size, though? This decline is possibly related to warmer conditions on the earth in the 10,000 years after the last ice age ended. Colder conditions favor bulkier bodies because they conserve heat better. As we have acclimated to warmer temperatures, the way we live has also generally become less physically demanding, which overall serves to drive down body weights.

Another likely reason for this decline is that brains are energetically expensive and will not be maintained at larger sizes unless it is necessary. The fact that we increasingly store and process information externally - in books, computers and online - means that many of us can probably get by with smaller brains. Some anthropologists have also proposed that larger brains may be less efficient at certain tasks, such as rapid computation, because of longer connection pathways.

The way we live may have affected brain size. For instance, domesticated animals have smaller brains than their wild counterparts probably because they do not require the extra brainpower that could help them evade predators or hunt for food. Similarly, humans have become more domesticated. But as long as we keep our brains fit for our particular lifestyles, there should be no reason to fear for the collective intelligence of our species.

http://www.eurekalert.org/pub_releases/2014-11/jhub-srf112014.php

Suicide risk falls substantially after talk therapy

Researchers find repeat suicide attempts and deaths by suicide plummet even years after treatment

Repeat suicide attempts and deaths by suicide were roughly 25 percent lower among a group of Danish people who underwent voluntary short-term psychosocial counseling after a suicide attempt, new Johns Hopkins Bloomberg School of Public Health-led research suggests.

The findings are believed to be the first to show that talk therapy-focused suicide prevention actually works, averting future suicide attempts in this very high-risk population. Although just six-to-ten talk therapy sessions were provided, researchers found long-term benefits: Five years after the counseling ended, there were 26 percent fewer suicides in the group that received treatment as compared to a group that did not.

A study on the findings is published online Nov. 24 in Lancet Psychiatry.

"We know that people who have attempted suicide are a high-risk population and that we need to help them. However, we did not know what would be effective in terms of treatment," says the study's leader, Annette Erlangsen, DPH, an adjunct associate professor in the Department of Mental Health at the Johns Hopkins Bloomberg School of Public Health. "Now we have evidence that psychosocial treatment - which provides support, not medication - is able to prevent suicide in a group at high risk of dying by suicide."

The researchers say their findings suggest that it might be valuable to broadly implement therapy programs for people who have attempted suicide in the past.

In Denmark, which has free health care for its citizens, the first suicide prevention clinics were opened in 1992 for people at risk of suicide but not in need of psychiatric hospitalization. The clinics were opened nationwide in 2007.

For the multi-center study, the researchers analyzed Danish health data from more than 65,000 people in Denmark who attempted suicide between Jan. 1, 1992 and Dec. 31, 2010. Of that group, they looked at 5,678 people who received psychosocial therapy at one of eight suicide prevention clinics. The researchers then compared their outcomes over time with 17,304 people who had attempted suicide and looked similar on 31 factors but had not gone for treatment afterward. Participants were followed for up to 20 years.

The researchers found that during the first year, those who received therapy were 27 percent less likely to attempt suicide again and 38 percent less likely to die of any cause. After five years, there were 26 percent fewer suicides in the group that had been treated following their attempt. After 10 years, the suicide rate for those who had therapy was 229 per 100,000 compared to 314 per 100,000 in the group that did not get the treatment.

The therapy itself varied depending on the individual needs of the patient so the researchers can't say exactly what the "active ingredient" was that inoculated many against future suicide attempts. While it is possible that it was simply the provision of a safe, confidential place to talk, the researchers say they plan to gather more data on which specific types of therapy may have worked better than others.

Study co-author Elizabeth A. Stuart, PhD, an associate professor in the Bloomberg School's Department of Mental Health, says that before this, it was not possible to determine whether a specific suicide prevention treatment was working. It isn't ethical to do a randomized study where some get suicide prevention therapy while others don't, Stuart says. That the Danish clinics were rolled out slowly and participation was voluntary, and that extensive baseline and long-term follow-up data were available on such a large group of people, gave the researchers the best way to gather this kind of information.

"Our findings provide a solid basis for recommending that this type of therapy be considered for populations at risk for suicide," she says.

"Short and long term effects of psychosocial therapy provided to persons after deliberate self-harm: a register-based, nationwide multicentre study using propensity score matching" was written by Annette Erlangsen, Bertel Dam Lind, Elizabeth A Stuart, Ping Qin, Elsebeth

Stenager, Kim Juul Larsen, August Wang, Marianne Hvid, Ann Colleen Nielsen, Christian Møller Pedersen, Jan-Henrik Winsløv, Charlotte Langhoff, Charlotte Mühlmann and Merete Nordentoft.
The research was funded by the Danish Health Insurance Foundation, the Research Council of Psychiatry, Region of Southern Denmark, the Research Council of Psychiatry, Capital Region of Denmark, and the Strategic Research Grant from Health Sciences, Capital Region of Denmark. Stuart's time on the projects was partially supported by a grant from the National Institutes of Health's National Institute of Mental Health (1R01MH099010).

http://nyti.ms/1vUOrgq

Solar and Wind Energy Start to Win on Price vs. Conventional Fuels

In a study, the cost of wind power came in as low as 1.4 cents a kilowatt-hour.

By DIANE CARDWELLNOV. 23, 2014

For the solar and wind industries in the United States, it has been a long-held dream: to produce energy at a cost equal to conventional sources like coal and natural gas.

That day appears to be dawning. The cost of providing electricity from wind and solar power plants has plummeted over the last five years, so much so that in some markets renewable generation is now cheaper than coal or natural gas.

Utility executives say the trend has accelerated this year, with several companies signing contracts, known as power purchase agreements, for solar or wind at prices below that of natural gas, especially in the Great Plains and Southwest, where wind and sunlight are abundant.

Those prices were made possible by generous subsidies that could soon diminish or expire, but recent analyses show that even without those subsidies, alternative energies can often compete with traditional sources.

In Texas, Austin Energy signed a deal this spring for 20 years of output from a solar farm at less than 5 cents a kilowatt-hour. In September, the Grand River Dam Authority in Oklahoma announced its approval of a new agreement to buy power from a new wind farm expected to be completed next year. Grand River estimated the deal would save its customers roughly $50 million from the project. And, also in Oklahoma, American Electric Power ended up tripling the amount of wind power it had originally sought after seeing how low the bids came in last year.

“Wind was on sale - it was a Blue Light Special,” said Jay Godfrey, managing director of renewable energy for the company. He noted that Oklahoma, unlike many states, did not require utilities to buy power from renewable sources.

“We were doing it because it made sense for our ratepayers,” he said.

According to a study by the investment banking firm Lazard, the cost of utility-scale solar energy is as low as 5.6 cents a kilowatt-hour, and wind is as low as 1.4 cents. In comparison, natural gas comes at 6.1 cents a kilowatt-hour on the low end and coal at 6.6 cents. Without subsidies, the firm’s analysis shows, solar costs about 7.2 cents a kilowatt-hour at the low end, with wind at 3.7 cents.

“It is really quite notable, when compared to where we were just five years ago, to see the decline in the cost of these technologies,” said Jonathan Mir, a managing director at Lazard, which has been comparing the economics of power generation technologies since 2008.

Mr. Mir noted there were hidden costs that needed to be taken into account for both renewable energy and fossil fuels. Solar and wind farms, for example, produce power intermittently - when the sun is shining or the wind is blowing - and that requires utilities to have power available on call from other sources that can respond to fluctuations in demand. Alternately, conventional power sources produce pollution, like carbon emissions, which face increasing restrictions and costs.

But in a straight comparison of the costs of generating power, Mr. Mir said that the amount solar and wind developers needed to earn from each kilowatt-hour they sell from new projects was often “essentially competitive with what would otherwise be had from newly constructed conventional generation.”

Experts and executives caution that the low prices do not mean wind and solar farms can replace conventional power plants anytime soon.

“You can’t dispatch it when you want to,” said Khalil Shalabi, vice president for energy market operations and resource planning at Austin Energy, which is why the utility, like others, still sees value in combined-cycle gas plants, even though they may cost more. Nonetheless, he said, executives were surprised to see how far solar prices had fallen. “Renewables had two issues: One, they were too expensive, and they weren’t dispatchable. They’re not too expensive anymore.”

According to the Solar Energy Industries Association, the main trade group, the price of electricity sold to utilities under long-term contracts from large-scale solar projects has fallen by more than 70 percent since 2008, especially in the Southwest.

The average upfront price to install standard utility-scale projects dropped by more than a third since 2009, with higher levels of production. The price drop extends to homeowners and small businesses as well; last year, the prices for residential and commercial projects fell by roughly 12 to 15 percent from the year before.

The wind industry largely tells the same story, with prices dropping by more than half in recent years. Emily Williams, manager of industry data and analytics at the American Wind Energy Association, a trade group, said that in 2013 utilities

signed "a record number of power purchase agreements and what ended up being historically low prices."

Especially in the interior region of the country, from North Dakota down to Texas, where wind energy is particularly robust, utilities were able to lock in long contracts at 2.1 cents a kilowatt-hour, on average, she said. That is down from prices closer to 5 cents five years ago. "We're finding that in certain regions with certain wind projects that these are competing or coming in below the cost of even existing generation sources," she said.

Both industries have managed to bring down costs through a combination of new technologies and approaches to financing and operations. Still, the industries are not ready to give up on their government supports just yet.

Already, solar executives are looking to extend a 30 percent federal tax credit that is set to fall to 10 percent at the end of 2016. Wind professionals are seeking renewal of a production tax credit that Congress has allowed to lapse and then reinstated several times over the last few decades.

Senator Ron Wyden, the Oregon Democrat, who for now leads the Finance Committee, held a hearing in September over the issue, hoping to push a process to make the tax treatment of all energy forms more consistent.

"Congress has developed a familiar pattern of passing temporary extensions of those incentives, shaking hands and heading home," he said at the hearing. "But short-term extensions cannot put renewables on the same footing as the other energy sources in America's competitive marketplace."

Where that effort will go now is anybody's guess, though, with Republicans in control of both houses starting in January.

http://news.sciencemag.org/earth/2014/11/space-rock-impacts-not-random

Space rock impacts not random

When it comes to small space rocks blowing up in Earth's atmosphere, not all days are created equal.

Sid Perkins

Scientists have found that, contrary to what they thought, such events are not random, and these explosions may occur more frequently on certain days. Large objects can survive a trip through Earth's atmosphere relatively intact, but many smaller bodies break up at high altitude, sometimes in an immense burst of energy. Researchers used data from sensors designed to detect clandestine nuclear tests, among other sources, to identify airbursts with an energy equivalent to or larger than that released by 1 kiloton of exploding TNT. Between 2000 and 2013, they identified 33 such events (including the meteoroid that blazed into the atmosphere and detonated over Chelyabinsk, Russia, in February 2013, see image; the large blip in the meteor trail at right denotes where the 500-kiloton airburst occurred). Of those events, there were nine pairs of explosions - or airbursts - that occurred within one calendar day of each other, the researchers will report in January in the Monthly Notices of the Royal Astronomical Society. There's a less than 2% chance of finding nine such pairs in a random sample, the researchers note. The data set also sports 16 pairs of events with three or fewer calendar days' difference, which for a random sample could be statistically expected only about 2.2% of the time - a number of coincidences that is simply too high to be the result of chance alone, the researchers contend. Rather than random occurrences, many large airbursts might result from collisions between Earth and streams of debris associated with small asteroids or comets. The new findings may help astronomers narrow their search for objects in orbits that threaten Earth, the researchers suggest.

http://www.eurekalert.org/pub_releases/2014-11/caos-ssr112114.php

Scientists solve reptile mysteries with landmark study on the evolution of turtles

The California Academy of Sciences uses next generation sequencing technology to define a turtle 'tree of life' linking turtles to dinosaurs

SAN FRANCISCO - A team of scientists, including researchers from the California Academy of Sciences, has reconstructed a detailed "tree of life" for turtles. The specifics of how turtles are related - to one another, to other reptiles, and even to dinosaurs - have been hotly debated for decades. Next generation sequencing technologies in Academy labs have generated unprecedented amounts of genetic information for a thrilling new look at turtles' evolutionary history. These high-tech lab methods revolutionize the way scientists explore species origins and evolutionary relationships, and provide a strong foundation for future looks into Earth's fossil record.

Research results, appearing in Molecular Phylogenetics and Evolution, describe how a new genetic sequencing technique called Ultra Conserved Elements (UCE) reveal turtles' closest relatives across the animal kingdom. The new genetic tree uses an enormous amount of data to refute the notion that turtles are most closely related to lizards and snakes. Instead, authors place turtles in the newly named group "Archelosauria" with their closest relatives: birds, crocodiles, and dinosaurs. Scientists suspect the new group will be the largest group of vertebrates to ever receive a new scientific name.

The UCE technique used in high-tech labs allowed scientists to move beyond years of speculation and place the Archelosauria group in its rightful place on the reptile tree of life. UCE has been available since 2012, yet scientists are just

beginning to tap its potential for generating enormous amounts of genetic data across vertebrates.

"Calling this is an exciting new era of sequencing technology is an understatement," says Brian Simison, PhD, Director of the Academy's Center for Comparative Genomics (CCG) that analyzed the study's massive amount of data. The CCG is a state-of-the-art facility comprised of a sequencing lab, frozen DNA collection, and computing resources that serves as the Academy's core genetic center. Established in the summer of 2008, the CCG continues to refine Academy research - including new turtle findings - on a global, evolutionary scale.

"In the space of just five years, reasonably affordable studies using DNA sequencing have advanced from using only a handful of genetic markers to more than 2,000 - an unbelievable amount of DNA," adds Simison. "New techniques like UCE dramatically improve our ability to help resolve decades-long evolutionary mysteries, giving us a clear picture of how animals like turtles evolved on our constantly-changing planet."

Major findings also resolve an evolutionary mystery surrounding softshell turtles - a bizarre group of scale-less turtles with snorkel-like snouts. Until now, studies linked softshell turtles with a smaller semi-aquatic group called mud turtles, despite the fact that softshells appear in the fossil record long before their mud-loving counterparts. The Academy's study places softshells in a league of their own on the evolutionary tree, quite far removed from any turtle relatives. Their long independent history helps explain their striking looks as well as their ancient presence in the fossil record.

Study coauthor James Parham, PhD - Academy Research Associate, Assistant Professor of Geological Sciences at Cal State Fullerton, and renowned turtle expert - says cutting-edge testing techniques bring a new level of clarity to more than two decades of his turtle research. With large amounts of data backing up each evolutionary branch on the turtle tree of life, scientists are able to compare their evolution not only across species, but also across each continent's corresponding fossil records.

"I have been working on the evolutionary relationships of turtles for over 20 years using a variety of methods," says Parham. "Fossils are essential for showing us what extinct turtles looked like, but also in letting us know when and where they lived in the past."

Parham notes that studying turtle fossils - particularly the physical features of their bones - hasn't always painted an accurate evolutionary picture of turtle relationships across continents and through time. "The turtle tree of life based on fossil turtle anatomy didn't match up with the timing of their appearance in the fossil record, as well as their geography," Parham says. "But the tree of life generated at the Academy's CCG is consistent with time and space patterns we've gathered from the fossil record. These new testing techniques help reconcile the information from DNA and fossils, making us confident that we've found the right tree."

http://www.eurekalert.org/pub_releases/2014-11/mhif-sfm112014.php

Study finds most older adults qualify for statin therapy under new cholesterol guidelines

In a cohort of individuals aged 66-75 years, 97 percent now qualify for a statin

MINNEAPOLIS, MN - Nearly all individuals in their late 60s and early 70s - including 100 percent of men - now qualify for and should consider starting a statin medication to reduce their risk of cardiovascular disease, under the recently released cholesterol guidelines from the American College of Cardiology (ACC) and the American Heart Association (AHA).

That's according to a research letter published today in the 11/20/2014 (JAMA-IM) by Michael D. Miedema, MD, MPH, a research cardiologist at Minneapolis Heart Institute Foundation and cardiologist at Minneapolis Heart Institute® at Abbott Northwestern Hospital.

Released in November 2013, the ACC/AHA guidelines for the treatment of blood cholesterol attempt to target individuals that are most likely to benefit from cholesterol-lowering statin therapy.

"The guidelines are a significant change from prior guidelines that relied heavily on levels of bad cholesterol to determine who to treat," states Dr. Miedema. "Instead, the new guidelines recommend focusing statin therapy on the individuals that are at the highest risk for heart attack and stroke, even if their cholesterol levels are within normal limits."

In addition to recommending statin therapy for individuals with known cardiovascular disease, diabetes, or markedly elevated cholesterol levels, the guidelines also recommend statin therapy for individuals without these conditions, but with an elevated estimated risk of a heart attack or stroke in the next 10 years based on a risk calculator. The calculator factors in an individual's age, gender, race, and risk factors and recommends that patients with an estimated 10-year risk above 7.5% consider statin therapy.

While Dr. Miedema believes the scientific evidence supports this "risk-based" approach, one potential concern is that the risk calculator relies too heavily on age to determine an individual's risk. "Older individuals will likely cross the 7.5% threshold based on age alone, even if they have normal cholesterol levels and no other cardiovascular risk factors, and our study confirms this notion."

Miedema and his colleagues studied 6,088 black and white adults between the ages of 66 and 90 in the Atherosclerosis Risk in Communities (ARIC) Study, a longitudinal study of cardiovascular disease sponsored by the National Heart, Lung, and Blood Institute that has been following participants for about 25 years. The ARIC cohort was reassessed in 2013, and the study analyzed the volume of statin-eligible participants based on the previous Adult Treatment Panel (ATP) III cholesterol guidelines compared to the newer ACC/AHA guidelines.

"Based on the ATP III guidelines, we found that just over 70% of the ARIC participants were eligible for statin therapy," Miedema said. "In contrast, 97 percent were statin eligible by ACC/AHA criteria. For men 66-75 years old, the qualification rate was 100 percent."

While half of the cohort was older than 75, the ACC/AHA guidelines do not provide a recommendation for or against statin therapy for people of that age group. However, researchers noted that more than half of these older individuals in the study were taking a statin.

"We don't have great data on the efficacy of statin medications in the elderly so the guidelines drew a cut-off for the recommendations at age 75," Miedema said. "This is understandable, but it kind of leaves clinicians in the dark as to what to do with healthy elderly patients, who are often at high risk for heart attacks and strokes." "We clearly need more research looking at the best way to determine who should and should not take a statin, as well as the risks and benefits of statin therapy in elderly patients," Miedema said.

http://www.eurekalert.org/pub_releases/2014-11/hms-ar112014.php

Ambulance risk

Advanced life support ambulances for out-of-hospital cardiac arrest cost lives

Jake Miller

Boston, MA - Lights flash, a siren wails and an ambulance races to help a person whose heart has stopped beating.

In most cases, a 911 dispatcher will have sent an advanced life support, or ALS, ambulance to the scene, equipped with sophisticated gear and staffed with a crew of highly trained paramedics who can deliver specialized care in the field, including intubations and IV interventions.

Unfortunately, according to a new study by health policy researchers at Harvard, those advanced techniques actually increase the patient's risk of death.

People with out-of-hospital cardiac arrest who were treated by an ALS ambulance are more likely to die and to have poor neurological outcomes than those treated by basic life support, or BLS, ambulances, which use less-sophisticated treatment techniques, the study finds. The results are published today in JAMA Internal Medicine.

"Our study suggests BLS saves more lives than ALS, and therefore, the principles of BLS should be a priority for treating and transporting out-of-hospital cardiac arrest patients," said Prachi Sanghavi, a PhD student in the Evaluative Science and Statistics concentration of the Harvard Program in Health Policy, and lead author of the study.

BLS ambulances provide a more limited set of treatments in the field and instead focus on rapidly transporting patients to the nearest emergency department. For example, instead of waiting to intubate a patient, they might provide air using a simple, hand-pumped ventilation bag.

"We know that community training, rapid and appropriate delivery of pre-hospital care, and high-quality hospital cardiac care may substantially improve these survival rates," said study author Alan Zaslavsky, professor of health care policy at Harvard Medical School. "This study provides important insight about the choice between providing more care in the field and bringing patients as quickly as possible to hospital treatment."

Since the 1970s, ALS has grown to become the predominant form of care for cardiac arrest and other medical emergencies in the US, but there is little evidence that ALS saves lives compared with BLS, and some research has suggested that the treatments and additional time associated with ALS may harm patients. In the current study, the researchers found that patients who received BLS instead of ALS were more likely to survive to hospital discharge, to 30 days, and to 90 days. Of an estimated 380,000 cases of out-of-hospital cardiac arrest annually, 90 percent do not survive to hospital discharge, the researchers said. But at 90 days, BLS patients were nearly 50 percent more likely to survive than ALS patients. Basic life support was also associated with better neurological functioning among hospitalized patients, with fewer incidents of coma, vegetative state or brain death.

The researchers obtained a large, random sample of Medicare claims for patients in nonrural counties for ambulance services that occurred between 2006 and 2011. They compared survival and other outcomes between patients who received ALS and those who received BLS, using statistical methods to balance the two groups for characteristics such as age and other factors that might impact both the type of ambulance dispatched and the chances for survival. For example, older patients might be both more likely to receive ALS and more likely to die from cardiac arrest. The study adjusted for these possible sources of bias by studying comparable populations.

Other co-authors included Anupam Jena, HMS assistant professor of health care policy and assistant professor of medicine at Massachusetts General Hospital, and Joseph Newhouse, John D. MacArthur Professor of Health Policy and Management at Harvard University,

director of the Division of Health Policy Research and Education, chair of the Committee on Higher Degrees in Health Policy, and director of the Interfaculty Initiative in Health Policy. This research was funded by a National Science Foundation Graduate Research Fellowship and a Health Services Research Dissertation Award from the Agency for Healthcare Research and Quality, and by an Early Independence Award from the National Institutes of Health.

http://www.eurekalert.org/pub_releases/2014-11/wuso-ptr112114.php

Protein that rouses the brain from sleep may be target for Alzheimer's prevention

A protein that stimulates the brain to awaken from sleep may be a target for preventing Alzheimer's disease, a study by researchers at Washington University School of Medicine in St. Louis suggests.

In recent years, scientists at Washington University have established links between sleep problems and Alzheimer's. For example, they have shown in people and in mice that sleep loss contributes to the growth of brain plaques characteristic of Alzheimer's, and increases the risk of dementia.

The new research, in mice, demonstrates that eliminating that protein - called orexin - made mice sleep for longer periods of time and strongly slowed the production of brain plaques.

"This indicates we should be looking hard at orexin as a potential target for preventing Alzheimer's disease," said senior author David M. Holtzman, MD, head of the Department of Neurology. "Blocking orexin to increase sleep in patients with sleep abnormalities, or perhaps even to improve sleep efficiency in healthy people, may be a way to reduce the risk of Alzheimer's. This is important to explore further."

The research appears Nov. 24 in The Journal of Experimental Medicine.

Brain plaques, which are mostly made of a protein called amyloid beta, accumulate in the brain before the onset of Alzheimer's symptoms such as memory loss, personality changes and disorientation. These plaques continue to collect as the disease progresses. Scientists think that slowing or stopping this buildup could slow or stop the disease.

In the current study, the researchers worked with mice genetically engineered to develop a buildup of amyloid in the brain, which is characteristic of Alzheimer's disease. When the researchers bred these mice with mice lacking the gene for orexin, their offspring slept longer and developed only half as many Alzheimer's plaques, compared with the mice that had the orexin protein.

Orexin is made by cells in the brain's hypothalamus that stimulate wakefulness. "These cells have branches that carry orexin throughout the brain, and the protein acts like a switch," said Holtzman, the Andrew B. and Gretchen P. Jones Professor of Neurology. "If you stimulate orexin production in sleeping mice, they wake up immediately."

Low orexin levels are associated with narcolepsy, a condition marked by excessive sleepiness and frequent daytime sleeping spells. The mice with no orexin typically slept an extra hour or more during the 12-hour period when mice with orexin became more active. When scientists reversed the experiment and artificially increased orexin levels throughout the brain, the mice stayed awake longer and developed more Alzheimer's-like plaques.

But if the researchers changed orexin levels only in part of the brain - a change that did not affect the amount of time mice slept - plaque levels were unaffected.

"The fact that orexin can only affect plaques when it also affects sleep means we will have to think carefully about how to target it for Alzheimer's prevention," Holtzman said. "But the declines in plaque levels that we saw in the mice were very strong, so we're still very interested in exploring its potential for reducing risk."

He and his colleagues, including first author Jee Hoon Roh, MD, PhD, currently are studying the effects of sleep medications on amyloid beta production and plaque accumulation. The FDA recently approved Belsomra, the first sleep medication that affects orexin, and the researchers hope to assess it or similar drugs in the future.

This work was supported by the American Academy of Neurology Clinical Research Training Fellowship; the Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Science, ICT and Future Planning (MSIP), 2013R1A1A1012925; an NRF MRC grant funded by the Korean government (MSIP), 2008-0062286; the Korea Institute of Science and Technology Institutional Program, 2E24242-13-110; grants 2014-0783, 2014-7203 and 2014-9077 from the Asan Institute for Life Sciences; an Ellison Medical Foundation Senior Scholar Award; the National Institutes of Health (NIH), P01NS074969, R01NS090934 and P30NS057105; the JPB Foundation; and the Cure Alzheimer's Fund.

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http://www.eurekalert.org/pub_releases/2014-11/uop-ptg112114.php

Penn team's game theory analysis shows how evolution favors cooperation's collapse

Adding more flexibility to the Prisoner's Dilemma can allow selfish strategies to be more successful.

Last year, University of Pennsylvania researchers Alexander J. Stewart and Joshua B. Plotkin published a mathematical explanation for why cooperation and

generosity have evolved in nature. Using the classical game theory match-up known as the Prisoner's Dilemma, they found that generous strategies were the only ones that could persist and succeed in a multi-player, iterated version of the game over the long term.

But now they've come out with a somewhat less rosy view of evolution. With a new analysis of the Prisoner's Dilemma played in a large, evolving population, they found that adding more flexibility to the game can allow selfish strategies to be more successful. The work paints a dimmer but likely more realistic view of how cooperation and selfishness balance one another in nature.

"It's a somewhat depressing evolutionary outcome, but it makes intuitive sense," said Plotkin, a professor in Penn's Department of Biology in the School of Arts & Sciences, who coauthored the study with Stewart, a postdoctoral researcher in his lab.

"We had a nice picture of how evolution can promote cooperation even amongst self-interested agents and indeed it sometimes can, but, when we allow mutations that change the nature of the game, there is a runaway evolutionary process, and suddenly defection becomes the more robust outcome."

Their study, which will appear in the Proceedings of the National Academy of Sciences, examines the outcomes of the Prisoner's Dilemma, a scenario used in the field of game theory to understand how individuals decide whether to cooperate or not. In the dilemma, if both players cooperate, they both receive a payoff. If one cooperates and the other does not, the cooperating player receives the smallest possible payoff, and the defecting player the largest. If both players do not cooperate, they both receive a payoff, but it is less than what they would gain if both had cooperated.

In other words, it pays to cooperate, but it can pay even more to be selfish.

Stewart and Plotkin's previous study examined an iterated and evolutionary version of the Prisoner's Dilemma, in which a population of players matches up against one another repeatedly. The most successful players "reproduce" more and pass along their winning strategies to the next generation. The researchers found that, in such a scenario, cooperative and even forgiving strategies won out, in part because "cheaters" couldn't win against themselves.

In the new investigation, Stewart and Plotkin added a new twist. Now, not only could players alter their strategy - whether or not they cooperate - but they could also vary the payoffs they receive for cooperating.

This, Plotkin said, may more accurately reflect the balancing of risk and reward that occurs in nature, where organisms decide not only how often they cooperate but also the extent to which they cooperate.

Initially, as in their earlier study, cooperative strategies found success.

"But when cooperative strategies predominate, payoffs will rise as well," Stewart said. "With higher and higher payoffs at stake, the temptation to defect also rises. In a sense the cooperators are paving the way for their own demise."

Indeed, Stewart and Plotkin found that the population of players reached a tipping point after which defection was the predominant strategy in the population.

In a second analysis, they allowed the payoffs to vary outside the order set by the Prisoner's Dilemma.

Instead of unilateral defection winning the greatest reward, for example, it could be that mutual cooperation reaped the greatest payoff, the situation described by a game known as Stag Hunt. Or, mutual defection could generate the lowest possible reward, as described by the game theory model known as the Snowdrift or Hawk-Dove game.

What they found was that, again, there was an initial collapse in cooperative strategies. But, as the population continued to play and evolve, players also altered the payoffs so that they were playing a different game, either Snowdrift or Stag Hunt.

"So we see complicated dynamics when we allow the full range of payoffs to evolve," Plotkin said. "One of the interesting results is that the Prisoner's Dilemma game itself is unstable and is replaced by other games. It is as if evolution would like to avoid the dilemma altogether."

Stewart and Plotkin say their new conception of how strategies and payoffs co-evolve in populations is ripe for testing, with the marine bacteria Vibrionaceae as a potential model. In these bacterial populations, the researchers noted, individuals cooperate by sharing a protein they extrude that allows them to metabolize iron.

But the bacteria can possess mutations that alter whether they produce the protein and how much they generate, whether and how much they cooperate, as well as mutations that affect how efficiently they can take up the protein, their payoff.

The Penn researchers said a "natural experiment" using these or other microbes could put their theory to the test, to see exactly when and how selfishness can pay off.

"After this study, we end up with a less sunny view of the evolution of cooperation," Stewart said. "But it rings true that it's not the case that evolution always tends towards happily ever after."

The study received support from the Burroughs Wellcome Fund, David and Lucile Packard Foundation, U.S. Department of the Interior, U.S. Army Research Office and the Foundational Questions in Evolutionary Biology Fund.

http://www.eurekalert.org/pub_releases/2014-11/uoc-scb112414.php

Selenium compounds boost immune system to fight against cancer

The immune system is designed to remove things not normally found in the body. Cells undergoing change, e.g. precursors of cancer cells, are therefore normally recognised and removed by the immune system. Unfortunately, the different cancer cells contain mechanisms that block the immune system's ability to recognise them, allowing them to freely continue cancer development.

Certain cancer cells overexpress immunostimulatory molecules in liquid form. Such over-stimulation has a negative impact on the immune system:

"You can say that the stimulating molecules over-activate the immune system and cause it to collapse, and we are, of course, interested in blocking this mechanism. We have now shown that certain selenium compounds, which are naturally found in, e.g., garlic and broccoli, effectively block the special immunostimulatory molecule that plays a serious role for aggressive cancers such as melanoma, prostate cancer and certain types of leukaemia," says Professor Søren Skov, Department of Veterinary Disease Biology, University of Copenhagen.

The new findings have just been published in the Journal of Biological Chemistry

Dissolved molecules

In this study, the researchers are focusing on the so-called NGK2D ligands. There are eight variants, of which one in particular has caught the researchers' attention, because it assumes liquid form. It is precisely the molecular dissolution that causes serious problems, once the cancer is raging. The entire bloodstream is, so to speak, infected, and the molecule is therefore used as a marker of serious illness:

"Molecules are found both on the surface of the cancer cells and dissolved in the blood of the affected person. We are now able to show that selenium compounds appear to have a very beneficial effect when it comes to neutralising the special variant of the NGK2D ligand - both in soluble form and when the molecule is placed on the cell surface," says Professor Søren Skov.

Better drugs in future

The researchers are constantly learning more about the disease mechanisms causing aggressive cancers in the skin, blood and reproductive organs:

"The overexpression seen in cancers such as melanoma, prostate cancer and certain types of leukaemia significantly impairs the immune system. If we can find ways to slow down the over-stimulation, we are on the right track. The new results are yet another small step towards better cancer drugs with fewer adverse effects," says Søren Skov.

Søren Skov's research team is part of a major EU project tasked with examining the potential for improving cancer treatment by boosting the immune system.

http://www.eurekalert.org/pub_releases/2014-11/uoaf-urs112414.php

UAlberta researchers stop 'vicious cycle of inflammation' that leads to tumor growth

UAlberta research team finds that inhibiting a key enzyme decreases the early development of tumours, their spread to other organs and improves the effectiveness of chemotherapies

Edmonton - A team of researchers from the University of Alberta has discovered a new approach to fighting breast and thyroid cancers by targeting an enzyme they say is the culprit for the "vicious cycle" of tumour growth, spread and resistance to treatment.

A team led by University of Alberta biochemistry professor David Brindley found that inhibiting the activity of an enzyme called autotaxin decreases early tumour growth in the breast by up to 70 per cent. It also cuts the spread of the tumour to other parts of the body (metastasis) by a similar margin. Autotaxin is responsible for producing lysophosphatidic acid, a signaling molecule that promotes cancer cell survival, growth and metastasis. It is also linked to resistance to the beneficial effects of chemotherapy and radiotherapy.

"Autotaxin causes a lot of serious problems in the treatment of breast and other cancers. Essentially, the body hijacks this enzyme to help a tumour grow, survive treatment and spread to other areas of the body," said Brindley, senior author of a series of related studies. "By inhibiting it, we found we could block the growth of breast and thyroid tumours and break the cycle of treatment resistance."

Autotaxin is normally involved in wound repair and tissue regeneration. It also drives inflammatory conditions such as colitis, arthritis and cancer. Brindley believes it is this inflammation-associated event that is especially problematic and could fuel breast and thyroid tumour growth.

According to Brindley, a tumour is like a wound that does not heal. The body hijacks autotaxin to help a tumour grow, resist being killed by chemotherapy and radiotherapy, and to spread to other areas of the body. As the tumour grows or is damaged by treatment, it produces more inflammatory mediators, which in turn produce more autotaxin. That then increases the production of more inflammatory mediators. The research team found that it could block the growth of breast and thyroid tumours by breaking the vicious cycle with the autotaxin inhibitor.

Brindley's team - which included co-authors Matthew Benesch, a Vanier Scholar, Killam Laureate, and MD/ PhD candidate in the Faculty of Medicine & Dentistry; Ganesh Venkatraman, an Alberta Innovates-Health Solutions sponsored PhD candidate; Xiaoyun Tang, a Canadian Breast Cancer Foundation-funded

postdoctoral fellow; and endocrine surgeon Todd McMullen - used a drug developed by Ono Pharmaceuticals in Japan to inhibit autotaxin activity.

Daily doses of the drug reduced the initial phase of breast tumour growth by 60 to 70 per cent in experimental models. The inhibitor compound also cut tumour metastasis to the lungs by a similar margin. Later tests with a different technique for blocking the effects of lysophosphatidic acid enabled the team to block breast and thyroid tumour growth and spread by up to 80 per cent.

Brindley said his team was surprised when Benesch discovered that autotaxin is not produced by breast cancer cells themselves, but largely by the surrounding breast fat tissue. As the tumour develops and causes inflammation in the breast, the fat tissue produces more autotaxin, aggravating the problem by making the tumour grow more, metastasize and resist further treatment.

"With this drug we are cutting this vicious cycle," he said, explaining that by blocking autotaxin the researchers saw a five-fold reduction in inflammation markers in the blood, and a ten-fold reduction in the breast fat tissue adjacent to the tumour.

The research team is now trying to promote the testing of the compound in human clinical trials in Edmonton - the first autotaxin inhibitor to make it to the clinic after more than 10 years of research. Brindley says that it shows it's not a "pie in the sky" theory but a potential new therapy that could be used in combination with chemotherapy to improve the treatment of cancer patients.

"We've shown that the autotaxin inhibitor has strong therapeutic potential, even though we are at the early stages" he said. "A third of women with breast cancer die from metastasis and many thyroid cancer patients do not respond well to treatment. If we can improve the treatment of these patients, it will be a very big deal."

"This is a very exciting discovery on many levels," said Liz Viccars, CEO, Canadian Breast Cancer Foundation - Prairies/NWT Region. "We are very proud to have supported this work in Dr. Brindley's lab with a CBCF-funded research grant, as well as supporting Dr. Tang's contributions through one of our inaugural Fellowship Grants.

"This discovery is an exceptional demonstration of fundamental basic research potentially leading to the development and implementation of personalized cancer therapies and treatments. The impact of such findings will improve the quality of life and patient care for those dealing with breast and other cancers."

The research was published in 2014 in FEBS Letters, the Journal of Lipid Research and two papers in the FASEB Journal. The work was funded by the Canadian Breast Cancer Foundation, Alberta Cancer Foundation, Canadian Institutes of Health Research and Alberta Innovates - Health Solutions.

http://www.eurekalert.org/pub_releases/2014-11/bc-day112014.php

Does a yogurt a day keep diabetes away?

Lower risk of type 2 diabetes risk associated with high intake of yogurt points to value of yogurt ina healthy diet.

A high intake of yogurt has been found to be associated with a lower risk of developing type 2 diabetes, according to research published in open access journal BMC Medicine. This highlights the importance of having yogurt as part of a healthy diet.

Type 2 diabetes is a chronic condition that occurs when the body doesn't produce enough insulin, or the body's cells develop resistance to insulin. There is an increased risk of developing it if a relative has the condition or if an individual has an unhealthy lifestyle. Approximately 366 million people are affected by type 2 diabetes worldwide and it is estimated this will increase to 552 million people by 2030, which puts pressure on global healthcare systems.

Researchers from Harvard School of Public Health pooled the results of three prospective cohort studies that followed the medical history and lifestyle habits of health professionals. These studies were the Health Professionals' Follow-up Study (HFPS), which included 51,529 US male dentists, pharmacists, vets, osteopathic physicians and podiatrists, aged from 40 to 75 years; Nurses' Health Study (NHS), which began in 1976, and followed 121,700 female US nurses aged from 30 to 55 years; and Nurses' Health Study II (NHS II), which followed 116,671 female US nurses aged from 25 to 42 years beginning in the year 1989. At the beginning of each cohort study, participants completed a questionnaire to gather baseline information on lifestyle and occurrence of chronic disease. Participants were then followed up every two years with a follow-up rate of more than 90 per cent.

Participants were excluded if they had diabetes, cardiovascular disease or cancer at baseline. People were also excluded if they did not include any information about dairy consumption. This left a total of 41,497 participants from HPFS, 67,138 from NHS and 85,884 from NHS II.

Mu Chen, the study's lead author from Harvard School of Public Health, says: "Our study benefited from having such a large sample size, high rates of follow up and repeated assessment of dietary and lifestyle factors."

Within the three cohorts 15,156 cases of type 2 diabetes were identified during the follow-up period. The researchers found that the total dairy consumption had no association with the risk of developing type 2 diabetes. They then looked at consumption of individual dairy products, such as skimmed milk, cheese, whole milk and yogurt. When adjusting for chronic disease risk factors such as age and

BMI as well as dietary factors, it was found that high consumption of yogurt was associated with a lower risk of developing type 2 diabetes.

The authors then conducted a meta-analysis, incorporating their results and other published studies, up to March 2013, that investigated the association between dairy products and type 2 diabetes. This found that consumption of one 28g serving of yogurt per day was associated with an 18 per cent lower risk of type 2 diabetes.

Previous research has suggested calcium, magnesium, or specific fatty acids present in dairy products may lower the risk of type 2 diabetes. It has been shown that probiotic bacteria found in yogurt improves fat profiles and antioxidant status in people with type 2 diabetes and the researchers suggest this could have a risk-lowering effect in developing the condition. To confirm this observation, and investigate whether or not yogurt is causal in the lowering of risk, randomized controlled trials are needed.

Senior researcher on the study Frank Hu, Harvard School of Public Health, says: "We found that higher intake of yogurt is associated with a reduced risk of type 2 diabetes, whereas other dairy foods and consumption of total dairy did not show this association. The consistent findings for yogurt suggest that it can be incorporated into a healthy dietary pattern."

Dairy consumption and risk of type 2 diabetes: 3 cohorts of US adults and an updated meta-analysis, Mu Chen, Qi Sun, Edward Giovannucci, Dariush Mozaffarian, JoAnn E. Manson, Walter C. Willett and Frank B. Hu
BMC Medicine 2014, 12:215

http://phys.org/news/2014-11-year-old-blood-mammoth-cloning-closer.html

40,000-year-old blood brings mammoth cloning closer

Mammoth cloning is closer to becoming a reality following the discovery of blood in the best-preserved specimen ever found.

Nov 24, 2014 by Hayley Dunning

An autopsy on a 40,000-year-old mammoth has yielded blood that could contain enough intact DNA to make cloning possible, galvanising scientists who have been working for years to bring back the extinct elephant relative. Tests are still being conducted on the blood to see if it will yield a complete genome – the genetic code necessary to build an organism.

Dr Tori Herridge with the mammoth. **Credit: Channel 4 Television**

Blood and guts

The mammoth (nicknamed Buttercup) was discovered in 2013 on Maly Lyakhovsky Island in northern Siberia and excavated from the permafrost. The flesh was remarkably well-preserved, and oozed a dark red liquid when scientists cut into it. That liquid has now been confirmed as blood, following an autopsy conducted by scientists including Museum palaeobiologist Dr Tori Herridge.

'As a palaeontologist, you normally have to imagine the extinct animals you work on,' said Dr Herridge.

'So actually coming face-to-face with a mammoth in the flesh, and being up to my elbows in slippery, wet, and frankly rather smelly mammoth liver, counts as one of the most incredible experiences of my life.' The full results of the autopsy will be shown in the Channel 4 documentary Woolly Mammoth - The Autopsy, on Sunday 23 November at 20.00. The South Korean firm Sooam Biotech Research Foundation is leading the research project.

Life and death of a mammoth

The blood was not the only remarkable finding of the autopsy. Analysis of the mammoth's tusks revealed it was a female who had been through at least eight successful calving events. Rates of tusk growth depend on whether the female is pregnant or lactating, and from Buttercup's tusks the team were able to tell that at least one of her calves had died.

Analysis of her teeth show that Buttercup died in her fifties. The molar teeth of mammoths and elephants, which are closely related, are replaced six times throughout their lives. Once the last set wears down, the animal generally starves and dies. However, it was determined that Buttercup met her end by becoming trapped in a peat bog and getting eaten alive by predators. Despite her brutal death she was incredibly well-preserved, thanks oxygen-free environment of the peat bog and the freezing process.

'The information gleaned from Buttercup's autopsy about her life and death, and the future discoveries that will come from analyses of her muscles and internal organs, will add to our understanding of these magnificent Ice Age beasts,' said Dr Herridge.

If we can clone - should we?

The information learnt about the lives of mammoths is exciting in itself, but it is the potential for cloning that has captured the most attention.

However, while we are now closer to the reality of creating a living mammoth than ever before, Dr Herridge thinks that it may not be a good idea.

'I doubt that there are many people in the world who would like to see a real-life woolly mammoth as much as I do. And yet I think cloning one would be ethically flawed,' she wrote in an opinion piece for the Guardian this week.

A major objection to mammoth cloning is the fact that endangered Asian elephant surrogates would be required to birth a live mammoth baby. It is likely that many surrogates would be needed before the first successful birth.

'Does the potential benefit to humanity of cloning a mammoth outweigh the suffering an Asian elephant surrogate mother might experience? I've yet to hear a convincing argument that it does,' wrote Dr Herridge.

'So, why should we clone a mammoth? Because it would be cool to see one? That's not going to cut it, I'm afraid.'

http://bit.ly/15GSqS0

US government cracks down on clinical-trials reporting

Proposed regulations would close loopholes that allow researchers to hide negative data.

Sara Reardon

Clinical-trial results are often unpublished, even for approved drugs.

Hiding negative results and harmful side effects that occur in clinical trials would become harder in the United States under regulations proposed on 19 November by the US National Institutes of Health (NIH) and the Food and Drug Administration (FDA).

One proposal would require companies seeking the FDA's approval of a new drug or therapy to post all clinical-trial results to the government website ClinicalTrials.gov, even if the treatment being tested is never approved; current law mandates this only for drugs that are approved. Companies and researchers that do not comply with the deadlines set out in the proposal could face fines of US$10,000 per day.

The second proposal would require that any NIH-funded research on interventions, not just drugs, be registered and reported on ClinicalTrials.gov. The rule would apply to surgical techniques and behavioural interventions such as anti-smoking programmes. And for the first time, federally funded researchers will be required to post the results of their phase I clinical trials. Noncompliant institutions could have their NIH funding withdrawn.

The regulations are intended to close a loophole in a 2007 law known as the FDA Amendments Act (FDAAA), which requires sponsors of FDA-approved drugs to post the results of their clinical trials on ClinicalTrials.gov. A 2013 report found that only about half of trial results posted on the site are ever published in peer-reviewed journals.

"When a lot of dollars and time and volunteers are potentially putting themselves in a risk situation, we need to be sure the results of that are finding their way into view of the public," NIH director Francis Collins said at a press conference announcing the proposed regulations.

Reaction to the government announcement was mixed.

"This shows a much broader understanding of what a clinical trial is than in earlier legislation," says Kay Dickersin, director of the Center for Clinical Trials at Johns Hopkins Bloomberg School of Public Health in Baltimore, Maryland. But Dickersin is concerned about a number of loopholes that remain in the regulations. Industry and privately funded studies are not required to post phase I results. And trial sponsors are required to report only summaries of people's reactions to a drug, not each person's results. Researchers have found that analysing data from individuals can yield vastly different information about adverse events than summaries alone2.

But Jennifer Miller, a bioethicist at Duke University in Durham, North Carolina, says that the regulations are addressing the wrong question altogether. Miller's unpublished analysis comparing the number of trials registered with the FDA with those reported on ClinicalTrials.gov suggest that results for most trials are not reported - even for drugs that are approved. "If you were going to expand or enhance FDAAA, you would think there would be considerations around monitoring and enforcement of the existing law," she says.

Nature *doi:10.1038/nature.2014.16390*

http://bit.ly/1tpzIDB

Humans Are Becoming City-Dwelling "Metro Sapiens"

To achieve sustainability, the human species needs to embrace its urban side, argues public health researcher Jason Vargo

By Sarah Zielinski smithsonian.com

Hunting and gathering, Metro sapien-style, in Vancouver's Granville Island Public Market. **(Robert Mullan/incamerastock/Corbis)**

Cities have been around for thousands of years, since the first were settled in Mesopotamia between 4000 and 3000 B.C. But only over the last several centuries have humans moved into cities en masse. Now more than half the world's population can be found in urban areas. "Cities are very much the dominant habitat of our species," writes Jason Vargo in the *Journal of Environmental Studies and Sciences*.

Vargo, a public health scientist and urban planner at the Nelson Institute for Environmental Studies and the Global Health Institute, argues that humans, at least in current population numbers, can no longer survive in solely rural lifestyles.

To live sustainably, people need to embrace their inner urbanites - and recognize our species not as *Homo sapiens*, but "Metro sapiens". Vargo spoke with *Smithsonian.com* about this audacious proposal and what it means for our future on Earth:

Are city dwellers - Metro sapiens - fundamentally different from people living in the country?

No. I don't think so. But the reason I use that term is that it embraces this idea that to make it on this planet we're going to have to adopt urbanism to help us minimize our environmental impact on the planet. We're only going to do that if we become Metro sapiens. *Homo sapiens*, the way that we're doing it right now, probably won't survive. Though we don't see cities as natural, part of my reasoning behind putting "metro" into our species name is to get us to think about how humans have been living in settlements of some kind for a long time now, and maybe that is part of what's natural for us.

Why are cities, which are the source of many environmental problems, our future?

It's easy to look at cities and think, well, that's a real scar on the natural landscape. But if we're talking about how a million people are organizing, you can't have everyone living on a single plot of a land with a yard and a tree. You need some sort of denser organization, to conserve the land outside of the cities and also reduce energy use inside cities.

Those demand-side benefits are important, because those strategies are not talked about very much. When we hear about national energy policy, it's often about increasing efficiency of devices or supply of energy. But people that live in New York City, for example, drive less because they don't have cars. This is something that David Owen talks about in the book *Green Metropolis*. He calls it "embodied efficiency". The vertical living of New York City actually has this embodied efficiency that makes energy use in our daily lives less.

Not every city is like that, though, and even New York has its downsides. Which characteristics of urban life should we be adopting?

It's not just density but intensity, not just quantity but quality, not just location but connectivity. So it's not only having a service nearby, but it's being able to get to that service and access that service. Places need to be high quality. They need to be thoughtful and be places where people want to take ownership and spend time in. If they're not, people disregard them and allow criminal activities to go on. We want people to be outside and socializing, creating communities, being neighbors.

Are there any cities that others should be emulating?

There's no sustainable city on the planet, so it can be a bit difficult to tell people that we really need to embrace cities as a strategy moving forward, but at the same time there's no perfect model. Just from a gestalt perspective, I've really enjoyed spending time in … Vancouver. I thought it was really impressive the way the city related to its surrounding environment. Vancouver seemed to have embraced urban strategies, like vegetation on roofs and in right-of-ways to minimize water pollution and maintain water quality.

But there are other parts beyond just what you see, such as the way that the government works and the way neighbors are engaged in decision-making, that also matter. If you look at the best examples of sustainable cities, you'll see that there have been communities that expressed the values of environmental sustainability or mobility or equity decades ago, and you can chronicle the legislation and the actions and then the physical construction that have been in line with those values.

What does placing even more of the population in urban environments do for nature?

It gets easier to preserve the land outside of urban spaces if more people are living more urban lives. So higher degrees of urbanism, because each person is consuming less land, can be really crucial for preserving wild places. Also, if you're working on something like the ecosystem of North Woods or the Central Sands, which is important for farming here in Wisconsin, you're not really seeing the whole picture if you don't see the connection to urban areas. The metabolism of cities demands resources from those areas.

With half the population now living in cities and much more expected, that is something we should all be thinking about. Much of the urban development that will exist in 100 years hasn't happened yet, so there is great opportunity, especially in fields like urban ecology. If we can figure out characteristics or components of cities that not only improve our daily quality of life but also improve the maintenance of these more natural areas, then I think we'll be better off.

http://nyti.ms/1ynXfJo

Leading Surgeon Is Accused of Misconduct in Experimental Transplant Operations

Prestigious Swedish medical institute begins investigation of a surgeon considered a pioneer in regenerative medicine

By HENRY FOUNTAIN NOV. 24, 2014

A prestigious medical institute in Sweden has begun an investigation of a surgeon who is considered a pioneer in the field of regenerative medicine, after complaints that he did not receive ethical approvals for experimental operations on patients and misled medical journals about the success of the procedures.

The Karolinska Institute, which awards the Nobel Prize in Medicine, said it had asked an independent expert to look into the complaints against Paolo Macchiarini, a visiting professor who operated on three patients at Karolinska University Hospital in Stockholm. In the procedures, Dr. Macchiarini removed diseased or damaged windpipes and implanted replacements made of plastic and treated with stem cells and drugs to encourage the growth of new tissue.

"Since the accusations against Dr. Macchiarini are serious and detailed, I considered that they should be thoroughly investigated," said Anders Hamsten, vice chancellor of the institute. He said Friday that he hoped to have the investigator's report by mid-January.

Dr. Macchiarini's work, which is just one of many efforts at laboratories around the world to make human tissues that could help prolong lives and ease organ shortages, was the subject of a Page 1 article in The New York Times in 2012 that described the first plastic windpipe implant, on an Eritrean man living in Iceland who had tracheal cancer.

The patient, one of the three cited in the complaints, died in January 2014 and spent the last eight months of his life in the Karolinska hospital. Of the other patients, one, an American, died several months after his surgery, and the other has been hospitalized since her operation more than two years ago and requires a procedure every four hours to clean out her airway, according to the complaints filed with the institute.

The complaints were filed in August and September by four doctors who have been involved in the treatment and care of the three patients.

Reached in Krasnodar, Russia, where he has done his most recent operations, Dr. Macchiarini said the accusations against him were unfounded.

"We have never ever manipulated data," he said, adding that he had complied with all regulations and laws regarding medical ethics. He said he was confident that he would be cleared.

One of the doctors who filed the complaints, Karl-Henrik Grinnemo, is himself the subject of a complaint by one of Dr. Macchiarini's colleagues, Philipp Jungebluth. Dr. Jungebluth has accused Dr. Grinnemo of ethical breaches in connection with a grant Dr. Grinnemo received from the Swedish government.

In a letter to the institute responding to Dr. Jungebluth's complaint, Dr. Grinnemo said that it was "lacking in substance and containing very serious misrepresentations."

Dr. Hamsten said the complaint against Dr. Grinnemo was being handled by the institute's ethics council.

The complaints against Dr. Macchiarini were lodged in the form of letters to the institute, copies of which were obtained by The Times. They assert that there is no evidence that the experimental operations - considered "compassionate use" because the patients were said to have few if any alternatives for survival - had been subject to ethical review. According to the complaints, only one of the patients, the Eritrean man, appeared to have signed a consent form for the operation, and in that case the form was dated more than two weeks after the surgery, according to a copy of the document included with the complaints.

The Eritrean man's case was the subject of a paper, described as a "proof of concept study," by Dr. Macchiarini and others that was published online in the British medical journal The Lancet on Nov. 24, 2011, five and a half months after the synthetic windpipe was implanted.

The paper described the connections between the implant and the patient's own lung tissues as being open and the implant partly lined with healthy tissue of the kind needed for the airway to function properly. It said there were "no major complications" five months after the operation.

But according to the complaint, during a procedure on the patient several days before the paper was published, stents had to be inserted into the implant to keep it open and holes were seen between the implant and the patient's tissues. Dr. Macchiarini, the complaint said, must have been aware of the problems, and the paper should not have been published as written.

A spokeswoman for The Lancet declined to say whether the journal had been notified of the allegations.

Correction: November 27, 2014

An article on Tuesday about accusations of misconduct against Paolo Macchiarini, a surgeon who is a pioneer in the field of regenerative medicine, misstated the timing of the complaints against him by doctors in Sweden. The complaints were filed in August and September, not last month.

http://www.bbc.com/news/health-30180804

Brain's dementia weak spot identified

The brain has a weak spot for Alzheimer's disease and schizophrenia, according to UK scientists who have pinpointed the region using scans.

By Michelle Roberts Health editor, BBC News online

The brain area involved develops late in adolescence and degenerates early during ageing.

At the moment, it is difficult for doctors to predict which people might develop either condition.

The findings, in the journal PNAS, hint at a potential way to diagnose those at risk earlier, experts say.

Although they caution that "much more research is needed into how to bring these exciting discoveries into the clinic".

Weak spot

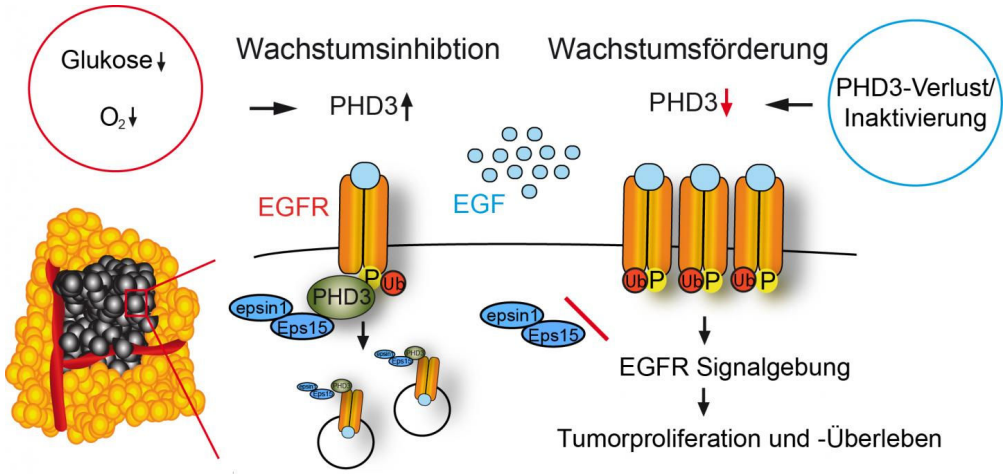
The Medical Research Council team who carried out the study did MRI brain scans on 484 healthy volunteers aged between eight and 85 years.
The researchers, led by Dr Gwenaëlle Douaud of Oxford University, looked at how the brain naturally changes as people age.
The images revealed a common pattern - the parts of the brain that were the last to develop were also the first to show signs of age-related decline.
These brain regions - a network of nerve cells or grey matter - co-ordinate "high order" information coming from the different senses, such as sight and sound.
When the researchers looked at scans of patients with Alzheimer's disease and scans of patients with schizophrenia they found the same brain regions were affected. The findings fit with what other experts have suspected - that although distinct, Alzheimer's and schizophrenia are linked.
Prof Hugh Perry of the MRC said: "Early doctors called schizophrenia 'premature dementia' but until now we had no clear evidence that the same parts of the brain might be associated with two such different diseases. This large-scale and detailed study provides an important, and previously missing, link between development, ageing and disease processes in the brain. "It raises important issues about possible genetic and environmental factors that may occur in early life and then have lifelong consequences. The more we can find out about these very difficult disorders, the closer we will come to helping sufferers and their families."
Dr Michael Bloomfield of University College London said: "Schizophrenia can be potentially devastating but at the moment it's very difficult to predict with certainty who is going to have a good prognosis and who might have a poor one. "This study brings us a step closer to being able to make this prediction, so patients could in the future receive better targeted treatments."
Armed with this new knowledge, it may also be possible to understand how to prevent the brain changes before they occur, he said

http://www.eurekalert.org/pub_releases/2014-11/guf-wcc112014.php

Why cancer cells grow despite a lack of oxygen

Hypoxia protein also regulates growth factors

FRANKFURT/GIESSEN. Healthy cells reduce their growth when there is a lack of oxygen (hypoxia). This makes it even more surprising that hypoxia is a characteristic feature of malignant tumours. In two publications in the current edition of the "Nature Communications" journal, researchers from Goethe University and Justus-Liebig-University of Giessen report on how cancer cells succeed at circumventing the genetic program of growth inhibition.
It has long been known that PHD proteins (prolyl-hydroxylase domain proteins) play a key role among the regulators of hypoxia. They control the stability of the hypoxia-induced transcription factors (HIFs) which govern the adaptation of cells to a lack of oxygen. The two teams led by Professor Amparo Acker-Palmer, Goethe University, and Professor Till Acker, Justus-Liebig-University, have now discovered that a special PHD protein, PHD3, also controls the epidermal growth factor receptor (EGFR).



A special PHD protein, PHD3, also controls the epidermal growth factor receptor (EGFR). In healthy cells, PHD3 responds to stressors such as a lack of oxygen by stimulating the uptake of EGF receptors into the cell interior. Growth signals are down-regulated by this internalization. This process is disrupted in tumor cells due to the loss of PHD3. As a result, the internalization of EGFR is suppressed, which leads to overactivity of EGFR signals, and thus to uncontrolled cell growth.
Garlov et al.

In healthy cells, PHD3 responds to stressors such as a lack of oxygen by stimulating the uptake of EGF receptors into the cell interior. Growth signals are down-regulated by this internalisation. "We have discovered that PHD3 serves as a scaffolding protein, binding to central adapter proteins such as Eps15 and Epsin1 in order to promote the uptake of EGFR into the cells," says Acker-Palmer. This process is disrupted in tumour cells due to the loss of PHD3. As a result, the internalisation of EGFR is suppressed, which leads to overactivity of EGFR signals, and thus to uncontrolled cell growth.
The research team was able to show that the loss of PHD3 is a crucial step in the growth of human malignant brain tumours (glioblastomas). The tumour cells thus become refractory to the growth-inhibiting signals under hypoxia. "Clinically, this discovery is highly relevant, because it shows an alternative mechanism for the hyperactivation of the EGF receptor that is independent of its genetic

amplification. It can be therapeutically suppressed by EGFR inhibitors," explains Till Acker, a neuropathologist at the University of Giessen.

"Our work shows an unexpected and new function of PHD3 on the interface of two currently red-hot research areas: Oxygen measurement and EGFR signalling," Acker-Palmer explains. "This once again proves how significant growth receptor internalisation is to the development of cancer." This connection was already shown by the research team in 2010 for tumour angiogenesis (Sawamiphak et al, Nature 2010).

Henze et al: Loss of PHD3 allows tumours to overcome hypoxic growth inhibition and sustain proliferation through EGFR; Nature Communications 25.11.2014; DOI 10.1038/ncomm6582
Garvalov et al.: PHD3 regulates EGFR internalization and signalling in tumours, Nature Communications 25.11.2014, DOI: 10.1038/ncomms6577

http://www.eurekalert.org/pub_releases/2014-11/iop-sbt112414.php

Sweet-smelling breath to help diabetes diagnosis in children

The potential to quickly diagnose children with type 1 diabetes before the onset of serious illness could be achieved using a simple, non-invasive breath test, according to new research published today.

In one of the most comprehensive breath-based studies of children with type 1 diabetes performed to date, a team of researchers from Oxford, UK have linked a sweet-smelling chemical marker in the breath with a build-up of potentially harmful chemicals in the blood that accumulate when insulin levels are low.

It is hoped these results - linking an increased level of breath acetone with increased levels of ketones in the blood - could inspire the development of a diagnostic device to identify children with new diabetes before the onset of diabetic ketoacidosis (DKA). The results of the study have been published today, 26 November, in IOP Publishing's Journal of Breath Research.

DKA occurs when a severe lack of insulin means the body cannot use glucose for energy and starts to break down fat instead. Organic compounds called ketones are the by-product of the breakdown of fat and, if left unchecked, can build up and cause the body to become acidic. About one in four children diagnosed with type 1 diabetes don't know they have it until they develop DKA, which can cause severe illness.

Acetone, which is the simplest ketone, is one of the by-products produced in the development of DKA and is usually disposed of through the breath. Indeed, for over 200 years acetone has been known to produce a sweet smell on the breath of diabetes sufferers.

In their study, the researchers, from the University of Oxford, Oxford Medical Diagnostics and Oxford Children's Hospital, collected the breath samples from 113 children and adolescents between the ages 7 and 18.

Isoprene and acetone were collected in breath bags and measurements were compared with capillary blood glucose and ketone levels, which were taken at the same time during a single visit to Oxford Children's Hospital.

The researchers found a significant relationship between increased levels of acetone in the breath of the subjects and increased levels of blood ketones - specifically β hydroxybutyrate. They found no link between isoprene and acetone levels in breath and glucose levels in the blood.

Co-author of the study, Professor Gus Hancock, said: "While breath acetone has been measured in relatively large cohorts of healthy individuals, most measurements on people with type 1 diabetes have been carried out on relatively small cohorts, typically made up of less than 20 people, with relatively few measurements on children. "Our results have shown that it is realistically possible to use measurements of breath acetone to estimate blood ketones.

"We are working on the development of a small hand held device that would allow the possibility of breath measurements for ketone levels and help to identify children with new diabetes before DKA supervenes. Currently testing for diabetes requires a blood test which can be traumatic for children.

"Also, if the relationship between breath acetone and blood ketone levels is true at higher levels of ketones, a simple breath-test could assist with the management of sick days in children with diabetes, preventing hospital admissions by providing a warning of the possible development of DKA."

Comparison of breath gases, including acetone, with blood glucose and blood ketones in children and adolescents with type 1 diabetes
3. The published version of the paper 'Comparison of breath gases, including acetone, with blood glucose and blood ketones in children and adolescents with type 1 diabetes'
(Comparison of breath gases, including acetone, with blood glucose and blood ketones in children and adolescents with type 1 diabetes. Tom P J Blaikie, Julie A Edge, Gus Hancock, Daniel Lunn, Clare Megson, Rob Peverall, Graham Richmond, Grant A D Ritchie and David Taylor J. Breath Res. 8 (2014) 046010) will be freely available online from Wednesday 26 November. It will be available at http://iopscience.iop.org/1752-7163/8/4/046010.

http://www.eurekalert.org/pub_releases/2014-11/thuo-cgr112514.php

Centipede's genome reveals how life evolved on our planet

Oft-maligned creature genetically sequenced for first time by international team

Centipedes, those many-legged creatures that startle us in our homes and gardens, have been genetically sequenced for the first time. In a new study in the journal PLOS Biology, an international team of over 100 scientists today reveals how this humble arthropod's DNA gave them new insight into how life developed on our planet.

Centipedes are members of the arthropods, a group with numerous species including insects, spiders and other animals. Until now, the only class of arthropods not represented by a sequenced genome was the myriapods, which include centipedes and millipedes. For this study, the researchers sequenced the genome of the centipede Strigamia maritima, because its primitive features can help us understand more complex arthropods.

According to Prof. Ariel Chipman, senior co-author of the study and project leader at the Hebrew University of Jerusalem's Alexander Silberman Institute of Life Science, the genetic data reveal how creatures transitioned from their original dwelling-place in the sea to living on land.

This is Strigamia maritima, the centipede species genetically sequenced in the study. **Dr. Carlo Brena**

"The use of different evolutionary solutions to similar problems shows that myriapods and insects adapted to dry land independently of each other," said Chipman. "For example, comparing the centipede and insect genomes shows that they independently evolved different solutions to the same problem shared by all land-dwelling creatures - that of living in dry air."

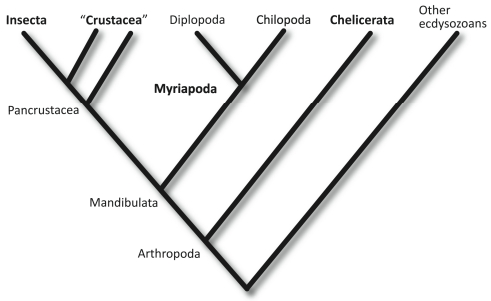
According to Chipman, the study found that despite being closely related to insects, the centipede lacks the olfactory gene family used by insects to smell the air, and thus developed its own air-sniffing ability by expanding other gene families not present in insects.

In addition, Chipman said, this specific group of centipedes live underground and have lost their eyes, together with almost all vision genes and genes involved in the body's internal clock. They maintain enhanced sensory capabilities enabling them to recognize their environment and capture prey.

Published in the latest edition of PLOS Biology, the research is a collaborative effort by over 100 scientists from 50 institutions. Thousands of human-hours went into looking at specific genes in the centipede genome, with each researcher looking at a limited set of genes or at specific structural characteristics to address specific questions.

Other leaders of the international research effort include Dr. Stephen Richards, Baylor College of Medicine; Dr. David Ferrier, University of St. Andrews; and Prof. Michael Akam of Cambridge University. The research paper is titled "The First Myriapod Genome Sequence Reveals Conservative Arthropod Gene Content and Genome Organisation in the Centipede Strigamia maritima."

While early studies of genomics focused on humans, as sequencing equipment and expertise became more readily available, researchers expanded into animals directly relevant to human wellbeing. In the latest research, genomic sequencing has become more broad-based, investigating the workings of the world around us.



The phylogenetic position of the centipedes (Chilopoda), with respect to other arthropods, according to the currently best-supported phylogeny. The four traditionally accepted arthropod classes are marked in bold.

In explaining the purpose of the research, Hebrew University's Chipman said: "If we have a better understanding of the biological world around us, how it operates, and how it came to be as it is, we will ultimately have a better understanding of ourselves."

According to Chipman, the research will have applications for other researchers ranging from conservation to dealing with crop pests.

http://bbc.in/1rGRZvy

Bubonic Plague Spreads in Madagascar

Madagascar said Monday it was trying to contain an outbreak of plague - similar to the Black Death that swept medieval Europe - that has killed 47 people and is spreading to the capital Antananarivo.

Nov 25, 2014 11:27 AM ET // by AFP

"The plague" has been taking lives in the most gruesome of ways for thousands of years. And guess what: It's still here.

The health ministry said there had been 138 suspected cases since the beginning of the year and warned that the death toll was likely to rise in coming months.

Two people have been infected in Antananarivo, one of them dying, and health workers have mounted a pest control campaign through slum areas around the city, the World Health Organization (WHO) said.

The health ministry's secretary general, Philemon Tafangy, said "two hundred households have been disinfected" this month. He said those who had contact with the infected had been given antibiotics in a bid to arrest the spread the disease.

The WHO last week said 40 people had died as a result of plague, which was first identified in August.

Plague is spread by fleas and mostly affects rats, but humans can also contract the disease if they are bitten by a disease-carrying flea. The bubonic form prompts swelling of the lymph node, but can be treated with antibiotics. The pneumonic

version, affecting the lungs, can be spread from person to person through coughing and can kill within 24 hours.

Resistant fleas

The situation in Madagascar is all the more worrying because of a high level of resistance to insecticides targeting fleas, the U.N. health agency said.

In Ankasina, a slum outside Antananarivo, the family of the young woman who died from the plague said they have been stigmatized by the community.

According to Bernadette Rasoarimanana, the mother of the deceased woman, community members have been giving them "dirty looks" since the death of her daughter.

Residents of the poor and overcrowded slum speak of squalid conditions, infested with rats, increasing the risk of infection. "Our neighborhood is really dirty and has been neglected by the state for a long time," she said.

Plague often breaks out in the vast island nation, and is usually at its worst between October and March. The last case of plague in the capital was 10 years ago, said Christophe Rogier, of the island's Institut Pasteur.

"It is possible that the plague continued to survive in Antananarivo for 10 years without touching humans," with the virus restricted to its rat population, he said. "Rats are a natural reservoir of the plague, and they also survive the plague."

According to the International Committee of the Red Cross, the country has recorded on average 500 cases of plague every year since 2009.

The Black Death, otherwise known as the bubonic plague, is estimated to have killed some 25 million people across Europe in the Middle Ages.

http://nyti.ms/1pzpXqa

Our Cats, Ourselves

Have humans been subject to the same dynamics of domestication as our pets?

By RAZIB KHANNOV. 24, 2014

DAVIS, Calif. - IT'S commonplace to call our cats "pets." But anyone sharing a cat's household can tell you that, much as we might like to choose when they eat in the morning, or when they come inside for the night, cats are only partly domesticated.

The likely ancestors of the domestic dog date from more than 30,000 years ago. But domestic cats' forebears join us in the skeletal record only about 9,500 years ago. This difference fits our intuition about their comparative degrees of domestication: Dogs want to be "man's best friend"; cats, not so much.

Fossils are handy snapshots of the past, but a genomic sequence is a time machine, enabling scientists to run evolutionary history backward. The initial sequence of the domestic cat was completed in 2007, but a recent study to which I contributed compared the genomes of the domestic cat and the wildcat (Felis silvestris) and sheds new light on the last 10,000 years of feline adaptations.

Domestic cats are not just wildcats that tolerate humans in exchange for regular meals. They have smaller skulls in relation to their bodies compared with wildcats, and are known to congregate in colonies. But in comparison with dogs, cats have a narrower range of variation in size and form.

Wesley C. Warren, an author of the study, notes that domestic cats have excellent hunting skills, like their wild ancestors. This, too, supports the notion that cats are only semi-domesticated.

Comparing the genomes of the wildcat and the domestic cat added much to what we had known. Michael J. Montague, the lead author, told me he'd anticipated that the two genomes would be very similar, but our study found a specific set of differences in genes involved in neuron development. This brain adaptation may explain why domestic cats are docile.

Scientists have long observed that domesticated species exhibit a suite of strikingly similar traits, from floppy ears to smaller brains, than those of their wild ancestors. Domestication may select for a few similar traits encoded by genetic changes (like smaller brains), but these may produce what we assume are secondary effects (like floppy ears).

Once they were living among us, cats didn't need to think so much to stay alive; nor did they need such large jaws after we started feeding them our processed scraps. Hence smaller skulls. The same dynamic holds for dogs: Wolves beat dogs in general intelligence tests.

By examining patterns in our animals' genomes, we've confirmed that the same sets of genes seem to be targeted again and again in evolution. As far back as Charles Darwin, domestic animals in particular have yielded insights about evolution because we know what sorts of selection pressures they were subject to. After all, it was us they were primarily adapting to.

Which brings us to the genome of one critical tame animal: ourselves, humans. The Nobel Prize-winning zoologist Konrad Z. Lorenz once suggested that humans were subject to the same dynamics of domestication. Our brain and body sizes peaked during the end of the last ice age, and declined with the spread of agriculture.

Instead of poring over the meager fossil record, we can survey patterns of variation across tens of thousands of living individuals. Genomics now provides evidence that humans have been subject to a great deal of natural selection over the past 10,000 years. A beautiful example is the ancestors of Tibetans' absorption of small portions of the genome of ancient human relatives adapted for living at high altitude.

Our cultural flexibility and creativity since the end of the ice age have not freed humans from evolutionary forces, but have opened up novel and startling paths. Thinking of domestication as an evolutionary process that occurs through "artificial" selection creates a false dichotomy of nurture and nature that plays into a conceit of human exceptionalism. In fact, the idea that we are apart from nature, that it is ours to tame and exploit, is an outmoded approach.

A more useful interpretation is that over the past 10,000 years, humans fashioned their own ecosystem. We were part of a natural process that altered the landscape. In that light, we can think of the domestic cat as an ecological response to the emergence of parasites (rodents attracted by early Neolithic granaries). The same forces that reshaped the genomes of our domesticates also reshaped ours.

No longer roving in small bands subsisting on game and unprocessed plants, we settled down in villages, harvesting the same crops year after year. For millenniums, peasants fed on what we might today term porridge, of various types. Our teeth became smaller - indeed, both dogs and humans show evidence of adaptation to starchy diets.

Just as the fur of our mammalian domesticates, freed from the constraint of needing to fade into the landscape, became a riot of diverse colors, human pigmentation started to change and many populations became light-skinned. With a cheek-by-jowl existence, humans and their animals began sharing diseases, remolding the immunity of whole populations, but leaving those who did not experience this co-evolution untouched and vulnerable. Possibly, some pathogens incubated in cats, like Toxoplasma gondii, may even alter human behavior.

Many of us conceive of our relationship to our pets as analogous to that between a parent and child. But the natural history tells a more pragmatic tale. Cats emerged in the context of profound ecological changes to the post-ice-age landscape wrought by humans.

We were the authors of those changes, but in the process of telling that story, we became protagonists within it. One of the essential steps in knowing ourselves, and seeing where we are going, is to look around and take note of how we've reshaped those nearest to us, and they us.

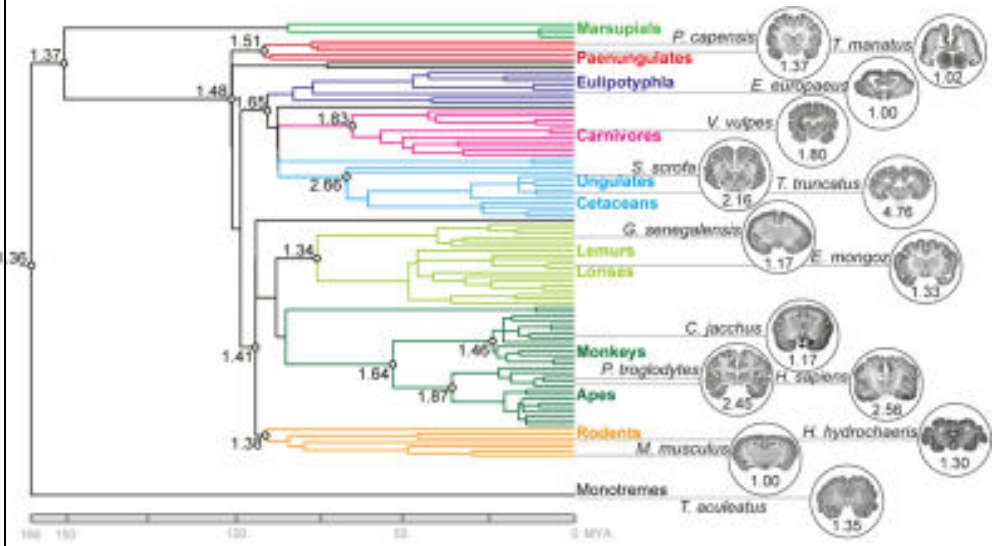
http://bit.ly/12foH08

Brain folding

What expansion of the neocortex, which lets us think, dream, or speak is still a mystery

The neocortex is the part of the brain that enables us to speak, dream, or think. The underlying mechanism that led to the expansion of this brain region during evolution, however, is not yet understood. A research team headed by Wieland Huttner, director at the Max Planck Institute of Molecular Cell Biology and Genetics, now reports an important finding that paves the way for further research on brain evolution: The researchers analyzed the gyrencephaly index, indicating the degree of cortical folding, of 100 mammalian brains and identified a threshold value that separates mammalian species into two distinct groups: Those above the threshold have highly folded brains, whereas those below it have only slightly folded or unfolded brains. The research team also found that differences in cortical folding did not evolve linearly across species.

The Dresden researchers examined brain sections from more than 100 different mammalian species with regard to the gyrencephaly index, which indicates the degree of folding of the neocortex. The data indicate that a highly folded neocortex is ancestral – the first mammals that appeared more than 200 million years ago had folded brains. Like brain size, the folding of the brain, too, has increased and decreased along the various mammalian lineages. Life-history traits seem to influence this: For instance, mammals with slightly folded or unfolded brains live in rather small social groups in narrow habitats, whereas those with highly folded brains form rather large social groups spreading across wide habitats.



Gallery of the superbrains: Increased or reduced folding of the brain is possible at each fork in evolution. A crucial threshold value of 1.5 divides mammals into two groups: those with highly folded brains and those with few or no brain folds. **PLoS Biology unter Verwendung von Hirnschnitten von**

A threshold value of the folding index at 1.5 separates mammalian species into two distinct groups: Dolphins and foxes, for example, are above this threshold value – their brains are highly folded and consist of several billion neurons. This

is so because basal progenitors capable of symmetric proliferative divisions are present in the neurogenic program of these animals. In contrast, basal progenitors in mice and manatees lack this proliferative capacity and thus produce less neurons and less folded or unfolded brains.

Duration and speed of brain development

The highly folded brains of mammals not only contain more neurons, they also grow with greater speed: The brain weight accumulated per gestational day is 14 times greater in species with a high degree of cortical folding. The differences among species between the two groups separated by the threshold value can be explained by longer neurogenic periods rather than different neurogenic programs. The neurogenic period of a human fetus is eight to nine days longer than that of apes. This leads to a brain three times larger than that of a chimpanzee – a fundamental difference that contributes to what makes us human.

Eric Lewitus, Iva Kelava, Alex T. Kalinka, Pavel Tomancak, Wieland B. Huttner. "An Adaptive Threshold in Mammalian Neocortical Evolution." PLOS Biology, 18. November 2014 (DOI: 10.1371/journal.pbio.1002000

http://www.eurekalert.org/pub_releases/2014-11/gu-neo112514.php

New evidence of ancient rock art across Southeast Asia

Rich art practice by region's first people

Latest research on the oldest surviving rock art of Southeast Asia shows that the region's first people, hunter-gatherers who arrived over 50,000 years ago, brought with them a rich art practice.

Published this week in the archaeological journal Antiquity, the research shows that these earliest people skilfully produced paintings of animals in rock shelters from southwest China to Indonesia. Besides these countries, early sites were also recorded in Thailand, Cambodia and Malaysia.

Griffith University Chair in Rock Art Professor Paul Taçon led the research which involved field work with collaborative international teams in rugged locations of several countries.

The oldest paintings were identified by analysing overlapping superimpostions of art in various styles as well as numerical dating. It was found that the oldest art mainly consists of naturalistic images of wild animals and, in some locations, hand stencils.

The research shows that 35,000 - 40,000 year old dates for some rock art in Sulawesi, Indonesia announced in October by Griffith University Senior Research Fellow Maxime Aubert is not an anomaly. Instead, the practice was widespread across the region.

Professor Taçon said that, "As with the early art of Europe, the oldest Southeast Asian images often incorporated or were placed in relation to natural features of rock surfaces. "This shows a purposeful engagement with the new places early peoples arrived in for both symbolic and practical reasons.

"Essentially, they humanised landscapes wherever they went, transforming them from wild places to cultural landscapes. This was the beginning of a process that continues to this day."

But unlike in Europe, the oldest surviving rock art of Southeast Asia is more often found in rock shelters rather than deep caves, suggesting experiences in deep caves cannot have been their inspiration as has long been argued for Europe.

"This significantly shifts debates about the origins of art-making and supports ideas that this fundamental human behaviour began with our most ancient ancestors in Africa rather than Europe.

"The research supports the idea suggested by the early Indonesian rock art dates that modern humans brought the practice of making semi-permanent images in rocky landscapes to Europe and Asia from Africa," Professor Taçon said.

These results have implications not only for our understanding of Southeast Asian and European rock art but also Australian, because in Kakadu-Arnhem Land and other parts of northern Australia the oldest surviving rock art also consists of naturalistic animals and stencils.

Thus the practice of making these sorts of designs may have been brought to Australia at the time of initial colonisation, but it may alternatively have been independently invented or resulted from as yet unknown forms of culture contact. All three possibilities are equally intriguing. New investigations in both northern Australia and Southeast Asia are currently being planned.

http://www.eurekalert.org/pub_releases/2014-11/e-hac112414.php

How a common antacid could lead to cheaper anti-cancer drugs

Cimetidine could be 1 of many common over-the-counter medicines to treat cancer

A popular indigestion medication can increase survival in colorectal cancer, according to research published in ecancermedicalscience. But in fact, scientists have studied this for years - and a group of cancer advocates want to know why this research isn't more widely used.

"Cimetidine is an interesting drug as it's very safe, very well-known, and has clinical results in cancer that have been confirmed in a number of trials," says Pan Pantziarka, lead author of the paper and member of the Repurposing Drugs in Oncology (ReDO) project.

Cimetidine treats indigestion by blocking histamine receptors in the gut, which decreases the production of gastric acid. It also appears to block histamine receptors in cancer cells, as well as supporting the immune system's defences against cancer.

Cimetidine has been shown to have positive effects in colorectal and gastric cancer, melanoma, and renal cell carcinoma.

"Cimetidine is one of the most interesting examples of repurposed drugs in oncology - a drug with an extensive history of pre-clinical and clinical evidence of efficacy in a range of different cancers and with multiple mechanisms of action at work," says Pantziarka.

Raising awareness of untapped medicines

An international collaboration between anticancer researchers from across the world, the ReDO project is dedicated to promoting the cause of common medicines which may represent an untapped source of novel therapies for cancer.

In a previous paper published in ecancermedicalscience, the ReDO researchers examined the anti-cancer properties of the drug mebendazole, an over-the-counter treatment currently used for threadworm.

Now, working in partnership with ecancer, the ReDO project is publishing a series of papers on drugs with enough evidence to be taken to clinical trials. Future papers will address the potential anti-cancer uses of nitroglycerin (used to treat angina), itraconazole (a common anti-fungal), diclofenac (an over-the-counter painkiller), and clarithromycin (an antibiotic).

"Such promising therapies are often ignored since pharmaceutical companies lack financial incentives to develop them further via proper clinical trials," says Gauthier Bouche, medical director of Anticancer Fund. "The ReDO project was established to find and document such opportunities."

A cheaper solution to the cancer crisis

Repurposed anticancer drugs such as aspirin and antacids may represent the future of cancer drug research, according to leaders of the ReDO project.

Cheap, accessible, and with few side-effects, these solutions are very attractive to healthcare professionals in low- and middle-income countries. Repurposed drugs could also reduce the financial burden of cancer in developed countries.

"Cimetidine is a drug that can meet patient needs now - so we need to ask ourselves: what's stopping it being used?" asks Pantziarka.

http://www.eurekalert.org/pub_releases/2014-11/nifm-pch112514.php

Prehistoric conflict hastened human brain's capacity for collaboration, study *says*

Warfare may have greatly contributed to the evolutionary emergence of humans' high intelligence and ability to cooperate

KNOXVILLE - Warfare not only hastened human technological progress and vast social and political changes, but may have greatly contributed to the evolutionary emergence of humans' high intelligence and ability to work together toward common goals, according to a new study from the National Institute for Mathematical and Biological Synthesis (NIMBioS).

How humans evolved high intelligence, required for complex collaborative activities, despite the various costs of having a big brain has long puzzled evolutionary biologists. While the human brain represents only about two percent of the body's weight, it uses about 20 percent of the energy consumed. Other costs of having a large brain include a need for extended parental care due to a long growth period, difficulties giving birth to larger-headed babies, and some mental illnesses associated with brain complexity. So how did the human brain evolve to become so large and complex?

Another long-running question is how did humans evolve strong innate preferences for cooperative behavior, as cooperative behavior is vulnerable to exploitation by cheaters and "free-riders." A free-rider doesn't contribute or cooperate and thereby undermines the effectiveness of the group's collaborative effort, something scientists call "the collective action problem." Thus, collaborative behavior is expected to be rare, and indeed, in animals it is typically limited to close relatives. Humans, however, are a unique species where collaboration is widespread and not limited to relatives.

In the new study published in the Journal of Royal Society Interface, lead author Sergey Gavrilets, a professor of ecology and evolutionary biology and mathematics at the University of Tennessee, Knoxville, and NIMBioS associate director for scientific activities, developed a mathematical model that offers answers to both evolutionary puzzles.

The model shows that intelligence and cooperative behavior can co-evolve to solve the problem of collective action in groups and to overcome the costs of having a large brain.

The research points to the types of collective actions that are most effective at hastening collaboration. According to the model, collaborative ability evolves easiest if there is direct conflict or warfare between groups, what Gavrilets calls "us vs. them" activities. In contrast, collective activities, such as defending against predators or hunting for food, which Gavrilets calls "us vs. nature" activities, are much less likely to result in a significant increase in collaborative abilities.

The study also predicts that if high collaborative ability cannot evolve, perhaps for example because the costs of having a big brain are too high, the species will harbor a small proportion of individuals with a genetic predisposition to perform individually-costly but group-beneficial acts.

In addition, the model challenges influential theories on when large-game hunting and within-group coalitions first appeared in humans. Some scientists say that within-group coalitions and collaborative hunting came first and then

subsequently created conditions for the evolution of collaboration in between-group conflicts. Yet, Gavrilets' model shows the opposite: that collaboration in between-group fighting preceded both within-group coalitions and collaborative hunting.

"Our ability to effectively collaborate with others is largely responsible for what our species came to be. The big question is how this ability first evolved when there are large metabolic and physiological costs related to human brain size and when collaboration can be easily undermined by free riders. The model offers an answer which emphasizes the role of between-group conflicts in shaping unique human features," Gavrilets said.

Gavrilets S. 2014. Collective action and the collaborative brain. Journal of the Royal Society Interface. Published online 26 November 2014. http://dx.doi.org/10.1098/rsif.2014.1067

http://www.eurekalert.org/pub_releases/2014-11/biom-tsi112414.php

Two studies identify a detectable, pre-cancerous state in the blood

Findings pave way for new lines of cancer research focused on detection and prevention

Boston, MA.- Researchers from the Broad Institute of MIT and Harvard, Harvard Medical School, and Harvard-affiliated hospitals have uncovered an easily detectable, "pre-malignant" state in the blood that significantly increases the likelihood that an individual will go on to develop blood cancers such as leukemia, lymphoma, or myelodysplastic syndrome. The discovery, which was made independently by two research teams affiliated with the Broad and partner institutions, opens new avenues for research aimed at early detection and prevention of blood cancer. Findings from both teams appear this week in the New England Journal of Medicine.

Most genetic research on cancer to date has focused on studying the genomes of advanced cancers, to identify the genes that are mutated in various cancer types. These two new studies instead looked at somatic mutations - mutations that cells acquire over time as they replicate and regenerate within the body - in DNA samples collected from the blood of individuals not known to have cancer or blood disorders.

Taking two very different approaches, the teams found that a surprising percentage of those sampled had acquired a subset - some but not all - of the somatic mutations that are present in blood cancers. These individuals were more than ten times more likely to go on to develop blood cancer in subsequent years than those in whom such mutations were not detected.

The "pre-malignant" state identified by the studies becomes more common with age; it is rare in those under the age of 40, but appears with increasing frequency with each decade of life that passes, ultimately appearing in more than 10% of those over the age of 70. Carriers of the mutations are at an overall 5% risk of developing some form of blood cancer within five years. This "pre-malignant" stage can be detected simply by sequencing DNA from blood.

"People often think about disease in black and white - that there's 'healthy' and there's 'disease' - but in reality most disease develops gradually over months or years. These findings give us a window on these early stages in the development of blood cancer," said Steven McCarroll, senior author of one of the papers. McCarroll is an assistant professor of genetics at Harvard Medical School and director of genetics at the Broad's Stanley Center for Psychiatric Research. Benjamin Ebert, an associate member of the Broad and associate professor at Harvard Medical School and Brigham and Women's Hospital, is the senior author of the other paper.

The mutations identified by both studies are thought to originate in blood stem cells, and confer a growth-promoting advantage to the mutated cell and all of its "clones" - cells that derive from that original stem cell during the normal course of cell division. These cells then reproduce at an accelerated rate until they account for a large fraction of the cells in a person's blood. The researchers believe these early mutations lie in wait for follow-on, "cooperating" mutations that, when they occur in the same cells as the earlier mutations, drive the cells toward cancer. The majority of mutations occurred in just three genes; DNMT3A, TET2, and ASXL1.

"Cancer is the end-stage of the process," said Siddhartha Jaiswal, a Broad associated scientist and clinical fellow from Massachusetts General Hospital who was first author of Ebert's paper. "By the time a cancer has become clinically detectable it has accumulated several mutations that have evolved over many years. What we are primarily detecting here is an early, pre-malignant stage in which the cells have acquired just one initiating mutation."

The teams converged on these findings through very different approaches. Ebert's team had hypothesized that, since blood cancers increase with age, it might be possible to detect early somatic mutations that could be initiating the disease process, and that these mutations also might increase with age. They looked specifically at 160 genes known to be recurrently mutated in blood malignancies, using genetic data derived from approximately 17,000 blood samples originally obtained for studies on the genetics of type 2 diabetes.

They found that somatic mutations in these genes did indeed increase the likelihood of developing cancer, and they saw a clear association between age and the frequency of these mutations. They also found that men were slightly more likely to have mutations than women, and Hispanics were slightly less likely to have mutations than other groups.

Ebert's team also found an association between the presence of this "pre-malignant" state, and risk of overall mortality independent of cancer. Individuals with these mutations had a higher risk of type 2 diabetes, coronary heart disease, and ischemic stroke as well. However, additional research will be needed to determine the nature of these associations.

In the related paper, McCarroll's team discovered the phenomenon while studying a different disease. They, too, were looking at somatic mutations, but they were initially interested in determining whether such mutations contributed to risk for schizophrenia. The team studied roughly 12,000 DNA samples drawn from the blood of patients with schizophrenia and bipolar disorder, as well as healthy controls, searching across the whole genome at all of the protein-coding genes for patterns in somatic mutations.

They found that the somatic mutations were concentrated in a handful of genes; the scientists quickly realized that they were cancer genes. The team then used electronic medical records to follow the patients' subsequent medical histories, finding that the subjects with these acquired mutations had a 13-times elevated risk of blood cancer.

McCarroll's team conducted follow-up analyses on tumor samples from two patients who had progressed from this pre-malignant state to cancer. These genomic analyses revealed that the cancer had indeed developed from the same cells that had harbored the "initiating" mutations years earlier.

"The fact that both teams converged on strikingly similar findings, using very different approaches and looking at DNA from very different sets of patients, has given us great confidence in the results," said Giulio Genovese, a computational biologist at the Broad and first author of McCarroll's paper. "It has been gratifying to have this corroboration of each other's findings."

Jaiswal will be presenting the findings on December 9 at the American Society of Hematology Annual Meeting in San Francisco.

All of the researchers involved emphasized that there is no clinical benefit today for testing for this pre-malignant state; there are no treatments currently available that would address this condition in otherwise healthy people. However, they say the results open the door to entirely new directions for blood cancer research, toward early detection and even prevention.

"The results demonstrate a way to identify high-risk cohorts - people who are at much higher than average risk of progressing to cancer - which could be a population for clinical trials of future prevention strategies," McCarroll said. "The abundance of these mutated cells could also serve as a biomarker - like LDL cholesterol is for cardiovascular disease - to test the effects of potential prevention therapies in clinical trials."

Ebert agrees:

"A new focus of investigation will now be to develop interventions that might decrease the likelihood that individuals with these mutations will go on to develop overt malignancies, or therapeutic strategies to decrease mortality from other conditions that may be instigated by these mutations," he said.

The researchers also say that the findings show just how important it is to collect and share large datasets of genetic information: both studies relied on DNA samples collected for studies completely unrelated to cancer.

"These two papers are a great example of how unexpected and important discoveries can be made when creative scientists work together and with access to genomic and clinical data," said Broad deputy director David Altshuler, one of Ebert's co-authors. "For example, Steve's team found stronger genetic relationships to cancer than they have yet found for the schizophrenia endpoint that motivated their original study. The pace of discovery can only accelerate if researchers have the ability to apply innovative methods to large datasets."

Ebert's team was funded by the National Institutes of Health (NIH); the Gabrielle's Angel Foundation; and the Leukemia and Lymphoma Society. McCarroll's team was supported by the Stanley Center for Psychiatric Research; the National Human Genome Research Institute (NHGRI); and the National Institute of Mental Health. Genetic data for Ebert's paper was collected with support from NIH (T2D-GENES; Longevity Genes Project); the Medical Research Council and Wellcome Trust (Go-T2D); the Slim Initiative for Genomic Medicine in the Americas; and NHGRI, the National Heart, Lung, and Blood Institute and National Institute on Minority Health and Health Disparities (Jackson Heart Study).

http://www.eurekalert.org/pub_releases/2014-11/cmu-cmr112414.php

Carnegie Mellon researchers identify brain regions that encode words, grammar, story

Brain scans of Harry Potter readers yields computational model of reading

Some people say that reading "Harry Potter and the Sorcerer's Stone" taught them the importance of friends, or that easy decisions are seldom right. Carnegie Mellon University scientists used a chapter of that book to learn a different lesson: identifying what different regions of the brain are doing when people read.

Researchers from CMU's Machine Learning Department performed functional magnetic resonance imaging (fMRI) scans of eight people as they read a chapter of that Potter book. They then analyzed the scans, cubic millimeter by cubic millimeter, for every four-word segment of that chapter. The result was the first integrated computational model of reading, identifying which parts of the brain are responsible for such subprocesses as parsing sentences, determining the meaning of words and understanding relationships between characters.

As Leila Wehbe, a Ph.D. student in the Machine Learning Department, and Tom Mitchell, the department head, report today in the online journal PLOS ONE, the model was able to predict fMRI activity for novel text passages with sufficient accuracy to tell which of two different passages a person was reading with 74 percent accuracy.

"At first, we were skeptical of whether this would work at all," Mitchell said, noting that analyzing multiple subprocesses of the brain at the same time is unprecedented in cognitive neuroscience. "But it turned out amazingly well and now we have these wonderful brain maps that describe where in the brain you're thinking about a wide variety of things."

Wehbe and Mitchell said the model is still inexact, but might someday be useful in studying and diagnosing reading disorders, such as dyslexia, or to track the recovery of patients whose speech was impacted by a stroke. It also might be used by educators to identify what might be giving a student trouble when learning a foreign language.

"If I'm having trouble learning a new language, I may have a hard time figuring out exactly what I don't get," Mitchell said. "When I can't understand a sentence, I can't articulate what it is I don't understand. But a brain scan might show that the region of my brain responsible for grammar isn't activating properly, or perhaps instead I'm not understanding the individual words."

Researchers at Carnegie Mellon and elsewhere have used fMRI scans to identify activation patterns associated with particular words or phrases or even emotions. But these have always been tightly controlled experiments, with only one variable analyzed at a time. The experiments were unnatural, usually involving only single words or phrases, but the slow pace of fMRI - one scan every two seconds - made other approaches seem unfeasible.

Wehbe nevertheless was convinced that multiple cognitive subprocesses could be studied simultaneously while people read a compelling story in a near-normal manner. She believed that using a real text passage as an experimental stimulus would provide a rich sample of the different word properties, which could help to reveal which brain regions are associated with these different properties.

"No one falls asleep in the scanner during Leila's experiments," Mitchell said. They devised a technique in which people see one word of a passage every half second - or four words for every two-second fMRI scan. For each word, they identified 195 detailed features - everything from the number of letters in the word to its part of speech. They then used a machine learning algorithm to analyze the activation of each cubic centimeter of the brain for each four-word segment.

Bit by bit, the algorithm was able to associate certain features with certain regions of the brain, Wehbe said.

"The test subjects read Chapter 9 of Sorcerer's Stone, which is about Harry's first flying lesson," she noted. "It turns out that movement of the characters - such as when they are flying their brooms - is associated with activation in the same brain region that we use to perceive other people's motion. Similarly, the characters in the story are associated with activation in the same brain region we use to process other people's intentions."

Exactly how the brain creates these neural encodings is still a mystery, they said, but it is the beginning of understanding what the brain is doing when a person reads.

"It's sort of like a DNA fingerprint - you may not understand all aspects of DNA's function, but it guides you in understanding cell function or development," Mitchell said. "This model of reading initially is that kind of a fingerprint."

A complementary study by Wehbe and Mitchell, presented earlier this fall at the Conference on Empirical Methods in Natural Language Processing, used magnetoencephalography (MEG) to record brain activity in subjects reading Harry Potter. MEG can record activity every millisecond, rather than every two seconds as in fMRI scanning, but can't localize activity with the precision of fMRI. Those findings suggest how words are integrated into memory - how the brain first visually perceives a word and then begins accessing the properties of the word, and fitting it into the story context.

This research was supported by the National Science Foundation, the National Institute of Child Health and Human Development and the Rothberg Brain Imaging Award.

http://www.eurekalert.org/pub_releases/2014-11/d-gc-brp112614.php

Brain researchers pinpoint gateway to human memory

Study in humans tracks information flow within the brain using ultra-precise magnetic resonance imaging

The human brain continuously collects information. However, we have only basic knowledge of how new experiences are converted into lasting memories.

Now, an international team led by researchers of the University of Magdeburg and the German Center for Neurodegenerative Diseases (DZNE) has successfully determined the location, where memories are generated with a level of precision never achieved before.

The team was able to pinpoint this location down to specific circuits of the human brain. To this end the scientists used a particularly accurate type of magnetic resonance imaging (MRI) technology. The researchers hope that the results and method of their study might be able to assist in acquiring a better understanding of the effects Alzheimer's disease has on the brain.

The science journal "Nature Communications" reports on their findings.

For the recall of experiences and facts, various parts of the brain have to work together. Much of this interdependence is still undetermined, however, it is known that memories are stored primarily in the cerebral cortex and that the control center that generates memory content and also retrieves it, is located in the brain's interior. This happens in the hippocampus and in the adjacent entorhinal cortex.

"It is been known for quite some time that these areas of the brain participate in the generation of memories. This is where information is collected and processed. Our study has refined our view of this situation," explains Professor Emrah Düzel, site speaker of the DZNE in Magdeburg and director of the Institute of Cognitive Neurology and Dementia Research at the University of Magdeburg.

"We have been able to locate the generation of human memories to certain neuronal layers within the hippocampus and the entorhinal cortex. We were able to determine which neuronal layer was active. This revealed if information was directed into the hippocampus or whether it traveled from the hippocampus into the cerebral cortex. Previously used MRI techniques were not precise enough to capture this directional information. Hence, this is the first time we have been able to show where in the brain the doorway to memory is located."

For this study, the scientists examined the brains of persons who had volunteered to participate in a memory test.

The researchers used a special type of magnetic resonance imaging technology called "7 Tesla ultra-high field MRI". This enabled them to determine the activity of individual brain regions with unprecedented accuracy.

A Precision method for research on Alzheimer's

"This measuring technique allows us to track the flow of information inside the brain and examine the areas that are involved in the processing of memories in great detail," comments Düzel.

"As a result, we hope to gain new insights into how memory impairments arise that are typical for Alzheimer's. Concerning dementia, is the information still intact at the gateway to memory? Do troubles arise later on, when memories are processed? We hope to answer such questions."

„Laminar activity in the hippocampus and entorhinal cortex related to novelty and episodic encoding", Anne Maass, Hartmut Schütze, Oliver Speck, Andrew Yonelinas, Claus Tempelmann, Hans-Jochen Heinze, David Berron, Arturo Cardenas-Blanco, Kay H. Brodersen, Klaas Enno Stephan, Emrah Düzel, Nature Communications, 2014, doi: 10.1038/ncomms6547

http://www.eurekalert.org/pub_releases/2014-11/uoz-dsc112514.php

DNA survives critical entry into Earth's atmosphere

Applied to the outer shell of the payload section of a rocket using pipettes, small, double-stranded DNA molecules flew into space from Earth and back again.

After the launch, space flight, re-entry into Earth's atmosphere and landing, the so-called plasmid DNA molecules were still found on all the application points on the rocket from the TEXUS-49 mission. And this was not the only surprise: For the most part, the DNA salvaged was even still able to transfer genetic information to bacterial and connective tissue cells. "This study provides experimental evidence that the DNA's genetic information is essentially capable of surviving the extreme conditions of space and the re-entry into Earth's dense atmosphere," says study head Professor Oliver Ullrich from the University of Zurich's Institute of Anatomy.

Spontaneous second mission

The experiment called DARE (DNA atmospheric re-entry experiment) resulted from a spontaneous idea: UZH scientists Dr. Cora Thiel and Professor Ullrich were conducting experiments on the TEXUS-49 mission to study the role of gravity in the regulation of gene expression in human cells using remote-controlled hardware inside the rocket's payload. During the mission preparations, they began to wonder whether the outer structure of the rocket might also be suitable for stability tests on so-called biosignatures. "Biosignatures are molecules that can prove the existence of past or present extraterrestrial life," explains Dr. Thiel. And so the two UZH researchers launched a small second mission at the European rocket station Esrange in Kiruna, north of the Arctic Circle.

DNA survives the most extreme conditions

The quickly conceived additional experiment was originally supposed to be a pretest to check the stability of biomarkers during spaceflight and re-entry into the atmosphere. Dr. Thiel did not expect the results it produced: "We were completely surprised to find so much intact and functionally active DNA." The study reveals that genetic information from the DNA can essentially withstand the most extreme conditions.

Various scientists believe that DNA could certainly reach us from outer space as Earth is not insulated: in extraterrestrial material made of dust and meteorites, for instance, around 100 tons of which hits our planet every day.

This extraordinary stability of DNA under space conditions also needs to be factored into the interpretion of results in the search for extraterrestrial life: "The results show that it is by no means unlikely that, despite all the safety precautions, space ships could also carry terrestrial DNA to their landing site. We need to have this under control in the search for extraterrestrial life," points out Ullrich.

Cora S. Thiel, Svantje Tauber, Andreas Schütte, Burkhard Schmitz, Harald Nuesse, Ralf Möller, Oliver Ullrich. Functional Activity of Plasmid DNA after Entry into the Atmosphere of Earth Investigated by a New Biomarker Stability Assay for Ballistic Spaceflight Experiments. PLoS ONE. November 26, 2014. doi:10.1371/journal.pone.0112979

http://www.eurekalert.org/pub_releases/2014-11/cp-dho112014.php

Dogs hear our words and how we say them

First evidence of how dogs also differentiate and process various components of human speech

When people hear another person talking to them, they respond not only to what is being said - those consonants and vowels strung together into words and sentences - but also to other features of that speech - the emotional tone and the speaker's gender, for instance. Now, a report in the Cell Press journal Current Biology on November 26 provides some of the first evidence of how dogs also differentiate and process those various components of human speech.

"Although we cannot say how much or in what way dogs understand information in speech from our study, we can say that dogs react to both verbal and speaker-related information and that these components appear to be processed in different areas of the dog's brain," says Victoria Ratcliffe of the School of Psychology at the University of Sussex.

Previous studies showed that dogs have hemispheric biases - left brain versus right - when they process the vocalization sounds of other dogs. Ratcliffe and her supervisor David Reby say it was a logical next step to investigate whether dogs show similar biases in response to the information transmitted in human speech. They played speech from either side of the dog so that the sounds entered each of their ears at the same time and with the same amplitude. "The input from each ear is mainly transmitted to the opposite hemisphere of the brain," Ratcliffe explains. "If one hemisphere is more specialized in processing certain information in the sound, then that information is perceived as coming from the opposite ear."

If the dog turned to its left, that showed that the information in the sound being played was heard more prominently by the left ear, suggesting that the right hemisphere is more specialized in processing that kind of information.

The researchers did observe general biases in dogs' responses to particular aspects of human speech. When presented with familiar spoken commands in which the meaningful components of words were made more obvious, dogs showed a left-hemisphere processing bias, as indicated by turning to the right. When the intonation or speaker-related vocal cues were exaggerated instead, dogs showed a significant right-hemisphere bias.

"This is particularly interesting because our results suggest that the processing of speech components in the dog's brain is divided between the two hemispheres in a way that is actually very similar to the way it is separated in the human brain," Reby says.

Of course, it doesn't mean that dogs actually understand everything that we humans might say or that they have a human-like ability of language - far from it. But, says Ratcliffe, these results support the idea that our canine companions are paying attention "not only to who we are and how we say things, but also to what we say." All of this should come as good news to many of us dog-loving humans, as we spend considerable time talking to our respective pups already. They might not always understand you, but they really are listening.

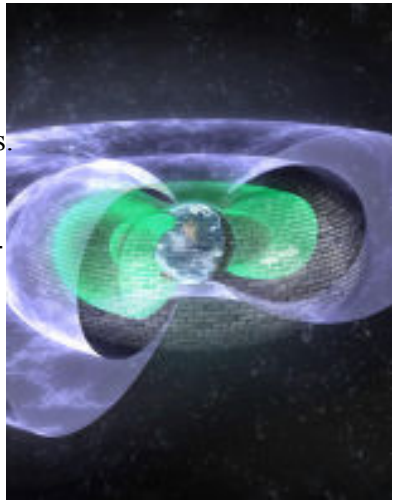
Current Biology, Ratcliffe et al.: "Orienting asymmetries in dogs' responses to different communicatory components of human speech"

http://www.eurekalert.org/pub_releases/2014-11/uoca-sti112514.php

Star Trek-like invisible shield found thousands of miles above Earth

Invisible shield 7,200 miles above Earth blocks so-called "killer electrons

A team led by the University of Colorado Boulder has discovered an invisible shield some 7,200 miles above Earth that blocks so-called "killer electrons," which whip around the planet at near-light speed and have been known to threaten astronauts, fry satellites and degrade space systems during intense solar storms. The barrier to the particle motion was discovered in the Van Allen radiation belts, two doughnut-shaped rings above Earth that are filled with high-energy electrons and protons, said Distinguished Professor Daniel Baker, director of CU-Boulder's Laboratory for Atmospheric and Space Physics (LASP). Held in place by Earth's magnetic field, the Van Allen radiation belts periodically swell and shrink in response to incoming energy disturbances from the sun.



Scientists have discovered an invisible shield roughly 7,200 miles above Earth.
Andy Kale, University of Alberta

As the first significant discovery of the space age, the Van Allen radiation belts were detected in 1958 by Professor James Van Allen and his team at the University of Iowa and were found to be comprised of an inner and outer belt extending up to 25,000 miles above Earth's surface. In 2013, Baker - who received his doctorate under Van Allen - led a team that used the twin Van Allen Probes launched by NASA in 2012 to discover a third, transient "storage ring"

between the inner and outer Van Allen radiation belts that seems to come and go with the intensity of space weather.

The latest mystery revolves around an "extremely sharp" boundary at the inner edge of the outer belt at roughly 7,200 miles in altitude that appears to block the ultrafast electrons from breeching the shield and moving deeper towards Earth's atmosphere.

"It's almost like theses electrons are running into a glass wall in space," said Baker, the study's lead author. "Somewhat like the shields created by force fields on Star Trek that were used to repel alien weapons, we are seeing an invisible shield blocking these electrons. It's an extremely puzzling phenomenon."

A paper on the subject was published in the Nov. 27 issue of Nature.

The team originally thought the highly charged electrons, which are looping around Earth at more than 100,000 miles per second, would slowly drift downward into the upper atmosphere and gradually be wiped out by interactions with air molecules. But the impenetrable barrier seen by the twin Van Allen belt spacecraft stops the electrons before they get that far, said Baker.

The group looked at a number of scenarios that could create and maintain such a barrier. The team wondered if it might have to do with Earth's magnetic field lines, which trap and control protons and electrons, bouncing them between Earth's poles like beads on a string. The also looked at whether radio signals from human transmitters on Earth could be scattering the charged electrons at the barrier, preventing their downward motion. Neither explanation held scientific water, Baker said.

"Nature abhors strong gradients and generally finds ways to smooth them out, so we would expect some of the relativistic electrons to move inward and some outward," said Baker. "It's not obvious how the slow, gradual processes that should be involved in motion of these particles can conspire to create such a sharp, persistent boundary at this location in space."

Another scenario is that the giant cloud of cold, electrically charged gas called the plasmasphere, which begins about 600 miles above Earth and stretches thousands of miles into the outer Van Allen belt, is scattering the electrons at the boundary with low frequency, electromagnetic waves that create a plasmapheric "hiss," said Baker. The hiss sounds like white noise when played over a speaker, he said.

While Baker said plasmaspheric hiss may play a role in the puzzling space barrier, he believes there is more to the story. "I think the key here is to keep observing the region in exquisite detail, which we can do because of the powerful instruments on the Van Allen probes. If the sun really blasts the Earth's magnetosphere with a coronal mass ejection (CME), I suspect it will breach the shield for a period of time," said Baker, also a faculty member in the astrophysical and planetary sciences department.

"It's like looking at the phenomenon with new eyes, with a new set of instrumentation, which give us the detail to say, 'Yes, there is this hard, fast boundary,'" said John Foster, associate director of MIT's Haystack Observatory and a study co-author.

Other CU-Boulder study co-authors included Allison Jaynes, Vaughn Hoxie, Xinlin Li, Quintin Schiller, Lauren Blum and David Malaspina. Other co-authors were from UCLA, Aerospace Corp. Space Sciences Lab in Los Angeles, the University of Minnesota, NASA's Goddard Space Flight Center in Greenbelt, Maryland, the University of Iowa and the New Jersey Institute of Technology.

http://www.eurekalert.org/pub_releases/2014-11/k-mcc112414.php

Moderate coffee consumption may lower the risk of Alzheimer's disease by up to 20 percent

Drinking 3-5 cups of coffee per day may help to protect against Alzheimer's Disease

Drinking 3-5 cups of coffee per day may help to protect against Alzheimer's Disease, according to research highlighted in an Alzheimer Europe session report published by the Institute for Scientific Information on Coffee (ISIC), a not-for-profit organisation devoted to the study and disclosure of science related to coffee and health.

The number of people in Europe aged over 65 is predicted to rise from 15.4% of the population to 22.4% by 20251 and, with an aging population, neurodegenerative diseases such as Alzheimer's Disease are of increasing concern. Alzheimer's Disease affects one person in twenty over the age of 65, amounting to 26 million people world-wide

Recent scientific evidence has consistently linked regular, moderate coffee consumption with a possible reduced risk of developing Alzheimer's Disease. An overview of this research and key findings were presented during a satellite symposium at the 2014 Alzhemier Europe Annual Congress.

The session report from this symposium highlights the role nutrition can play in preserving cognitive function, especially during the preclinical phase of Alzhemier's, before symptoms of dementia occur. The report notes that a Mediterranean diet, consisting of fish, fresh fruit and vegetables, olive oil and red wine, has been associated with a reduced risk for development of Alzheimer's Disease. Research suggests that compounds called polyphenols are responsible for this protective effect, these compounds are also found in high quantities in coffee. Epidemiological studies have found that regular, life-long moderate coffee consumption is associated with a reduced risk of developing Alzheimer's Disease

with the body of evidence suggesting that coffee drinkers can reduce their risk of developing the disease by up to 20%. A recent paper, suggested that moderate coffee consumption was associated with a lower risk of developing dementia over a four year follow-up period, however the effect diminished over longer follow up period.

Finally, the report explores the compounds within coffee, which may be responsible for this protective effect, identifying caffeine and polyphenols as key candidates. Caffeine helps prevent the formation of amyloid plaques and neurofibrulary tangles in the brain - two hallmarks of Alzheimer's Disease. In addition to this, both caffeine and polyphenols reduce inflammation and decrease the deterioration of brain cells - especially in the hippocampus and cortex, areas of the brain involved in memory.

Dr. Arfram Ikram, an assistant professor in neuroepidemiology at Erasmus Medical Centre Rotterdam, presented his findings at the symposium. He commented: "The majority of human epidemiological studies suggest that regular coffee consumption over a lifetime is associated with a reduced risk of developing Alzheimer's Disease, with an optimum protective effect occurring with three to five cups of coffee per day."

Dr. Iva Holmerova, vice chairperson of Alzheimer Europe, commented: "The findings presented in this report are very encouraging and help to develop our understanding of the role nutrition can play in protecting against Alzheimer's Disease. Coffee is a very popular beverage enjoyed by millions of people around the world and I'm pleased to know that moderate, lifelong consumption can have a beneficial effect on the development of Alzheimer's Disease."

The session report details the key scientific research presented by Dr. Neville Vassallo, Dr. Arfan Ikram and Dr. Astrid Nehlig during a session entitled: Nutrition and Cognitive Function, which took place on the 23rd October in Glasgow, UK.

http://bit.ly/1zGoY7u

Bitter coffee today? Try changing the colour of your cup

Cup colour appears to play a big part in the way coffee drinkers perceive the taste of cofee

George Van Doorn, The Conversation

We know different coloured plates can affect how food ‘tastes’ … and now we know that the same applies to coffee. Credit: Esti Alvarez/Flickr, CC BY-NC-SA

In Australia, around a billion cups of coffee a year are consumed in cafés, restaurants and other outlets. Even Britain, a nation famous for its fondness for tea, has in recent years seen a dramatic rise in its coffee consumption, with an estimated 70 million cups drunk each day.

Given the economic incentive to keep consumers drinking coffee, café owners, restaurateurs, crockery designers and manufacturers will, presumably, be interested in anything that can help to enhance the multisensory coffee-drinking experience for their clientele.

And, in research published last week in the journal Flavour by my colleagues and I, it appears that cup colour plays a big part in the way coffee drinkers perceive the taste of their morning cuppa.

One day, at my local cafe …

The idea behind this study came about serendipitously. A barista once told me that when coffee is consumed from a white, ceramic mug, it tastes more bitter than when drunk from a clear, glass mug. Note that these two mug types are among the most commonly used vessels to serve coffee in Australian cafés and restaurants.

My colleagues and I, then, sought to establish the validity of this claim which, to our knowledge, had not been tested before.

Although many studies have been published on colour-flavour interactions over the years, there is a lack of research on the psychological impact of the cups from which we drink. This paucity is surprising given, as we saw above, how many cups of coffee are drunk every day.

The notion that the colour of the receptacle could impact taste/flavour perception might relate to work by consumer studies researcher Betina Piqueras-Fiszman and colleagues, which showed that a red, strawberry-flavoured mousse presented on a white plate was rated as 10% sweeter and 15% more flavourful than when exactly the same food was presented on a black plate.

Coffee and contrast

Taking the principal one stage further, and given the conversation with the barista, we proposed that brown may be associated with bitterness (or, perhaps, negatively associated with sweetness) and that coffee from a white mug should be rated as somewhat more bitter than exactly the same coffee when consumed from a transparent mug.

It is possible that another mechanism might affect the perception of taste. Here, if light, opaque, milky brown coffee were to be associated with bitterness, then a light blue mug should intensify the brown of the coffee as it is brown's complementary colour; as such the brown of the coffee will "pop out".

This, in turn, would be expected to elevate ratings of bitterness relative to the same coffee when served in a transparent mug.

Some famous examples of the use of this "simultaneous contrast" mechanism are Heinz's use of a greenish-blue can to set off the red-orange colour of its beans and sauce, and Cadbury's use of purple packaging to enhance the colour of its chocolate.

In one experiment, the white mug enhanced the rated "intensity" of the coffee flavour relative to the transparent mug – but given slight physical differences in the mugs used, a second experiment was conducted using identical glass mugs with coloured sleeves.

Once again, the colour of the mug was shown to influence participants' rating of the coffee. In particular, the coffee was rated as less sweet in the white mug as compared to the transparent and blue mugs.

The takeaway message

Our study clearly shows that the colour of a mug does influence the perceived taste/ flavour of coffee. Interestingly, Dutch psychologist Ap Dijksterhuis suggested that because of the use of the word "strong" in advertising, consumers often confuse a coffee's strength or intensity with its "bitterness". In our research we found a trend in bitterness ratings that mirrored intensity ratings.

We also found that any reduction in the "sweetness" of the coffee when presented from a white mug might also be expected to increase perceived bitterness (or strength). This supports research (mentioned above) which shows brown, among other colours, is negatively associated with sweetness.

The crossmodal effect of the colour of the mug on the flavour of the coffee reported here suggests that café owners, baristas, as well as crockery manufacturers should carefully consider the colour of their mugs. The potential effects may spell the difference between a one-time purchase and a return customer.

http://bit.ly/15LWVuO

Calorie-burning fat boosted by medicinal Chinese plant

Easy weight loss always comes with a catch. A widely taken plant extract has helped obese mice burn off the calories without exercise – but there are concerns over its safety.

by **Colin Barras**

The fight against obesity gained ground in 2009 with the news that our bodies carry small deposits of brown adipose tissue – a type of fat that burns calories by turning energy into heat. Since then, researchers have been looking for ways to ramp up brown fat activity to realise the dream of weight loss without exercise or counting calories.

Enter berberine. A plant extract found in many Chinese herbal medicines, it has been linked to reductions in insulin resistance in animals. Guang Ning at the Shanghai Jiao Tong University School of Medicine have now shown that it helps weight control in obese mice by both activating brown fat and helping turn ordinary white fat brown.

Weight control

Ning's team gave the mice berberine every three days for a month. Scans showed that the brown fat between the rodent's shoulder blades burned more calories than that in mice not given the extract. There were also signs that the white fat in their groin had begun to act like brown fat. As a result, the mice fed a high-fat diet had better control over their weight.

It's a top quality bit of research, says Henri Huttunen at the University of Helsinki in Finland. "It nicely brings together some earlier isolated findings in a comprehensive package."

Whether berberine can help obese people control their weight is a different matter, though. There's been a lot of hype over the promise of brown adipose tissue, says Dominique Langin at the Institute of Metabolic and Cardiovascular Diseases in Toulouse, France. "But it remains true that adult humans, even lean ones, have much lower brown adipose capacity and 'browning' capacity than rodents."

Toxic to rodents

This might not stop people with obesity from taking berberine, though. "My understanding is that there are hundreds of thousands, if not millions of people who use berberine," says Huttunen. That might be a bad idea, though. A few weeks ago, Huttunen's team published a paper in which they detail evidence of a link between the supplement and toxicity in the central nervous system of rodents, which raises concerns about its safety for human use.

"If this was a pharmaceutical we would begin by showing it's safe and then looking at efficacy," says Huttunen. "But because it's a supplement there's much less concern about the safety – which I find a bit disturbing."

Ning points out that people have been taking berberine in China for 2000 years but agrees it's imperative to test its safety profile. "Toxicology must be studied for the long-term application in obesity treatment", he says.

Journal reference: Nature Communications, DOI: 10.1038/ncomms6493

http://bit.ly/1FGFd6F

Mercury spacecraft moves to testing ahead of 2016 launch to sun's closest planet

After facing down a couple of delays due to technical difficulties, Europe's and Japan's first Mercury orbiter is entering some of the final stages ahead of its 2016 launch.

Elizabeth Howell, Universe Today

Part of the BepiColombo orbiter moved into a European testing facility this past week that will shake, bake and otherwise test the hardware to make sure it's ready for its extreme mission.

Because Mercury is so close to the Sun, BepiColombo is going to have a particularly harsh operating environment. Temperatures there will soar as high as

350 degrees Celsius (662 degrees Fahrenheit), requiring officials to change the chamber to simulate these higher temperatures. Time will tell if the spacecraft is ready for the test.

BepiColombo is also special because it includes not one orbiting spacecraft, but two. Flying in different orbits, the Mercury Planetary Orbiter and the Mercury Magnetospheric Orbiter will try to learn more about this mysterious planet.

NASA's MESSENGER (MErcury Surface, Space ENvironment, GEochemistry and Ranging) spacecraft has spent the past few years orbiting Mercury, but before then, we had very little information on the planet. (And before MESSENGER, only brief flybys from NASA's Mariner 10 in the 1970s turned up spacecraft-based information on Mercury.)

MESSENGER has turned up quite a few surprises. It's showed us more about the nature of Mercury's tenuous atmosphere and it's discovered probable water ice (!) in permanently shadowed areas, among other things. The European Space Agency and Japan hope to push our understanding of the Sun's closest planet when BepiColombo gets there in 2024.

There are so many questions that Mercury presents us, and BepiColombo is trying to answer a few of those. For example, Mercury's density is higher than the rest of the other terrestrial planets for reasons that are poorly understood. Scientists aren't sure if its core is liquid or solid, or even it has active plate tectonics as Earth does. Its magnetic field is a mystery, given that Mars and Venus and the Moon don't have any. And there are tons of questions too about its atmosphere, such as how it is produced and how the magnetic field and solar wind work together.

Mercury Spacecraft Moves To Testing Ahead Of 2016 Launch To Sun's Closest Planet

On Oct. 30, 2014, the Mercury Planetary Orbiter (part of the BepiColombo mission) was moved into the European Space Agency's space simulator for testing ahead of the expected 2016 launch. Credit: ESA–A. Le'Floch

The two spacecraft will be carried together to Mercury's orbit along with a component called the Mercury Transfer Model (MTM), which will push the spacecraft out there using solar-electric propulsion. Just before BepiColombo enters orbit, MTM will be jettisoned and the Mercury Polar Orbiter will ensure the Mercury Magnetospheric Orbiter receives the needed resources to survive until the two spacecraft move into their separate orbits, according to the European Space Agency.

As for why it takes so long to get out there, to save on fuel the mission will swing by Earth, Venus and Mercury to get to the right spot. Once the two spacecraft are ready to go, they're expected to last a year in orbit - with a potential one-year extension.

http://bit.ly/1vYBlyE

New electrolyte for the construction of magnesium-sulfur batteries

A research team has now developed an electrolyte that may be used for the construction of magnesium-sulfur battery cells

The Helmholtz Institute Ulm (HIU) established by Karlsruhe Institute of Technology (KIT) is pushing research relating to batteries of the next and next-but-one generations: A research team has now developed an electrolyte that may be used for the construction of magnesium-sulfur battery cells. With magnesium, higher storage densities could be achieved than with lithium. Moreover, magnesium is abundant in nature, it is non-toxic, and does not degrade in air. The new electrolyte is now presented in the journal Advanced Energy Materials.

In many electrical devices, lithium-ion and metal-hydride batteries are applied for energy storage. Scientists are also studying alternatives to these established battery systems in order to enhance the safety, cost efficiency, sustainability, and performance of future devices. It is their objective to replace lithium by other elements. For this purpose, all battery components have to be newly developed and understanding of electrochemical processes is required.

Magnesium-based battery cells are presently considered an attractive option to replace lithium in batteries. In principle, magnesium allows higher storage densities to be reached than lithium. Other advantages of magnesium are its high abundance in nature, its non-toxicity, and its low degradation in air in contrast to lithium. So far, progress achieved in this area has been limited. For the design of magnesium batteries of high storage capacity and power density, suitable electrolytes are needed that can be easily to produced, that are stable, and can be used in high concentrations in different solvents.

At the HIU, a research team headed by Maximilian Fichtner and Zhirong Zhao-Karger has now presented a new promising electrolyte, which might allow for the development of an entirely new generation of batteries. The new electrolyte is characterized by a number of promising properties. It possesses an unprecedented electrochemical stability window and a very high efficiency. In addition, the electrolyte can be used in various solvents and at high concentrations. Moreover, the electrolyte is chemically compatible with a sulfur cathode, which can be discharged at a voltage close to the theoretical value.

Another advantage is the very simple production of the electrolyte. "Two commercially available standard chemicals, a magnesium amide and aluminium chloride, are applied. They are added to the solvent desired and subjected to

stirring. This simple mixture can then be used directly as an electrolyte in the battery.", Maximilian Fichtner says.

More information: Zhirong Zhao-Karger, Xiangyu Zhao, Di Wang, Thomas Diemant, R. Jürgen Behm, and Maximilian Fichtner: Performance Improvement of Magnesium Sulfur Batteries with Modified Non-Nucleophilic Elec-trolytes. Advanced Energy Materials. Article first published online: 6 OCT 2014. DOI: 10.1002/aenm.201401155

http://www.eurekalert.org/pub_releases/2014-11/uoha-ahf112614.php

Another human footprint in the ocean

Rising anthropogenic nitrate levels in the North Pacific Ocean

Human-induced changes to Earth's carbon cycle - for example, rising atmospheric carbon dioxide and ocean acidification - have been observed for decades. However, a study published this week in Science showed human activities, in particular industrial and agricultural processes, have also had significant impacts on the upper ocean nitrogen cycle.

The rate of deposition of reactive nitrogen (i.e., nitrogen oxides from fossil fuel burning and ammonia compounds from fertilizer use) from the atmosphere to the open ocean has more than doubled globally over the last 100 years. This anthropogenic addition of nitrogen has reached a magnitude comparable to about half of global ocean nitrogen fixation (the natural process by which atmospheric nitrogen gas becomes a useful nutrient for organisms). David Karl, Professor of Oceanography and Director of the Daniel K. Inouye Center for Microbial Oceanography at the University of Hawai'i, teamed up with researchers from Korea, Switzerland and the U.S. National Oceanic and Atmospheric Administration to assess changes in nitrate concentration between the 1960s and 2000s across the open North Pacific Ocean.

Their analysis, which could discern human-derived nitrogen from natural nitrogen fixation, revealed that the oceanic nitrate concentration increased significantly over the last 30 years in surface waters of the North Pacific due largely to the enhanced deposition of nitrogen from the atmosphere. "This is a sobering result, one that I would not have predicted," said Karl. "The North Pacific is so vast it is hard to imagine that humans could impact the natural nitrogen cycle."

The researchers used ocean data in conjunction with the state-of-the-art Earth System Model to reconstruct the history of the oceanic nitrate concentration and make predictions about the future state of the North Pacific Ocean. Their assessment revealed a consistent picture of increasing nitrate concentrations, the magnitude and pattern of which can only be explained by the observed increase in atmospheric nitrogen deposition.

Enhanced nitrogen deposition has several potential ecological ramifications. Because biological activity is limited by nitrate availability in the North Pacific Ocean, the input of new nitrogen from the atmosphere may increase photosysnthesis in the sunlit layers and export of carbon-rich organic material out of the surface ocean into the deep.

"The burgeoning human population needs energy and food - unfortunately, nitrogen pollution is an unintended consequence and not even the open ocean is immune from our daily industrial activities," said Karl.

Given the likelihood that the magnitude of atmospheric nitrogen deposition will continue to increase in the future, the North Pacific Ocean could rapidly switch to having surplus nitrate. Thus, past and future increases in atmospheric nitrogen deposition have the potential to alter the base of the marine food web; and, in the long term, the structure of the ecosystem.

In particular, the shift in nutrient availability could favor marine organisms that thrive under the high nitrate and low phosphorus conditions. If similar trends are confirmed in the Atlantic and Indian Oceans, it would constitute another example of a global-scale alteration of the Earth system. Further, the findings of this study of the North Pacific highlight the need for greater controls on the emission of nitrogen compounds during combustion and agricultural processes.

This research was supported by the Korean National Research Foundation of Ministry of Science, ICT and Future Planning, Science and Technology (Global Research Project), through a novel collaboration between scientists at Pohang University of Science and Technology and the University of Hawai'i. David Karl's participation was also supported by the U. S. National Science Foundation and the Gordon and Betty Moore Foundation through grants GBMF480.01 and GBMF3794.

I-N Kim, K Lee, N Gruber, D M Karl, J L Bullister, S Yang, T-W Kim (2014). Increasing anthropogenic nitrogen in the North Pacific Ocean. Science

http://www.eurekalert.org/pub_releases/2014-11/uoc - bfb112514.php

Bitter food but good medicine from cucumber genetics

High-tech genomics and traditional Chinese medicine come together as researchers identify the genes responsible for the intense bitter taste of wild cucumbers.

Taming this bitterness made cucumber, pumpkin and their relatives into popular foods, but the same compounds also have potential to treat cancer and diabetes.

"You don't eat wild cucumber, unless you want to use it as a purgative," said William Lucas, professor of plant biology at the University of California, Davis and coauthor on the paper to be published Nov. 28 in the journal Science.

That bitter flavor in wild cucurbits - the family that includes cucumber, pumpkin, melon, watermelon and squash - is due to compounds called cucurbitacins. The bitter taste protects wild plants against predators.

The fruit and leaves of wild cucurbits have been used in Indian and Chinese medicine for thousands of years, as emetics and purgatives and to treat liver

disease. More recently, researchers have shown that cucurbitacins can kill or suppress growth of cancer cells.

Bitterness is known to be controlled by two genetic traits, "Bi" which confers bitterness on the whole plant and "Bt", which leads to bitter fruit. In the new work, Lucas, Sanwen Huang at the Chinese Academy of Agricultural Sciences and colleagues employed the latest in DNA sequencing technology to identify the exact changes in DNA associated with bitterness.

They also tasted a great many cucumbers. "Luckily this is an easy trait to test for," Lucas said. "You just chomp on a cucumber leaf of fruit and your tongue gives you the readout!"

They were able to identify nine genes involved in making cucurbitacin, and show that the trait can be traced to two transcription factors that switch on these nine genes, in either leaves or the fruit, to produce cucurbitacin.

The new research shows how domestication tweaked cucumber genetics to make the fruit more edible. Understanding that process might open up approaches to developing other food crops based on plants that are naturally either inedible or poor in nutrition, Lucas said.

It could also make it much easier to produce cucurbitacins in large enough quantities to use in clinical trials and potentially in medicine, Lucas said. For example the anti-malarial drug artemisinin, originally derived from traditional Chinese medicine, is now being produced either as a precursor molecule in yeast or through synthetic biology systems.

Other collaborators on the study included researchers at the Institute of Vegetables and Flowers, Beijing; Agricultural Genomics Institute, Shenzhen, China; Nanjing Agricultural University, Nanjing; Hunan Agricultural University, Changsha; Institute of Botany, Chinese Academy of Sciences, Beijing; Hunan Academy of Agricultural Sciences, Changsha; Wuhan University, Wuhan; Institute of Microbiology, Chinese Academy of Sciences, Beijing; Nihon University, Tokyo, Japan; and Wageningen University, Wageningen, The Netherlands.

http://bit.ly/1yq050t

Super-safe iodide may save millions from heart disease

A common dietary supplement can massively reduce damage to the heart after a heart attack.

- 14:04 27 November 2014 by **Helen Thomson**

The effect was seen in mice but if the same is true for humans, it has the potential to transform treatments for the developed world's biggest killer.

Heart attacks generally occur because of a blockage in the arteries that prevents blood from getting to the heart. This can sometimes be fatal, but the worst damage may actually occur after treatment. When the blockage is removed, the sudden rush of oxygen-rich blood overwhelms cardiac cells and damages the tissue. This can cause death if enough cells are damaged and the heart stops beating.

Now it seems that a dose of iodide, a chemical with a long history of safe use in people, might prevent the worst of the damage.

"Iodide shows extraordinary benefit to the heart, I really think this has the potential to transform heart medicine," says Mark Roth at the Fred Hutchinson Cancer Research Center in Seattle, Washington.

Metabolic overdose

When the heart is deprived of oxygen during an attack, the rate of oxygen consumption in the heart cells plummets. The cells slow down their metabolic activity by reducing the chemical reactions going on inside them, to make the most of the little oxygen available.

For reasons not yet completely understood, when blood flow is restored, metabolic activity and associated oxygen consumption in the cells leaps up to several times higher than it was before the attack. This results in the production of abnormal molecules, or metabolites, that aren't recognised by the immune system. The immune system attacks these cells, causing what's known as a reperfusion injury.

It is such an important problem that recently the US National Institutes of Health stated that a primary goal of heart medicine should be to prevent the heart from "metabolising itself to death".

"We're trying to hold back the horses," says Roth, referring to his team's attempt to prevent the sudden increase in metabolic reactions after treatment.

To do so, the team replicated a heart attack in mice by tying a thread around a main artery. They then either gave the rodents an injection of iodide or a saline placebo 5 minutes before removing the string – the equivalent of doctors using a small balloon to widen blocked arteries in people. Dissection of the mouse hearts showed that rodents that received iodide had 75 per cent less dead tissue than those that were given the saline.

Roth thinks the iodide might decrease the production or secretion of hormones by the thyroid, among other things. These hormones normally stimulate metabolic reactions, so depressing them may reduce cardiac metabolism.

Hearty benefits

Malcolm Bell at the Mayo Clinic College of Medicine in Rochester, Minnesota, warns that reperfusion has historically been a difficult nut to crack. "The whole reperfusion injury field is filled with failed therapies despite promising animal work," he says.

Graham Nichol at the University of Washington in Seattle agrees that most therapies that help limit reperfusion injuries in animals have not been beneficial in

humans, bar one or two exceptions. However, he says that he is very impressed by the size of the benefits in Roth's study. "If it does work in humans, I think that will be because it works via multiple pathways, as opposed to previous failed therapies, which work on very specific pathways," he says.

He says that a 75 per cent reduction in tissue damage would result in better heart function, so that people who survive heart attacks would be less likely to have heart problems in the future, and much less likely to die of heart failure. "I can't give you a magic number of lives saved," he says, "but it's significant".

Roth remains positive about iodide's potential. He says it has been intensively studied for hundreds of years and is considered very safe for human consumption. Adults consume iodide every day, mainly by eating cereals and fish, and he points out that you can ingest 10,000 times the recommended daily allowance without experiencing any toxic effects. "The safety and efficacy of iodine is hard to overstate," he says. That means clinical trials could be approved relatively quickly – perhaps in the next year or two.

In the meantime, it is not known whether taking an iodide pill every day would help stave off heart attacks, but Roth says it's unlikely, since the body would probably adapt to continuously high levels of the chemical. "Maybe eating a couple of pills before a cardiac bypass surgery might help you out," he says, "it's all worth us investigating".

Journal reference: PLoS One, DOI: 10.1371/journal.pone.0112458

http://wrd.cm/1vZgZW1

Limestone 'Venus' 23,000 years old dug up in France

A limestone statuette of a shapely woman some 23,000 years old has been discovered in northern France in what archaeologists Thursday described as an "exceptional" find.

Archaeologists stumbled on the Paleolithic-era sculpture during a dig in the summer in Amiens, the first such find in half a century.

"The discovery of this masterpiece is exceptional and internationally significant," said Nicole Phoyu-Yedid, the head of cultural affairs in the area, on showing the find to the media.

"We were expecting to find classical vestiges such as tooled flint or bones," said archaeologist Clement Paris.

But on their second day of fieldwork, the team found a pile of limestone that included fragments which did not seem natural.

"That same night we carefully pieced together the 20-odd fragments and realised it was a female statuette," he added.

Carbon-14 dating of organic material found at the site showed the statue to be 23,000 years old.

About 12 centimetres (4.7 inches) high, it shows a woman with big breasts and buttocks. The head and arms are less detailed.

"The fact that the sculpture is not totally realistic shows the intent was to produce a symbolic image of a woman linked to fecundity," Paris said. Around 100 such figures have been found in Europe, mostly in Russia and central Europe, including around 15 in France, most of them discovered in the southwest.

A person points to a 23,000 year-old chalk statue of a woman called the "Venus of Renancourt" which was found at the paleolithic site of Renancourt, France

http://bit.ly/12dr6JN

Engineers create 'superomniphobic' texture capable of repelling all liquids

A pair of researchers from the UCLA Henry Samueli School of Engineering and Applied Science has created the first surface texture that can repel all liquids, no matter what material the surface is made of.

Matthew Chin in Chemistry / Materials Science

Phys.org - Because its design relies only on the physical attributes of the texture, the texture could have industrial or biomedical applications. For example, the surface could slow corrosion and extend the life of parts in chemical and power plants, solar cells or cookware.

Water will bead up on a nonstick cooking pan because it is coated with a hydrophobic material that repels water thanks to its chemical composition. If the hydrophobic material also is rough at the microscopic scale, it can trap air at its surface, causing the water to bead up and roll around effortlessly. Scientists have named such surfaces "superhydrophobic" to distinguish their unusual zeal to repel water. As an example in nature, water droplets will bead and roll down on some leaves.

"At the microscopic scale, the leaves' surfaces are 'hairy' and points of contact with water are reduced," said Chang-Jin "CJ" Kim, a UCLA professor of mechanical and aerospace engineering, and the study's principal investigator. "This reduction in points of contact means the water is held up by its own surface tension. Manmade superhydrophobic surfaces have been designed to take advantage of this phenomenon by forming microscale roughness or patterns on a hydrophobic material."

While a nonstick cooking pan is hydrophobic, it is not "oleophobic," meaning that it does not repel oil-based liquids. Cooking oil spreads out rather than beading up because it has a lower surface tension than water, making it more difficult to repel. Since the material is not oleophobic, roughening it won't make its surface oleophobic, let alone "superoleophobic."

However, in recent years scientists have created certain microscopic textures capable of making surface hydrophobic materials' surfaces not only oleophobic but also superoleophobic. But a true "omniphobic" surface - one that can repel any liquid, even those with the lowest surface tensions - has remained elusive.

Liquids with extremely low surface tension will "wet" not only the cooking pan but also even the best-performing superoleophobic surfaces today, collapsing into their microscopic texture. These liquids include fluorinated solvents, some of which are used for industrial applications like cooling electronic devices.

Although the term "superomniphobic" began to be used by some, no surface was shown to repel the fluorinated solvents.

Working with Tingyi "Leo" Liu, a postdoctoral scholar in Kim's lab and the paper's lead author, Kim demonstrated for the first time true omniphobicity. The engineers formed a surface covered with thousands of microscale flathead nails, each about 20 micrometers in head diameter - each much smaller than the width of a typical human hair - resembling the appearance of existing superoleophobic textures.

The effect had never previously been observed, either on manmade or natural surfaces. It relies solely on the physical attributes of the texture, rather than any chemical properties of the material the surface is made of. Kim said it would actually be appropriate to call it a "mechanical" surface.

The research, which was part of Liu's doctoral dissertation at UCLA, is published in the journal Science.

The key to the team's innovative design is additional nanoscale details around the nail heads. Underneath the flat head, a nanoscale thin and short "curtain" surrounds the top and droops down vertically. This overhang creates a reverse meniscus when the liquid is on the surface and suspended between the nails. These special nails, spaced about 100 micrometers apart, are reminiscent of a serif letter "T" in cross section. On this engineered surface, even completely wetting liquids roll around like a ball and slide right off when the surface tilted.

"In a manned spaceship, you can see how a liquid will hold together as a sphere and that's because it's completely surrounded by air, that's the same idea here," Liu said. "On our textured surface, liquid sits on a cushion that is 95 percent air, and its own surface tension holds it up so it can roll over the surface without collapsing."

The surface super-repelled all available liquids, including water, oils and many solvents, qualifying to be superomniphobic. It even super-repelled a fluorinated solvent called perfluorohexane, the liquid with the lowest known surface tension. The team made the same microscale pattern on surfaces of glass, a metal and a polymer. In each case, the engineered surface super-repelled all liquids in a series of tests.

The researchers said it could be capable of lasting a long time in an outdoor environment, such as on buildings or vehicles, because its repelling properties would not degrade from ultraviolet light exposure and extreme temperatures. And it could improve biomedical devices because its repelling properties would not degrade because of fouling by biofluids. Kim also has a UCLA faculty appointment in bioengineering and is a member of the California NanoSystems Institute. The researchers have filed a patent on the work.

More information: "Turning a surface superrepellent even to completely wetting liquids," by T. Liu et al., Science, 2014. www.sciencemag.org/lookup/doi/... 1126/science.1254787

http://bit.ly/1HR7rj4

Venus Express spacecraft, low on fuel, does delicate dance above doom below

It's been an interesting year for Venus Express.

Elizabeth Howell

A few months ago, controllers deliberately dipped the spacecraft into the atmosphere of the planet - for science purposes, of course. The daring maneuver was approved because the spacecraft is near the end of its mission. It's nearly out of fuel and will fall into Venus - sometime. Likely in 2015. No one knows exactly when, however.

Until Dec. 30, European Space Agency operators are going to boost the spacecraft's orbit to try to get a little more productivity out of it. After that, all depends on what gas is left in the tank.

The push against the dense atmosphere revealed a few surprises. In a recent blog post, ESA said the atmosphere was changing more than expected. Between different altitudes, controllers sometimes saw a steady rise in pressure and sometimes multiple peaks. The spacecraft's journeys took it as low as 129.2 kilometers (80 miles) above the surface, but mostly involving a month of "surfing" between 131 km and 135 km (81.4 miles and 83.9 miles).

"One possible explanation is that we detected atmospheric waves," stated Håkan Svedhem, Venus Express project scientist. "These features can be caused when high speed winds travel over mountain ranges. The waves then propagate upwards. However, such waves have never before been detected at such heights – twice the altitude of the cloud deck that blankets Venus."

ESA observed that the atmospheric density increased 1,000 times between 165 km and 130 km (102.5 miles and 80.8 miles) and that it also changed when the spacecraft moved from day to night (specifically, it was four times greater on the sunlit side.) Measurements were also taken of high-energy particles and Venus' magnetic fields, which are still being examined.

But now, the end is indeed near for the spacecraft after eight years at Venus - four times longer than its primary mission. Although it is healthy and performing routine science operations, fuel is only standing at around 3 kilograms (6.6 pounds) and oxidizer at 5 kg (11 lbs). It's possible not all of it is accessible due to propellant movement in the tanks, ESA said. The new maneuvers are expected to subtract 1.4 kg of fuel and 2 kg of oxidizer from these totals.

"Unfortunately, we do not know how much fuel remains in its tanks, but we are intending to continue the up-down process as long as possible, until the propellant runs out," Svedhem added. "We have yet to decide whether we shall simply continue until we lose control, allowing it to enter the atmosphere and burn up naturally, or whether we attempt a controlled descent until it breaks up."

More information: - *blogs.esa.int/rocketscience/20... rbit-and-keep-going/*

http://bit.ly/1vaolnt

Has the brain-zap backlash begun?

Stimulating the brain with electricity improves working memory, mental maths, focused attention, creativity and could help treat depression.

17:51 28 November 2014 by **Caroline Williams**

You can even buy DIY kits online. That's the good news. The bad news is that the most recent investigation has found it has almost no measurable effect on the brain. It's a conclusion that is likely to be controversial. Over the past decade, thousands of studies have reported a beneficial effect of transcranial direct current stimulation (tDCS) on the brain, as well as on behaviour and cognition – so much so that it has become something of a hot topic in neuroscience.

The idea behind tDCS is that passing a weak current through the brain changes the electrical potential of nerve cell membranes. This alters the strength of connections between neurons, making the circuit more, or less likely to fire. It's a tricky thing to measure directly, so any physiological effect is inferred by blood flow changes on functional MRI scans, changes in brainwaves measured by EEG, or in the strength of muscle contraction when the motor cortex is stimulated, known as an MEP.

But when Jared Horvath and his colleagues at the University of Melbourne in Australia, pooled the results of more than 100 studies reporting any or all of these measures, they found that only one was convincingly changed after tDCS. The other two were inconsistent at best.

Got no control

"There doesn't appear to be any significant or reliable effect of tDCS on blood flow, electrical, or evoked activity within the brain," says Horvarth. "The only measure tDCS appears to reliably modulate is MEP amplitude – a measure that fluctuates so strongly naturally that it has largely been abandoned as a clinically useful measure."

And not only that, because just 25 of the 117 studies used a control condition, where electrodes were placed on the scalp but not switched on, it is impossible to know whether stimulation was definitely the root cause of any changes seen.

So is it time to ditch tDCS as an unproven fad? Definitely not, says Roi Cohen Kadosh, a cognitive neuroscientist at the University of Oxford who uses electrical stimulation in his work.

"There are several things that explain what they found and why I am not that concerned," he says. "First, they didn't take account of individual differences or variation in stimulation intensity [between studies]. I would not expect that one stimulation would work on everyone or at the same level for everyone" he says. Other studies have found that differences in brain structure affect the dose of electricity that actually gets to the brain, he points out.

DIY, FYI

However, Vincent Walsh, a cognitive neuroscientist at University College London, is less convinced. "This is an important paper," he says, especially because it casts doubt on the aspect of this research that until now had been assumed to be the most robust - the physiology.

"In terms of cognition, which is the other aspect that people make claims about, tDCS is massively hyped. The danger is that people have been promised better memories, better reading, better maths, increased intelligence… you name it. The effects are small, short lasting, and no substantial claims have been replicated across laboratories. This paper is hopefully the beginning of a counterweight to all the bullshit."

To that end, Hovarth and the Melbourne team are currently finalising another analysis, this time looking at the evidence for cognitive and behavioural change after tDCS. He won't give details before publication, but Hovarth hints that many people might think the findings are controversial.

And what are the DIY stimulation enthusiasts to make of all this? "There are two options," says Horvath. "The first is that tDCS is doing something, but we don't know what, so take that on board. The second is a bit more innocuous: tDCS might not be doing anything to the brain, so have a good time, but temper your expectations."

Journal reference: Neuropsychologia, DOI: 10.1016/j.neuropsychologia.2014.11.021

http://bit.ly/11IgYaX

New Class of Polymers Discovered By Accident

Eco-friendly polymers strong enough to use in cars and airplanes

Nov 18, 2014 |By Rachel Nuwer

When research chemist Jeannette García found a candy-size lump of white material in a flask she had recently used, she had no idea what she had created. The material stuck firmly to the glass, so she used a hammer to break it free. But when she turned the hammer on the material itself, it refused to crack.

"When I realized just how high its strength was, I knew I needed to figure out what I'd made," García says.

García, a scientist at IBM Research–Almaden, enlisted the help of several colleagues to solve the puzzle.

They found that she had stumbled on a new family of thermoset polymers, exceptionally strong plastics that are used in products ranging from smartphones to airplane wings.

Thermosets account for about one third of the global polymers produced every year, but they are difficult to recycle.

García's new material, nicknamed Titan, is the first recyclable, industrial-strength thermoset ever discovered.

Unlike conventional thermosets, which pretty much refuse to be remolded, the new polymer can be reprocessed through a chemical reaction. García and her colleagues reported their discovery in May in Science.

Global demand for durable, recyclable plastics is expected to soon increase. By 2015, for example, both Europe and Japan will require that 95 percent of car parts produced there be recyclable.

"This is a perfect example of a material that would work for that," García says. But she believes that the new thermoset could also eventually extend into a range of applications—anticorrosive and antimicrobial coatings, drug delivery, adhesives, 3-D printing, water purification, among others.

Titan came with a bonus, too. García and her colleagues discovered a second form of the material—a self-healing, gel-like substance they call Hydro—that forms at lower temperatures.

"If you cut it in half and then put it back together, it instantly forms bonds," García says.

It could be used as an adhesive, she notes, or as a self-healing paint. Other, related compounds could follow.

"It's not just this one new polymer but a new polymer-forming reaction." García says.

http://bit.ly/1vAsKQy

Antikythera mechanism: Researchers find clues to an ancient Greek riddle

An ancient Greek astronomical puzzle now has another piece in place.

Phys.org - The New York Times reported the new evidence today in a story about research by James Evans, professor of physics at University of Puget Sound, and Christián Carman, history of science professor at University of Quilmes, Argentina.

The ancient Antikythera relic rescued from a shipwreck. **Credit: Giovanni Dall Orto**

The two researchers published a paper advancing our understanding of the Antikythera Mechanism, an ancient Greek mechanism that modeled the known universe of 2,000 years ago. The heavily encrusted, clocklike mechanism—dubbed the "world's first computer"—was retrieved from an ancient shipwreck on the bottom of the sea off Greece in 1901. The new work is published in the Archive for History of Exact Science.

After several years of studying the mechanism and Babylonian records of eclipses, the collaborators have pinpointed the date when the mechanism was timed to begin—205 B.C. This suggests the mechanism is 50–100 years older than most researchers in the field have thought.

The new work fills a gap in ancient scientific history by indicating that the Greeks were able to predict eclipses and engineer a highly complex machine—sometimes called the world's first computer—at an earlier stage than believed. It also supports the idea that the eclipse prediction scheme was not based on Greek trigonometry (which was nonexistent in 205 B.C.)—but on Babylonian arithmetical methods, borrowed by the Greeks.

Far more conjecturally, this timing also makes an old story told by Cicero more plausible—that a similar mechanism was created by Archimedes and carried back to Rome by the Roman general Marcellus, after the sack of Syracuse and the death of Archimedes in 212 B.C. If the Antikythera mechanism did indeed use an eclipse predictor that worked best for a cycle starting in 205 BC, the likely origin of this machine is tantalizingly close to the lifetime of Archimedes.

Evans and Carman arrived at the 205 B.C. date using a method of elimination that they devised. Beginning with the hundreds of ways that the Antikythera's eclipse patterns could fit Babylonian records (as reconstructed by John Steele, Brown University) the team used their system to eliminate dates successively, until they had a single possibility.

The calculations take into account lunar and solar anomalies (which result in faster or slower velocity), missing solar eclipses, lunar and solar eclipses cycles, and other astronomical phenomena. The work was particularly difficult because only about a third of the Antikythera's eclipse predictor is preserved.

Evans and Carman first presented their ongoing research at a Netherlands conference in June 2013, stimulating debate among their peers. The new online paper will appear in the journal's January 2015 hard copy edition.

http://www.eurekalert.org/pub_releases/2014-12/tju-hdb112414.php

HIV drug blocks bone metastases in prostate cancer

The receptor CCR5, targeted by HIV drugs, is also key in driving prostate cancer metastases, suggesting that blocking this molecule could slow prostate cancer spread

PHILADELPHIA - Although prostate cancer can be successfully treated in many men, when the disease metastasizes to the bone, it is eventually lethal. In a study published online December 1st in the journal Cancer Research, researchers show that the receptor CCR5 best known for its role in HIV therapy, may also be involved in driving the spread of prostate cancer to the bone.

"Because this work shows we can dramatically reduce metastasis in pre-clinical models, and because the drug is already FDA approved for HIV treatment- we may be able to test soon whether this drug can block metastasis in patients with prostate cancer," says Richard Pestell, M.D., Ph.D., MBA, Director of the Sidney Kimmel Cancer Center at Thomas Jefferson University and senior author on the study.

The work builds on previous research from Dr. Pestell's lab that showed in 2012 that CCR5 signaling was key in the spread of aggressive forms of breast cancer to the lungs. Their prior paper demonstrated that breast cancer cells that carried the CCR5 receptor on their surface were drawn to the lung. Given that prostate cancer cells were attracted to the bone and brain, Pestell's team investigated whether CCR5 could play a role in prostate cancer metastases as well.

The research was complicated by the fact that there was no immune competent mouse model of prostate cancer that reliably developed bone and brain metastases. So the researchers developed a prostate cancer cell line, driven by an upregulated Src gene, that regularly caused bone metastases in immune-competent mouse models. Because the immune system is so important in human prostate cancer it was important to develop a model that reflected human disease.

The researchers analyzed the genes of the metastasized bone and brain tumors and found genes driving the cancer were also involved in the CCR5 signaling pathway. To investigate further, the researchers administered the CCR5-blocking drug maraviroc to the new prostate cancer mouse model. In comparison to control animals, maraviroc dramatically reduced the overall metastatic load by 60 percent in the bone, brain and other organs.

Finally, in order to determine whether a similar mechanism might be at play in human prostate cancer, the researchers mined the genomic data of patients with prostate cancer and found that CCR5 was more highly expressed in prostate cancer tissue compared with normal tissue, and even more highly expressed in metastases compared with primary tumors. "In fact, we noticed that patients who had a lower expression of the CCR5-pathway genes had a longer survival times, whereas high expression of these CCR5 genes was associated with a shorter overall survival," said co-first author Xuanmao Jiao, Ph.D., and an instructor in the department of Cancer Biology at Jefferson.

The next steps for the researchers are to develop clinical trials using CCR5 pathway activation as a companion diagnostic for the trial

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http://nyti.ms/1rMXFUP

Federal Study Finds 55 Percent of Infants Sleep With Soft Bedding, Raising Risk of Death

2/3 of black and Latino parents still use bedding that is both unnecessary and unsafe

By Catherine Saint Louis Dec. 1, 2014

Nearly 55 percent of infants nationwide are put to bed with soft blankets or covered by a comforter, even though such bedding raises the chances of suffocation or sudden infant death syndrome, federal researchers reported Monday.

Their study, published in the journal Pediatrics, is the first to estimate how many infants sleep with potentially hazardous quilts, bean bags, blankets or pillows.

Despite recommendations to avoid putting anything but a baby in a crib, two-thirds of black and Latino parents still use bedding that is both unnecessary and unsafe, the study also found.

"I was startled a little bit by the number of people still using bedding in the sleep area," said Dr. Michael Goodstein, a neonatologist in York, Pa., who serves on a task force on sleep-related infant deaths at the American Academy of Pediatrics. "Sleeping face down on soft bedding increases the risks of SIDS 21-fold."

Among the risk factors for SIDS, "bedding has fallen through the cracks," said Dr. Thomas G. Keens, the chairman of the California SIDS Advisory Council. "This article is a wake-up call."

The new analysis looked at data gathered from 1993 to 2010 in the National Infant Sleep Position Study, which surveyed a random sample of nearly 19,000 parents by telephone.

Use of infant bedding declined roughly 23 percent annually from 1993 to 2000. In recent years, however, the declines have slowed or stalled entirely.

From 2001 to 2010, use of inappropriate bedding for white and Hispanic infants declined just 5 to 7 percent annually.

There was no decline in the use of such bedding for black infants.

Parents in the new study were not asked their reasons for using bedding. Previous research has found that they worry infants will be cold, or that the crib mattress is too hard.

Sometimes parents misunderstand that a soft blanket should neither be used under an infant nor to cover one, said Dr. Rachel Moon, a pediatrician, and Dr. Fern Hauck, a family physician, in an editorial accompanying the new study.

"Parents get a lot of mixed messages," said Carrie Shapiro-Mendoza, the lead author and a senior scientist in the division of reproductive health at the Centers for Disease Control and Prevention.

"A relative will give them a quilt or fluffy blanket that they may feel obligated to use, or they look at magazines and see a baby sleeping with a pillow."

In fact, the safest place for a baby to sleep is on his back in a crib or bassinet, never an adult bed or sofa.

The surface should be firm and covered by only a fitted sheet, no other bedding. Properly sized sleep sacks are acceptable, because babies rarely get tangled in them.

Many well-intentioned gift givers purchase unsafe crib comforters and ultrasoft blankets.

"If you want to show people how much you care, decorate the room," Dr. Goodstein said.

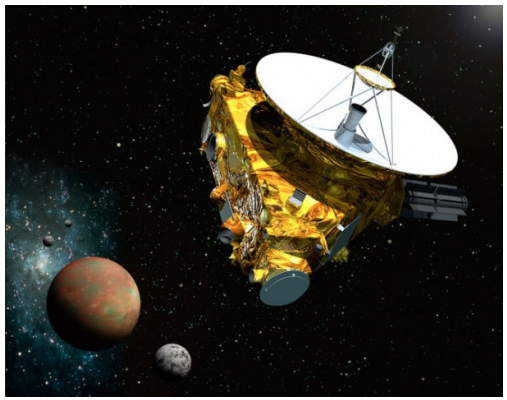
http://wrd.cm/1yASflM

Spacecraft Bound for Pluto Prepares for Its Close Encounter

The first spacecraft to ever visit Pluto is set to wake up on Dec. 6 in preparation for its midsummer rendezvous with the solar system's most famous dwarf planet.

By Marcus Woo

The New Horizons spacecraft has been speeding toward Pluto for almost nine years, covering 2.9 billion miles. To conserve energy and general wear and tear, the spacecraft has gone into intermittent hibernation, often for months at a time, slumbering for a total of five years. When sleeping, it was almost completely shut down, maintaining only enough power to send a weekly beep home telling mission controllers that it's doing fine. But now it's go time.



Artist's concept of the New Horizons spacecraft with Pluto and three of its moons.
Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute (JHUAPL/SwRI)

The spacecraft's systems are programmed to start up again on Dec. 6 at 12:00 p.m. PST/3:00 p.m. EST. An hour and a half later, it will send a signal back to Earth confirming that it's awake. But because it's so far away, it will take more than four hours for the message to reach mission control—around 6:30 p.m. PST/9:30 p.m. EST. Mission controllers will then take six weeks to check all of the spacecraft's systems and prepare its approach toward Pluto, which starts in earnest on January 15, 2015.

When New Horizons launched in January 2006, Pluto was still considered a full-fledged planet, the only one not to have been visited by any spacecraft. But later that year the International Astronomical Union vote to reclassify Pluto as a dwarf planet.

At the time of launch, Pluto was known to have three moons: Charon, discovered in 1978, and Nix and Hydra, spotted in 2005. Then in 2011 and 2012, scientists found two more, Kerberos and Styx, respectively, giving New Horizons even more places to explore. One of the mission's goals is see whether Pluto has any more companions, and if it has a ring system. Astronomers using the Hubble Space Telescope haven't seen anything yet, but that doesn't mean there aren't moons and rings too small and faint to detect.

More moons and a ring system would certainly be exciting. But they could also be bad news, says Simon Porter, a planetary scientist at the Southwest Research Institute in Tucson, Arizona, who's on the New Horizons science team. If there are smaller, yet-to-be-detected moons, then they likely have been struck by all sorts of other tinier objects, like baseball-sized space rocks. Those collisions would have kicked up dust that could escape the gravity of its moon, but not the Pluto system. That means there could be a lot of dust floating around, posing a hazard to New Horizons.

From the spacecraft's point of view, the millimeter-wide dust particles would be space bullets, zipping by at almost 30,000 miles per hour with enough force to do some major damage.

The New Horizons team is especially worried because the spacecraft itself will be chock full of exciting data. As it flies by Pluto, it will save all of its images and measurements onboard before sending them back to Earth (there will be so much data that it will take until late 2016 to finish transferring). If something happens to the spacecraft, all that information could be lost.

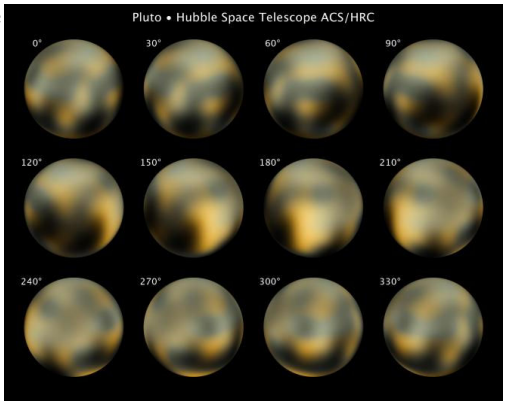
Fortunately, Porter and his colleagues have been scoping out the Pluto system. In addition to analyzing Hubble images, they're running computer simulations to assess the potential dangers posed by hypothetical moons placed in various orbits. So far, they don't see anything that could threaten New Horizons. But the worry is in the unexpected. "The concern is from dust from satellites that we don't know about," he said. New Horizons won't be close enough to Pluto to really assess the threat until late April. But even if there are unknown moons, the spacecraft might still be safe because its current trajectory takes it through areas that shouldn't be too dusty based on the physics of the system, Porter explains.

In the worst-case scenario, and New Horizons finds itself in perilous space, the team can position the piano-sized spacecraft so that its nearly 7-foot-wide dish antenna acts as a shield. The team can also change the trajectory of the craft so that it flies by Pluto at a greater distance, farther from any dangerously dusty regions. That would limit the resolution of the images, and if the spacecraft has to orient its dish antenna to act as a shield, then it can't point some of its instruments at Pluto, which means it can't collect as much data as scientists hope, Porter says. But at least the spacecraft would be safe.

Despite the risks, the mission is poised to return a glut of discoveries, continuing the legacy of the first planetary spacecraft: the Mariner missions that visited Mercury, Venus, and Mars in the 1960s and 1970s, and the Voyager missions that explored the outer planets in the 1980s. Those missions were pioneers, as nearly every image and measurement revealed fantastic worlds never seen before.

"Every time in the past we've had a first look at a new system, we've been surprised," said Will Grundy, a planetary scientist at Lowell Observatory in Flagstaff, Arizona, and a member of the mission's science team.

To date, the best image of Pluto (below), taken by Hubble, shows a blurry disk. Starting in the spring, New Horizons will reveal an icy world with a wispy atmosphere, possible polar ice caps, and maybe even mountains and cryogenic volcanoes and geysers that spew nitrogen or some ammonia-water blend, similar to the ones that might exist on Charon.



The most detailed view of Pluto, taken by Hubble from 2002 to 2003, hints at how the surface changes. **NASA/ESA/SRI (M. Buie)**

Telescopes reveal that Pluto's surface has the chemical signatures of compounds such as methane, nitrogen, and carbon monoxide. It's so cold there—an average of about -380 degrees Fahrenheit—that all those chemicals are frozen. But they are volatile substances and could be subject to all kinds of chemical and geological processes, meaning that Pluto's surface could be fairly active, Grundy says.

Yes, Pluto is "merely" a dwarf planet now, but that doesn't seem to matter to mission scientists. They all refer to Pluto as a planet, Grundy says, partly because that's what they've always known it to be and partly because it's "shorthand for a big round thing." At a press conference on Nov. 13, New Horizons project scientist Hal Weaver pointed out that the term "dwarf planet" still has the name "planet" in it.

Pluto is one of the largest objects in the Kuiper belt, a collection of cold bodies beyond the orbit of Neptune and the last frontier of the solar system. The first Kuiper belt object wasn't discovered until 1992. There are now more than 1,000 known Kuiper belt objects, and scientists estimate there are hundreds of thousands of them.

These objects have been around since the formation of the planets, so they serve as relics that help researchers understand the history and origin of the solar system. And Pluto contains clues about these ancient, icy bodies. For example, any craters on its surface will help scientists estimate how frequently Kuiper belt objects slammed into one another in the past, Grundy says.

Today, New Horizons is still 175 million miles from Pluto, but by mid-April, it will be close enough that its images will surpass those taken by Hubble.

"Then it gets better and better and better," Weaver said at the November press conference. By June and July, New Horizons will be close enough to study Pluto's geology. "We'll have lots of juicy science—historic science—well before the day of the closest approach," he said.

That day of closest approach is July 14, 2015, when the spacecraft will be only about 6,200 miles from Pluto, zipping by at about 31,300 miles per hour. Its high-resolution cameras will be able to pick out surface details 230 feet wide, which, at the same distance from Earth, would be equivalent to identifying the ponds in New York City's Central Park, according to planetary scientist Alan Stern of the Southwest Research Institute, who's leading the mission.

The rendezvous with Pluto will last six months, and New Horizons will map the geology, temperature, and composition of Pluto and its moons, and analyze the Plutonian atmosphere. As New Horizons leaves the Pluto system, it will glance back at Pluto passing in front of the sun to see whether there's a haze above the atmosphere—a feature that was also seen on Neptune's moon Triton, which is similar to Pluto in size, atmosphere, and surface composition. New Horizons may also discover a comet-like tail of particles streaming off Pluto.

Even when New Horizons leaves the Pluto system, it's not quite done. In October, astronomers used Hubble to identify three smaller Kuiper Belt Objects that New Horizons could visit in around 2019. But whether the spacecraft will make the extra visit depends on its post-Pluto condition and NASA funding.