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The planetary collision that formed the Moon may have been way more violent than we thought

But not all researchers are convinced

By Loren Grush @lorengrush Sep 12, 2016, 12:01p

After studying the chemical makeup of lunar rocks, scientists say they have found new evidence that disproves one of the leading theories of how the Moon formed. The evidence hinges on the presence of just one element: potassium, and it suggests that the planetary collision that formed our satellite was extremely violent — an idea that's very different from what was previously thought.

It could change our understanding of our planetary system's history

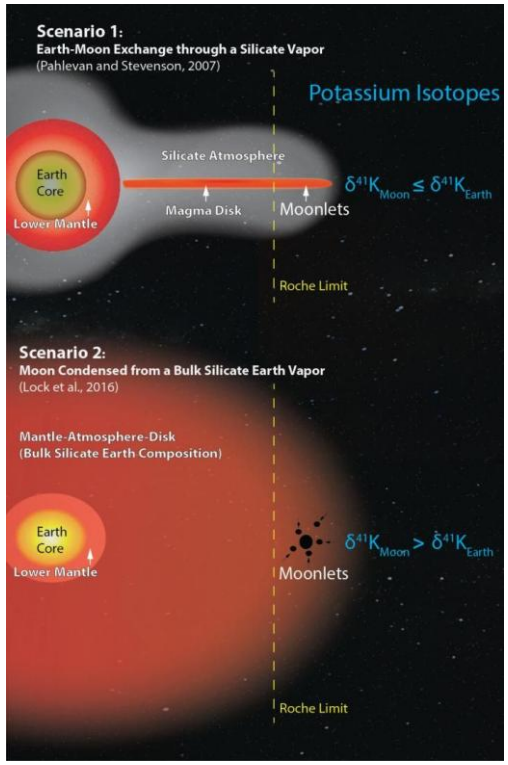
The new theory — detailed in a study published today in *Nature* — is a radical new concept that could change our understanding of our planetary system's history. But not all researchers are convinced just yet. "That is definitely a tall claim," Munir Humayun, a geologist at Florida State University who was not involved in the study, tells *The Verge*. "It's a little too early with their data to tell that."

For decades, most astronomers have agreed that the Moon is the result of a giant collision between the Earth and a Mars-sized object, called the impactor. But not everyone can agree on the exact mechanics of that collision. Right now, a popular theory suggests that the impact was relatively low-energy, leaving the Earth mostly intact but causing the impactor to melt into magma. This magma formed a disc out in space — what would eventually turn into the Moon.

But study author Kun Wang says that the potassium signatures they found paint a different scenario. The collision that formed the Moon wasn't low energy at all, he argues. Instead, the impact was extremely violent, pulverizing most of the Earth and the impactor, and turning them into a vapor. In this scenario, the vaporized Earth and impactor mix together into a giant dense atmosphere. This atmosphere then cools and condenses into our planet and its satellite.

"This model is entirely different," Wang, a geochemist at Washington University in St. Louis, tells *The Verge*. "The impact is much larger."

The idea that a giant planetary crash formed the Moon has been around since the 1970s; it's known as the giant-impact hypothesis. But there have been some problems with the model. Originally, the hypothesis suggested that about 80 percent of the Moon came from the impactor and the rest from Earth. That became an issue as researchers started studying the composition of the Moon more closely. It turns out that the Moon and Earth share a lot of the same chemical makeup, meaning the Moon must have been made from a much more significant portion of our planet's material.



Astronomers have modified the giant-impact hypothesis a bit.

***The two competing theories for how the Moon formed. The first depicts the silicate atmosphere concept, while the second depicts the concept of a more vaporized Earth.* (Kun Wang)**

To fix this problem, astronomers have modified the giant-impact hypothesis a bit. A new model from 2007 proposed that a silicate atmosphere surrounded the planetary system after the impactor collided with Earth. This atmosphere would have acted like a conduit, allowing materials to be exchanged between the Earth and the impactor's magma, which eventually formed the Moon. That would solve the mystery of why Earth and its satellite are so similar.

But Wang says his new potassium measurements don't fit with this model either. Specifically, the researchers analyzed seven lunar rocks and eight Earth rocks. They measured two different variants — or

isotopes — of potassium: potassium-41, the heaviest version of the element, and potassium-39, the lightest version. They found that the lunar samples are richer in the heavier element, potassium-41, than the Earth samples.

These findings don't support the giant-impact hypothesis the way it stands now, Wang explains. The Moon should be richer in potassium-39, not the other way around. If the "silicate atmosphere" theory is true, both Earth and the newly forming Moon would have been super heated after the collision, and potassium would have been evaporating from both objects. But since the Earth is so much bigger, the planet would have sent way more potassium over to the Moon, not the other way around. And since the lighter element evaporates faster than the heavier one, that should make the Moon more rich in potassium-39 — not potassium-41.

The only way to explain the higher abundance of potassium-41 on the Moon is the much more violent impact, says Wang. In this scenario, the Earth is almost completely vaporized, so all of the potassium from the planet would be mixed up in the dense vapor leftover from the collision. That vapor eventually condensed to form the Moon. In the condensation process, the heavy potassium would have condensed into the Moon more than the light potassium. Thus, the Moon would have more potassium-41. "Our paper is the first hard, real evidence to support that theory," says Wang.

Humayun says that Wang and his team haven't disproven anything just yet. But Humayun, who has specialized in potassium isotopes, says that Wang and his team haven't disproven anything just yet. The lunar samples used for the study don't accurately represent the Moon's potassium composition, Humayun says. And that means this study doesn't truly negate any of the Moon's origin stories — for now. "I'm very pleased overall with what they have done, I just wish they had used better samples," he says.

Wang and his team analyzed a mixture of lunar breccias and lunar basalts. Humayun argues that breccias — rocks made from small meteorites slamming into the surface of the Moon — tend to be contaminated with soil that has more potassium-41. That could confuse the readings. And the basalts used for the study aren't reliable either, he says. These rocks, which formed from lava that rapidly cooled long ago, sometimes run the risk of outgassing potassium out into space.

"Even a small amount of potassium loss could give rise to a measurable effect," says Humayun. "I can't say these concerns kill this theory, but you have to work past these concerns before you can claim you have the potassium composition measured."

Meanwhile, Wang and his team are already bracing themselves for some pushback on their research. They say it's only normal for people to be resistant to a new theory at first. "It will take time for people to accept a new idea," says Wang. "It took people decades to accept this giant-impact hypothesis. Now we're saying that giant impact hypothesis is not right, so it may take 10 to 20 years to accept the new model."

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Moon Cycles Might Be Linked to Really Big Quakes

Gravity. You might know it as the force that explains how all clumps of matter came to be. You might know it as John Mayer's nemesis.

You might know it as the thing that causes Earth's oceans to slosh back and forth twice daily.

The tidal pull of the Moon is also strong enough to cause some degree of movement in Earth's crust. That fact has caused serious scientists and cranks alike to speculate, for at least a century, about whether the tides can also cause earthquakes. And a new study published today in Nature Geoscience suggests this might be true—at least for the largest quakes.

Tides happen because the Moon's orbit is way slower than the Earth's rotation. Any given location on Earth generally passes under the Moon: high tide. "Stress goes up and down two times a day, and that's the kind of stressing we normally look for," says John Vidale, a

seismologist at the University of Washington who reviewed this paper. But the sun also exerts a—much weaker—tidal influence. When the sun and Moon line up, their gravitational influences combine, forming what's known as a spring tide.

Spring tides typically happen twice a month, during a full or new Moon. The new study cross-referenced earthquake records from three massive databases with tide charts. It found little to no correlation between spring tides and small quakes. But bigger quakes—your 7, 8, 9 magnitude shakers—started lining up with the moon cycles.

Now, hold up: This doesn't mean moon charts can predict quakes. For one, the pattern is barely statistically significant. "This really relies on having enough quakes to resolve the pattern," says Vidale. He says the records simply don't contain enough high magnitude quakes. "Sadly, it may take another hundred years of data to nail down the pattern solidly."

Even if scientists did have enough data to nail down the correlation, they still don't know enough about individual faults to predict which could go critical in a spring tide. "We can't measure all the stresses on the faults, and we don't know their geometry," Vidale says. Seismologists have been preoccupied for decades with looking for clues that might help them predict a quake. "The longer we look without finding any, the less likely it is they exist," he says.

Not to say that this study is useless. The fact that spring tides might affect only really big quakes could tell seismologists new things about how quakes happen. And that might help them improve their estimates for the danger of living near any particular fault line. But likely not. The high-risk zones are well mapped, and the odds of recurrence are pretty well established. If you live in an earthquake zone, preparation is your best bet. Get your home seismically certified. Put together a quake kit. Practice those "jump in a doorframe" reflexes. Or just move to a place where the Moon's gravity doesn't have any fault lines to flex.

http://go.nasa.gov/2csmnOY

NASA's THEMIS Sees Auroras Move to the Rhythm of Earth's Magnetic Field

Scientists find aurora moves in harmony with magnetic field lines

The majestic auroras have captivated humans for thousands of years, but their nature – the fact that the lights are electromagnetic and respond to solar activity – was only realized in the last 150 years. Thanks to coordinated multi-satellite observations and a worldwide network of magnetic sensors and cameras, close study of auroras has become possible over recent decades. Yet, auroras continue to mystify, dancing far above the ground to some, thus far, undetected rhythm.

Using data from NASA's Time History of Events and Macroscale Interactions during Substorms, or THEMIS, scientists have observed Earth's vibrating magnetic field in relation to the northern lights dancing in the night sky over Canada. THEMIS is a five-spacecraft mission dedicated to understanding the processes behind auroras, which erupt across the sky in response to changes in Earth's magnetic environment, called the magnetosphere.

These new observations allowed scientists to directly link specific intense disturbances in the magnetosphere to the magnetic response on the ground. A paper on these findings was published in Nature Physics on Sept. 12, 2016.

"We've made similar observations before, but only in one place at a time – on the ground or in space," said David Sibeck, THEMIS project scientist at NASA's Goddard Space Flight Center in Greenbelt, Maryland, who did not participate in the study. "When you have the measurements in both places, you can relate the two things together."

Understanding how and why auroras occur helps us learn more about the complex space environment around our planet. Radiation and energy in near-Earth space can have a variety of effects on our satellites – from disrupting their electronics to increasing frictional drag and interrupting communication or navigation signals. As our

dependence on GPS grows and space exploration expands, accurate space weather forecasting becomes ever more important.

The space environment of our entire solar system, both near Earth and far beyond Pluto, is determined by the sun's activity, which cycles and fluctuates through time. The solar system is filled with solar wind, the constant flow of charged particles from the sun. Most of the solar wind is deflected from Earth by our planet's protective magnetosphere. However, under the right conditions, some solar particles and energy can penetrate the magnetosphere, disturbing Earth's magnetic field in what's known as a substorm. When the solar wind's magnetic field turns southward, the dayside, or sun-facing side, of the magnetosphere contracts inward. The back end, called the magnetotail, stretches out like a rubber band. When the stretched magnetotail finally snaps back, it starts to vibrate, much like a spring moving back and forth. Bright auroras can occur during this stage of the substorm.

In this unstable environment, electrons in near-Earth space stream rapidly down magnetic field lines towards Earth's poles. There, they interact with oxygen and nitrogen particles in the upper atmosphere, releasing photons to create swaths of light that snake across the sky.

To map the auroras' electric dance, the scientists imaged the brightening and dimming aurora over Canada with all-sky cameras. They simultaneously used ground-based magnetic sensors across Canada and Greenland to measure electrical currents during the geomagnetic substorm. Further out in space, the five THEMIS probes were well-positioned to collect data on the motion of the disrupted field lines.

The scientists found the aurora moved in harmony with the vibrating field line. Magnetic field lines oscillated in a roughly six-minute cycle, or period, and the aurora brightened and dimmed at the same pace.

"We were delighted to see such a strong match," said Evgeny Panov, lead author and researcher at the Space Research Institute of the Austrian Academy of Sciences in Graz. "These observations reveal the missing link in the conversion of magnetic energy to particle energy that powers the aurora."

The brightening and dimming of the aurora corresponds to the motion of the electrons and magnetic field lines.

"During the course of this event, the electrons are flinging themselves Earthwards, then bouncing back off the magnetosphere, then flinging themselves back," Sibeck said.

When waves crash on the beach, they splash and froth, and then recede. The wave of electrons adopt a similar motion. The aurora brightens when the wave of electrons slams into the upper atmosphere, and dims when it ricochets off.

Before this study, scientists hypothesized that oscillating magnetic field lines guide the aurora. But the effect had not yet been observed because it requires the THEMIS probes to be located in just the right place over the ground-based sensors, to properly coordinate the data. In this study, scientists collected THEMIS data at a time when the probes were fortuitously positioned to observe the substorm.

"Even after nearly 10 years, the probes are still in great health, and the growing network of magnetometers and all-sky cameras continue to generate high quality data," said Vassilis Angelopoulos, co-author and THEMIS principal investigator at University of California, Los Angeles.

THEMIS is a mission of NASA's Explorer program, which is managed by Goddard. University of California, Berkeley's Space Sciences Laboratory oversees mission operations. The all-sky imagers and magnetometers are jointly operated by UC Berkeley, UCLA, University of Calgary and University of Alberta in Canada.

"The intention with THEMIS has always been that we would put these measurements together and make these observations," Sibeck said. "This is an extremely satisfying study and a pleasure to see the right use of this mission data."

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‘Big Success Story’: Sri Lanka Is Declared Free of Malaria

After a long struggle, Sri Lanka, the large island nation southeast of India, was declared free of malaria last week by the World Health Organization. It has been more than three years since the last case.

By DONALD G. McNEIL Jr. SEPT. 12, 2016

“This is a big success story,” said Dr. Pedro L. Alonso, the director of the W.H.O.’s global malaria program. “And it’s an example for other countries.”

Sri Lanka almost succeeded in eliminating malaria 50 years ago, but its huge effort fell apart. The country became the example most frequently cited by malariologists to show how defeat could be pried from the jaws of victory.

Through the 1940s, Sri Lanka routinely had a million cases of malaria a year. Then officials began an intensive public health campaign, relying on DDT to kill mosquitoes and chloroquine to cure the disease. By 1963, the annual caseload had fallen to a mere 17.

Then the drive ran out of money and faltered, and annual cases of malaria rose above 500,000 by 1969. By then, mosquitoes had evolved resistance to DDT, and by 1992 to its successor, malathion. Malaria parasites first showed resistance to chloroquine in 1984.

But the failure also was political: The country’s ethnic fabric disintegrated.

Sri Lanka had been the British colony of Ceylon, an exporter of tea and cinnamon. After its independence in 1948, the majority Buddhist Sinhalese began discriminating against the Hindu Tamils, whom the British had favored.

Decades of civil war between the government and the Tamil Tigers ensued, with the latter aided covertly by India, until the rebellion was crushed in 2009.

In 2000, outside the rebel-controlled areas in the northeast, malaria cases began dropping as the government, with donor help, deployed a mix of indoor spraying, bed nets, rapid diagnostic kits and medicines that combined artemisinin, an effective treatment, with other drugs.

The government also screened blood samples drawn — for any reason — in public clinics and hospitals for malaria infection, and officials established a nationwide electronic case-reporting system.

In war-torn areas, the disease retreated more slowly, although the Tigers often cooperated with malaria-control teams because their villages and fighters also suffered.

Nonetheless, in a population of 20 million, it took years to get rid of the last few hundred annual cases. Most were soldiers and itinerant laborers, often from India, who worked in remote slash-and-burn farming areas and in logging and gem-mining camps.

The Sri Lankan health ministry set up mobile clinics near the camps, as well as at airports and ferry landings where migrants arrived, offering diagnosis and treatment to all. Free malaria care is still a core part of the country’s effort to prevent an imported case from leading to a new outbreak.

“They don’t ask if anyone is legal or illegal,” Dr. Alonso said of the medical staff at the clinics. “If you ask questions, people won’t go.”

http://bit.ly/2csoEd0

Magma build-up at Japanese volcano poses threat to 'Naples of the Eastern World'

Pioneering new study could help provide early-warning system for volcanic eruptions worldwide

One of Japan's most active volcanoes could be close to a major eruption, threatening the safety of hundreds and thousands of residents of a nearby city, a new study has shown.

A team of experts, including Dr James Hickey from the University of Exeter, developed pioneering techniques to map the natural 'plumbing system' of Sakurajima volcano, on the south-west tip of the East Asian country, to discover a substantial growing magma reserve.

The magma build-up could see the volcano repeat its deadly eruption of 1914, which killed 58 people and caused widespread flooding in the

nearby city of Kagoshima -- now dubbed the 'Naples of the Eastern World'.

The team believe the ground-breaking study could help improve eruption forecasting and hazard assessment at volcanoes across the world, providing an enhanced early-warning system for potential eruptions.

The pivotal study is published in the scientific journal, Scientific Reports, on Tuesday, 13 September 2016.

Dr James Hickey, lead author of the study and who is now at the Camborne School of Mines, at Exeter's Penryn Campus said: "What we have discovered is not just how the magma flows into the reservoir, but just how great the reservoir is becoming.

"We believe that this new approach could help to improve eruption forecasting and hazard assessment at volcanoes not just in this area, but worldwide. We know that being forewarned means we are forearmed and providing essential information for local authorities can potentially help save lives if an eruption was imminent."

The international team of scientists focused their study around Aira caldera -- a large, submerged crater caused by the violent explosion and subsequent collapse of a voluminous magma reservoir.

This vast crater acts as a magma storage zone that feeds the nearby Sakurajima volcano, one of the island's most active volcanoes with small, localised eruptions occurring nearly every day.

The team, which included experts from the University of Bristol and the Sakurajima Volcano Research Centre in Japan, studied surface deformation in and around the caldera and volcano.

By combining recent GPS deformation measurements with other geophysical data and advanced 3D computer models, the team were able to reconstruct the magma plumbing system beneath the caldera.

The study showed that the volcano is being supplied with around 14 million cubic metres of magma each year -- which equates to roughly three-and-a-half times the volume of Wembley Stadium.

Crucially, the research also indicates magma is being supplied to the system at a faster rate than it can be released through regular, small eruptions from Sakurajima volcano.

The team believe that this excessive build-up of magma may indicate there is growing potential for a larger eruption.

Dr Hickey, who carried out the research while at the University of Bristol, added: "The 1914 eruption measured about 1.5 kilometres cubed in volume -- a massive event. From our data we think it would take around 130 years for the volcano to store the same amount of magma for another eruption of a similar size -- meaning we are around 25 years away."

"By identifying a timeframe over which we may see an increase in the level of activity at the volcano our colleagues at the Sakurajima volcano research centre can plan accordingly. The numerical constraints we were able to put on the magma supply conditions can also be used to assist with probabilistic and quantitative eruption forecasting."

Co-author Dr Joachim Gottsmann, from the University of Bristol added: "A thorough understanding of the rate and volume of magma supply and accumulation, and their thermomechanical controls, is essential for continued monitoring and eruption forecasting at Sakurajima volcano, and volcanoes worldwide."

Dr Haruhisa Nakamichi, Associate Professor at the Disaster Prevention Research Institute, Kyoto University, and co-author, said: "It is already passed by 100 years since the 1914 eruption, less than 30 years is left until a next expected big eruption, Kagoshima city office has prepared new evacuation plan from Sakurajima, after experiences of evacuation of the recent crisis in August 2015."

This study was funded by the European Commission VUELCO project, the University of Bristol International Strategic Fund, and the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan.

J. Hickey, J. Gottsmann, H. Nakamichi, and M. Iguchi. Thermomechanical controls on magma supply and volcanic deformation: Application to Aira caldera, Japan. Scientific Reports, 2016

http://bit.ly/2ciqtx6

Stiff and oxygen-deprived tumors promote spread of cancer

Specific conditions -- tumor hardness and a lack of oxygen at the tumor's core -- lead to breast-cancer progression in laboratory cultures

When Hippocrates first described cancer around 400 B.C., he referred to the disease's telltale tumors as "karkinos"—the Greek word for crab. The "Father of Western Medicine" likely noted that cancer's creeping projections mirrored certain crustaceans, and the tumors' characteristic hardness resembled a crab's armored shell.

Later, scientists added another attribute: Tumors are hypoxic. That is, they grow so large and dense that they exclude blood vessels, causing a lack of oxygen in their cores. But what role these characteristics play in the development of cancer has remained a mystery.

Moving one step closer to an answer, scientists from Princeton University and the Mayo Clinic Cancer Center have found that, in breast cancer, tumor hardness and hypoxia trigger a biological switch that causes certain cells to embark on a cancer-promoting program. Reported Aug. 8 in an article in the journal Cancer Research, this biological switch is critical to a tumors' ability to invade other tissue, a process called metastasis—and could offer a promising treatment target.

"Our study suggests that to combat cancer, we should be developing treatments that target the stiff, hypoxic regions of tumors," said lead author Celeste Nelson, a professor of chemical and biological engineering. "We were surprised to see just how important these two properties in the tumor microenvironment—stiffness and hypoxia—were for regulating cancer stem cells."

The specific cells triggered by stiffness and hypoxia are called cancer stem cells. These cells represent only a small proportion of the total cells in a tumor, but researchers believe they play a key role in spreading the disease. As normal stem cells help form an embryo, or aid in repairing muscles, cancer stem cells specialize in generating new malignant cells. In addition to spreading cancer, just 10 to 100 leftover cancer stem cells are needed to regenerate a tumor after it has been removed.

Using cultures of human breast-cancer cells and mouse mammary-cancer cells, Nelson and colleagues from Princeton and the Mayo Clinic in Jacksonville, Florida, discovered an association between a protein called integrin-linked kinase and the creation of cancer stem cells. Normally, integrin-linked kinase assists cells with a variety of important cellular tasks. But in dense, oxygen-poor tumors, the protein's function goes awry.

In the lab, the researchers created a range of human and mouse breast-cancer cultures reflecting different tissue conditions. They showed that stiff hypoxic cultures did indeed promote cancer stem cells. But when they eliminated the integrin-linked kinase from those samples, they found that the cancer stem cells stopped forming. Conversely, when they forced abnormal levels of integrin-linked kinase in samples containing softer or less hypoxic tissue, cancer stem cells formed. They also confirmed a significant association between tumor stiffness, integrin-linked kinase and cancer stem cell presence in samples from human breast-cancer patients.

"We could see tumor cells expressing cancer stem-cell markers and integrin-linked kinase located at regions with high collagen, which is used to estimate stiffness in a tumor," says Mei-Fong Pang, a postdoctoral fellow in Nelson's Tissue Morphodynamics Laboratory.

The findings suggest that stiffness and hypoxia cause integrin-linked kinase to behave abnormally, which in turn triggers cancer stem-cell formation.

There are likely other features in tumors that cause cancer stem cells to form, but the findings indicate that stiff, hypoxic conditions—and their effects on integrin-linked kinase—are two of the most prominent ones. This means the findings could be useful for better understanding some types of cancer and for developing treatments for those

characterized by solid tumors—including for more than just breast cancer.

"These findings may lead to the identification of a new therapeutic target to halt cancer progression and metastasis," said Ren Xu, an associate professor at the University of Kentucky's Markey Cancer Center who is familiar with the study but had no role in it.

"Given the crucial function of integrin-linked kinase in hypoxia and stiff-induced cancer progression, it is now critical to define the molecular mechanisms by which integrin-linked kinase expression is regulated under these conditions," Xu said.

Nelson and her colleagues plan to investigate the specific molecular pathways that promote the formation of cancer stem cells in the presence of rigidity, hypoxia and integrin-linked kinase. Building on that knowledge, treatments could eventually be created that specifically kill cancer stem cells. Finding a way to change conditions in the tumor itself could provide another solution.

"If we can make the tumor softer or reduce hypoxia," Nelson said, "we could potentially have a way to treat breast cancer and maybe other cancers as well."

The paper, "Tissue stiffness and hypoxia modulate the integrin-linked kinase ILK to control breast cancer stem-like cells," was published Aug. 8 in Cancer Research.

More information: M.-F. Pang et al. Tissue Stiffness and Hypoxia Modulate the Integrin-Linked Kinase ILK to Control Breast Cancer Stem-like Cells, Cancer Research (2016). DOI: 10.1158/0008-5472.CAN-16-0579

http://bit.ly/2cvbGI9

Motherless babies possible as scientists create live offspring without need for female egg

Motherless babies could be on the horizon after scientists discovered a method of creating offspring without the need for a female egg.

Sarah Knapton, Science Editor

The landmark experiment by the University of Bath rewrites 200 years of biology teaching and could pave the way for a baby to be born from the DNA of two men.

It was always thought that only a female egg could spark the changes in a sperm required to make a baby, because an egg forms from a special kind of cell division in which just half the number of chromosomes are carried over. Sperm cells form in the same way, so that when a sperm and egg meet they form a full genetic quota, with half our DNA coming from our mother and half from our father.

But now scientists have shown embryos could be created from cells which carry all their chromosomes which means that, in theory, any cell in the human body could be fertilised by a sperm.

Three generations of mice have already been created using the technique and are fit and healthy and now researchers are planning to test out the theory using skin cells.

Dr Tony Perry, a molecular embryologist and senior author of the study, said: “Some people say start the day with an egg, but what this paper says is that you don’t necessarily have to start development with one.

“It has been thought that only an egg cell was capable of reprogramming sperm to allow embryonic development to take place.

“Our work challenges that dogma, held since early embryologists first observed mammalian eggs in around 1827 and observed fertilisation 50 years later, that only an egg cell fertilised with a sperm cell can result in a live mammalian birth. “We’re talking about different ways of making embryos. Imagine that you could take skin cells and make embryos from them. This would have all kinds of utility.”

For the initial experiments, scientists "tricked" an egg into developing into an embryo using special chemicals which makes the egg think it has been fertilised. Crucially the cells in an embryo copy themselves completely when they divide, and so mirror closely most other cells in the body, such as skin cells.

When scientists injected the embryos with sperm, they grew into healthy mice which went on to produce their own litters.

Although the researchers began with an egg cell for the experiment, they do not believe it is required to spark the same development. In

theory, the technique should work with any cell in the body as long as half the chromosomes are removed first to allow them to fuse with the sperm's chromosomes.

Professor Robin Lovell-Badge, group leader at The Francis Crick Institute, said: "I'm not surprised that the authors are excited about this. I think it is a very interesting paper, and a technical tour de force.

"And I am sure it will tell us something important about reprogramming at these early steps of development that are relevant to fertilisation - and perhaps more broadly about reprogramming of cell fate in other situations. "It doesn't yet tell us how, but the paper gives a number of clear pointers."

The technique raises the possibility that gay men, for instance, could have a child whose DNA was half of each of the couple, although a woman would still need to act as a surrogate to carry the baby.

It also raises the possibility that a man could even fertilise his own cells to produce offspring containing a mixture of genes inherited from him and his parents. More realistically, the technique could allow women whose fertility has been wiped out by cancer drugs or radiotherapy to have their own children.

While eggs can be frozen before cancer therapy and later fertilised in an IVF clinic, currently nothing can be done once they have been lost. It may also help women to continue having children later in life. Women are born with all their eggs and they degrade with age, which makes conception more difficult in later life. But if it was possible to fertilise a new skin cell, it could improve the chance of having a baby.

Conception using sperm and non-egg cells could also aid the preservation of endangered species, since it avoids the need to recover eggs.

In the study, 30 mouse pups were born with a success rate of 24 per cent. This compares with a 1 per cent to 2 per cent success rate for offspring created by the Dolly the Sheep method of cloning by transferring DNA to donated eggs.

Some of the mice went on to have offspring themselves, and a number had offspring that went on to have their own pups. Fertility is generally seen as a sign of fitness and good health.

Dr Perry said that his team was planning to take the next step of attempting to produce live offspring from ordinary non-egg cells, such as skin cells.

Dr Paul Colville-Nash, from the Medical Research Council, which funded the study, said: "This is an exciting piece of research which may help us to understand more about how human life begins and what controls the viability of embryos, mechanisms which may be important in fertility."It may one day even have implications for how we treat infertility, though that's probably still a long way off."

The research was published in the journal Nature Communications.

http://bit.ly/2cCTH05

Study suggests how 'super aging' older adults retain youthful memory abilities

Some loss of memory is often considered an inevitable part of aging, but new research reveals how some people appear to escape that fate.

A study by Massachusetts General Hospital (MGH) investigators examines a remarkable group of older adults whose memory performance is equivalent to that of younger individuals and finds that certain key areas of their brains resemble those of young people.

The study published in The Journal of Neuroscience is the first step in a research program aimed at understanding how some older adults retain youthful thinking abilities and the brain circuits that support those abilities. The program is led by Bradford Dickerson, MD, director of the Frontotemporal Disorders Unit in the MGH Department of Neurology and Lisa Feldman Barrett, PhD, MGH Department of Psychiatry, who are co-senior authors of the new study.

While most older adults experience a gradual decline in memory ability, some researchers have described older adults - sometimes called "super agers" - with unusually resilient memories. For the current study, the MGH team enrolled adults ages 60 to 80 - 17 of

whom performed as well as adults four to five decades younger on memory tests, and 23 with normal results for their age group - and 41 young adults ages 18 to 35.

"Previous research on super aging has compared people over age 85 to those who are middle aged," says Alexandra Touroutoglou, PhD, MGH Neurology, co-senior author with Dickerson and Barrett. "Our study is exciting because we focused on people around or just after typical retirement age - mostly in their 60s and 70s - and investigated those who could remember as well as people in their 20s.

Imaging studies revealed that these super agers had brains with youthful characteristics. While the cortex - the outermost sheet of brain cells that is critical for many thinking abilities - and other parts of the brain typically shrink with aging, in the brains of super-agers a number of those regions were comparable in size to those of young adults. "We looked at a set of brain areas known as the default mode network, which has been associated with the ability to learn and remember new information, and found that those areas, particularly the hippocampus and medial prefrontal cortex, were thicker in super agers than in other older adults. In some cases, there was no difference in thickness between super agers and young adults," Touroutoglou says.

Barrett, who is also University Distinguished Professor at Northeastern University, adds, "We also examined a group of regions known as the salience network, which is involved in identifying information that is important and needs attention for specific situations, and also found preserved thickness among super-agers in several regions, including the anterior insula and orbitofrontal cortex."

Critically, the researchers showed not only that super-agers had no shrinkage in these brain networks but also that the size of these regions was correlated with memory ability. One of the strongest correlations between brain size and memory was found in an area at the intersection of the salience and default mode networks. Previous research has shown that this region - the para-midcingulate cortex - is an important hub that allows different brain networks to communicate efficiently. "We believe that effective communication between these networks is very important for healthy cognitive aging," Touroutoglou says.

Understanding which factors protect against memory decline could lead to important advances in preventing and treating age-related memory loss and possibly even various forms of dementia, says Dickerson, who is an associate professor of Neurology at Harvard Medical School. "We desperately need to understand how some older adults are able to function very well into their seventh, eight, and ninth decades. This could provide important clues about how to prevent the decline in memory and thinking that accompanies aging in most of us."

More information: The Journal of Neuroscience, DOI: 10.1523/JNEUROSCI.1492-16.2016

http://bit.ly/2d2qOM1

Penn Research Identifies Brain Network that Controls Spread of Seizures

First to show existence of a network of neural regions that can push or pull on synchronization of regions directly involved in a seizure

A flurry of coordinated activity in a brain-spanning network of neurons may sound like the formation of a brilliant new idea, but it is actually the description of a seizure. Understanding why and how this synchronization spreads would be a critical tool in treating severe epilepsy.

In a study published in Neuron, an interdisciplinary team of University of Pennsylvania researchers has identified a new explanation for this phenomenon. Using a computer model based on direct brain recordings from epilepsy patients, they are the first to show the existence of a network of neural regions that can push or pull on the synchronization of the regions directly involved in a seizure.

With further study, this regulatory network could be a more effective target for epilepsy therapies, including implantable stimulation

devices that would help quiet a localized seizure before it spreads throughout the brain.

The study was led by Danielle Bassett, Eduardo D. Glandt Faculty Fellow and associate professor in the Department of Bioengineering in the School of Engineering and Applied Science, Brian Litt, professor of neurology and neurosurgery in Penn's Perelman School of Medicine and of bioengineering in Engineering and director of the Penn Epilepsy Center, and Ankit Khambhati, Bassett's postdoctoral fellow and a recent graduate of the Litt Lab. Medicine's Kathryn Davis, assistant professor of neurology, and Timothy Lucas, assistant professor of neurosurgery and co-director of the Penn Center for Neuroengineering and Therapeutics, also contributed to the work

As a network scientist, Bassett studies how the interconnections between members of a group influence the behavior of the whole. Looking at epilepsy through that lens, she, Litt, and Khambhati developed a computer model of seizure networks based on brain recordings from Penn's epilepsy patients. An earlier study using that model showed that the algorithms in the model can predict where in the brain a seizure will originate and which groups of neurons it will likely spread to as it grows.

In their new study, the researchers aimed to understand how focal seizures, which are limited to only a part of the brain, become general seizures, which spread throughout the brain and are therefore more dangerous and debilitating.

"For people with epilepsy, there are a number of areas of the brain that are really broken—that's the seizure-generating network," Bassett said. "Our hypothesis was that there is a separate regulatory network that is usually able to quiet the seizure, and for people whose seizures generalize, that regulatory network is also broken."

"No one has really talked about this regulatory network before," she said.

In their new study, the researchers have shown that this second network acts on the one directly involved in the seizure, influencing whether the pathological synchronization remains confined to a local area or spreads across the brain.

"As a dysfunction in the ability of the brain to regulate the communication of information between brain regions," Khambhati said, "seizures can be thought of as a traffic flow problem. If, on one hand, all the traffic lights at an intersection are green, drivers from all directions attempt to cross at once, in complete synchrony, leading to a jam. On the other hand, if all the lights are red, drivers remain stationary and information ceases to flow. The most efficient road network should coordinate traffic flow where different groups of drivers are moving and stopped at different times."

To study how seizure networks synchronize and desynchronize, the researchers added a new dimension to their simulation. Using a technique known as "virtual cortical resection," they could simulate the surgical removal of different sections of the brain. Resection of regions implicated in the seizure network is a last-ditch treatment for severe epilepsy; using virtual cortical resection, the researchers could test the impact of targeting the regulatory network instead.

"Our virtual cortical resection technique," Khambhati said, "enables us to map the locations of synchronizing, or green-light, and desynchronizing, or red-light, brain regions that facilitate the flow of information. Intuitively, our results showed that seizures are more likely to spread in brain networks with a weaker capacity to limit traffic flow via desynchronizing brain regions."

"In engineering terms," Bassett said, "we think this regulatory network has what is known as a 'push-pull regulatory control.' There are some regions of the regulatory network that can push the seizure network into a less active state, or pull it out of that state."

This "push-pull" mechanism appears to work in a manner similar to other biological processes that maintain homeostasis, such as the regulation of heart rate or body temperature, but the researchers are the first to show this kind of regulatory network for epilepsy.

Identifying which regions are which in a patient's regulatory network could guide new treatment options, such as implantable stimulation devices that would bolster the nodes that help quiet seizure activity, or laser surgery to eliminate the nodes that promote it.

"Our team's method offers an exciting way to simulate the effect of different therapeutic interventions on patients and predict outcome and side effects," Litt said. "Functional simulations of this type have tremendous potential to guide new treatments for a variety of neurological disorders and diseases that affect other parts of the body as well."

This National Institutes of Health recently awarded the group a $4.5 million grant to continue with their epilepsy research.

The study was supported by the National Institutes of Health through awards R01-NS063039, 1U24 NS63930-01A1, Neil and Barbara Smit, the Citizens United for Research in Epilepsy, the Mirowski Foundation, the John D. and Catherine T. MacArthur Foundation, the Alfred P. Sloan Foundation, the Army Research Laboratory and the Army Research Office through contract numbers W911NF-10-2-0022 and W911NF-14-1-0679, the National Institute of Health (2-R01-DC-009209-11, 1R01HD086888-01, R01-MH107235, R01-MH107703, and R21-M MH-106799), the Office of Naval Research, and the National Science Foundation (BCS-1441502, CAREER PHY-1554488, and BCS-1631550). The content is solely the responsibility of the authors and does not necessarily represent the official views of any of the funding agencies.

http://wb.md/2cvjGc1

Confused? Don't worry because that can be a good thing

Confusion is a common aspect of our lives but it can be useful and perhaps even necessary, particularly when we are trying to learn something.

Jason M Lodge Gregor Kennedy

Confusion is typically experienced when we are confronted with new information. It is particularly likely to happen when the information we encounter is complex, counter-intuitive or unlike anything we've experienced before. When this happens it can be difficult to reconcile the new incoming information with what we already know.

For example, we might find a maths problem confusing because we don't know what the mathematical symbols mean or have difficulty with calculations.

Confusion occurs because the prior knowledge we have leaves us ill-equipped to deal with new information.

Regardless of the whether confusion occurs because things are overly complex or seemingly illogical, it is always associated with some sort of cognitive impasse, when we experience a difficulty incorporating new information into our existing way of understanding the world.

This is why confusion is referred to as an epistemic emotion, that is, an emotion specifically associated with the development of our knowledge and understanding.

Unproductive and productive confusion

When people are trying to learn something new, confusion is often seen as a negative, something to be avoided.

Few of us would readily think that a positive learning experience was associated with the state of confusion. The most obvious reason for this is that confusion, when it persists, can very easily escalate to frustration or boredom. From here it is only a short step to disengagement and giving up on trying to progress any further.

It is for these reasons that many teachers try to avoid situations where students are confused in their classes.

But our own research and that of others suggests that confusion, rather than being a negative, can actually be a productive aspect of the learning process.

Feeling confused can serve as a marker that something isn't working – it is by definition a signal of a cognitive impasse – and as such can be a particularly helpful cue for both students and teachers.

The key is to ensure that when confusion occurs, it is recognised and it is not allowed to persist for too long.

Recognising confusion

So to make sure we benefit from confusion, we first need to recognise and admit to being confused.

Most participants in our studies have been reluctant to admit to experiencing confusion. It is only revealed later through in-depth interviews.

This is not surprising as there is a negative stigma attached to confusion. It is often unfairly thought of as a sign of stupidity or a lack of intelligence. So a key way to harness confusion when you are challenged with new concepts or ideas, is to recognise that confusion exists. Be comfortable with this, but seek to resolve it.

Feeling confused is sometimes difficult in a world which often has a bias towards explanations of complex ideas that are simplified and easy to take in. For example, in new media environments, complex ideas and concepts are often presented in a documentary-like fashion: slick, fluent, engaging and entertaining.

Increasingly online videos routinely explain complex scientific processes with striking, easy to follow animations, accompanied by dulcet, highly scripted narration.

The ideas presented feel like they make sense at the time. But if the ideas do not challenge us in a fundamental way, they might not be being processed deeply enough to lead to any lasting learning.

Such environments may lead us into having a false level of confidence in our understanding of complex concepts. Glossy, high production value resources have been shown to give people an inflated sense of understanding.

Learning to embrace the confusion

It can be easy to find information about highly complex phenomena, such as climate change or vaccination, that seems easy to understand and aligns well with our intuitive conceptions (or misconceptions!).

In part this is because the internet has made it easy to find highly engaging and appealing explanations of phenomena that are very good at cutting down the complexity to make these concepts understandable.

It may also be that we gravitate towards interpretations of events that fit with our prior conceptions. But if the benefits of confusion are to be realised, we are coming to understand two key lessons.

First, being confused about complex concepts and phenomena can mean we are investing enough mental effort into trying to understand. Not finding novel, complex ideas confusing at first can be a sign of overconfidence which has been reliably shown to be detrimental to learning.

Second, it is critical to see struggle and confusion as an important part of the learning process. When encountering new, complex ideas, it is useful to find them challenging and confusing, so long as the confusion does not persist too long.

The struggle associated with overcoming confusion helps us to find better strategies for understanding the world.

So the next time you feel confused when trying to learning something new, take comfort in knowing that it might mean you are on the right track.

http://bit.ly/2cOcFpw

People Can Consciously Control Mental Activity Using Brain Scans

People who can "see" their brain activity can change it, after just one or two neurofeedback sessions, new research shows.

By Tia Ghose, Senior Writer | September 14, 2016 06:28pm ET

People in the study were able to quiet activity in the amygdala — an almond-shaped brain region that processes emotions such as fear — after seeing simple visual or auditory cues that corresponded to the activity level there, according to a new study published in the Sept. 15 issue of the journal Biological Psychiatry. The findings reveal the incredible plasticity of the brain, the researchers said.

The new technique could one day be used as an inexpensive treatment for people with anxiety, traumatic stress or other mental health conditions, said study co-author Dr. Talma Hendler, a psychiatrist and neuroscientist at the Tel Aviv Center for Brain Functions in Israel.

"I see it as a very good tool for children and for people who we don't want to give medication," Hendler told Live Science.

Healing the brain

Past studies have shown that people have tremendous power to shape their brain activity. For instance, mindfulness meditation, a type of meditation in which people focus on sensations from the body, can

help with symptoms of depression, anxiety and even low back pain. And studies show that Buddhist monks who have practiced meditating a lot are much better at "clearing the mind" than the average person. In other words, control over one's own mind can be learned.

However, most of these attempts to control brain activity are indirect, and they often alter activity across the entire brain.

Hendler and her colleagues wondered whether targeting the specific brain regions tied to specific conditions could be a more effective way of helping people with specific symptoms.

In a series of four different experiments with several dozen healthy people, Hendler and her colleagues asked the volunteers to sit inside a functional magnetic resonance imaging (fMRI) machine while simultaneously wearing an electroencephalogram (EEG) hat. The fMRI provided detailed information about which brain regions were active, and the EEG measured activity in the amygdala; together, they allowed the team to pinpoint the precise EEG signature that corresponded to amygdala activation.

Participants were then treated with neurofeedback, in one of two ways: In one condition, they listed to a sound, and in the other, they were shown a movie of a person riding a skateboard. But what they didn’t know was that the loudness of the sound they were hearing, or the speed of the person on the skateboard, was actually determined by the electrical activity going on in their own amygdala. The researchers channeled the measurements coming from the fMRI and EEG into an audible sound or a moving image.

The participants were asked to use "mental strategies" to make either the sound grow quieter, or the skateboarder go faster. If they succeeded, what they were really doing was tamping down the activity in their amygdala. [10 Things You Didn't Know About the Brain]

In a control group, participants were asked to do the same thing, but were treated with a fake neurofeedback. Unlike the true treatment group, the speed of the skateboard and the level of the sound were unrelated to the amygdala's activity, meaning that when the participants observed a change in the skateboarder's speed or the sound's volume, they were not altering their brain activity levels directly.

Next, people in both groups were asked to look at the faces of happy and sad people with either similar or discordant words above them. Past studies have shown that people who are better able to regulate their emotions are quicker to identify a person's facial expression when the word above that person's picture conflicts with the picture, than can people who have had traumatic stress, the researchers wrote in the article.

The results showed that, compared to those who received the sham treatment, people who were given cues based on activity in the amygdala were better able to reduce activity in that region of the brain

"It's actually quite amazing that this plasticity takes place after one session or two sessions," Hendler said. Other psychotherapy techniques aimed at treating PTSD or anxiety often take six, eight or 10 sessions, she said. However, she noted that the participants were all healthy. People with traumatic stress could require more sessions to master the method of controlling their mental activity, Hendler said.

What's more, in follow-up experiments, the participants showed a better ability to regulate emotions as measured by the facial-expression-recognition task.

At-home therapy

The findings suggest that this type of neurofeedback technique could one day become a cheap and relatively simple way for patients to be treated for anxiety, PTSD or other psychological conditions that are tied to amygdala hyperactivation, Hendler said.

Right now, the treatment requires an EEG cap that calls for gel and wiring, making it unsuitable for home use. But in the future, the team envisions using a wireless, miniature sensor that a patient could use at home, after an initial instructional session with a physician, Hendler said.

However, follow-up studies need to show that this method of targeted brain training works as well as techniques like mindfulness meditation or cognitive behavioral therapy, Hendler said.

"We hope this is a better way to actually modulate specific areas, and bring on some plasticity that is necessary to cure the brain," Hendler said.

http://bit.ly/2cO94F2

20 Big Questions about the Future of Humanity

We asked leading scientists to predict the future. Here's what they had to say

1. Does humanity have a future beyond Earth?

"I think it's a dangerous delusion to envisage mass emigration from Earth. There's nowhere else in the solar system that's as comfortable as even the top of Everest or the South Pole. We must address the world's problems here. Nevertheless, I'd guess that by the next century, there will be groups of privately funded adventurers living on Mars and thereafter perhaps elsewhere in the solar system. We should surely wish these pioneer settlers good luck in using all the cyborg techniques and biotech to adapt to alien environments. Within a few centuries they will have become a new species: the posthuman era will have begun. Travel beyond the solar system is an enterprise for posthumans—organic or inorganic."

—Martin Rees, British cosmologist and astrophysicist

2. When and where do you think we will find extraterrestrial life?

"If there is abundant microbial life on Mars, I suspect that we will find it within 20 years—if it is enough like our form of life. If an alien life-form differs much from what we have here on Earth, it is going to be difficult to detect. It's also possible that any surviving Martian microbes are rare and located in places that are difficult for a robotic lander to reach. Jupiter's moon Europa and Saturn's moon Titan are more compelling places. Europa is a water world where more complex forms of life may have evolved. And Titan is probably the most interesting place in the solar system to look for life. It is rich in organic molecules but very cold and has no liquid water; if life exists on Titan, it will be very different from life on Earth."

—Carol E. Cleland, philosophy professor and co-investigator in the Center for Astrobiology at the University of Colorado Boulder

3. Will we ever understand the nature of consciousness?

"Some philosophers, mystics and other *confabulatores nocturne* pontificate about the impossibility of ever understanding the true nature of consciousness, of subjectivity. Yet there is little rationale for buying into such defeatist talk and every reason to look forward to the day, not that far off, when science will come to a naturalized, quantitative and predictive understanding of consciousness and its place in the universe."

—Christof Koch, president and CSO at the Allen Institute for Brain Science; member of the Scientific American *Board of Advisers*

4. Will the entire world one day have adequate health care?

"The global community has made tremendous progress toward health equity over the past 25 years, but these advances have not reached the world's most remote communities. Deep in the rain forest, where people are cut off from transportation and cellular networks, mortality is the highest, access to health care is the most limited and quality of care is the worst. The World Health Organization estimates that one billion people go their entire lives without seeing a health worker because of distance. Health workers recruited directly from the communities they serve can bridge the gap. They can even fight epidemics such as Ebola and maintain access to primary care when health facilities are forced to shut their doors. My organization, Last Mile Health, now deploys more than 300 health workers in 300 communities across nine districts in partnership with the government of Liberia. But we can't do this work alone. If the global community is serious about ensuring access to health care for all, it must invest in health workers who can reach the most remote communities."

—Raj Panjabi, co-founder and chief executive at Last Mile Health and instructor at Harvard Medical School

5. Will brain science change criminal law?

"In all likelihood, the brain is a causal machine, in the sense that it goes from state to state as a function of antecedent conditions. The implications of this for criminal law are absolutely nil. For one thing, all mammals and birds have circuitry for self-control, which is modified through reinforcement learning (being rewarded for making good choices), especially in a social context. Criminal law is also about public safety and welfare. Even if we could identify circuitry unique to serial child rapists, for example, they could not just be allowed to go free, because they would be apt to repeat. Were we to conclude, regarding, say, Boston priest John Geoghan, who molested some 130 children, 'It's not his fault he has that brain, so let him go home,' the result would undoubtedly be vigilante justice. And when rough justice takes the place of a criminal justice system rooted in years of making fair-minded law, things get very ugly very quickly."

—Patricia Churchland, professor of philosophy and neuroscience at the University of California, San Diego

6. What is the chance *Homo sapiens* will survive for the next 500 years?

"I would say that the odds are good for our survival. Even the big threats—nuclear warfare or an ecological catastrophe, perhaps following from climate change—aren't existential in the sense that they would wipe us out entirely. And the current bugaboo, in which our electronic progeny exceed us and decide they can live without us, can be avoided by unplugging them."

—Carlton Caves, Distinguished Professor in physics and astronomy at the University of New Mexico

7. Are we any closer to preventing nuclear holocaust?

"Since 9/11 the U.S. has had a major policy focus on reducing the danger of nuclear terrorism by increasing the security of highly enriched uranium and plutonium and removing them from as many locations as possible. A nuclear terrorist event could kill 100,000 people. Three decades after the end of the cold war, however, the larger danger of a nuclear holocaust involving thousands of nuclear explosions and tens to hundreds of millions of immediate deaths still persists in the U.S.–Russia nuclear confrontation.

Remembering Pearl Harbor, the U.S. has postured its nuclear forces for the possibility of a bolt-out-of-the-blue first strike in which the Soviet Union would try to destroy all the U.S. forces that were targetable. We don't expect such an attack today, but each side still keeps intercontinental and submarine-launched ballistic missiles carrying about 1,000 warheads in a launch-on-warning posture. Because the flight time of a ballistic missile is only 15 to 30 minutes, decisions that could result in hundreds of millions of deaths would have to be made within minutes. This creates a significant possibility of an accidental nuclear war or even hackers causing launches.

The U.S. does not need this posture to maintain deterrence, because it has about 800 warheads on untargetable submarines at sea at any time. If there is a nuclear war, however, U.S. Strategic Command and Russia's Strategic Missile Forces want to be able to use their vulnerable land-based missiles before they can be destroyed. So the cold war may be over, but the Doomsday Machine that came out of the confrontation with the Soviets is still with us—and on a hair trigger."

—Frank von Hippel, emeritus professor at the Woodrow Wilson School of Public and International Affairs at Princeton University and co-founder of Princeton's Program on Science and Global Security

8. Will sex become obsolescent?

"No, but having sex to conceive babies is likely to become at least much less common. In 20 to 40 years we'll be able to derive eggs and sperm from stem cells, probably the parents' skin cells. This will allow easy preimplantation genetic diagnosis on a large number of embryos—or easy genome modification for those who want edited embryos instead of just selected ones."

—Henry Greely, director of the Center for Law and the Biosciences at Stanford University

9. Could we one day replace all of the tissues in the human body through engineering?

"In 1995 Joseph Vacanti and I wrote for this magazine about advances in artificial pancreas technology, plastic-based tissues such as artificial skin and electronics that might permit blind people to see [see 'Artificial Organs,' by Robert Langer and Joseph P. Vacanti; *Scientific American,* September 1995]. All of these are coming to pass, either as real products or in clinical trials. Over the next few centuries it is quite possible that nearly every tissue in the body may be able to be replaced by such approaches. Creating or regenerating tissues such as those found in the brain, which is extremely complex and poorly understood, will take an enormous amount of research. The hope is, however, that research in this area will happen quickly enough to help with brain diseases such as Parkinson's and Alzheimer's."

—Robert Langer, David H. Koch Institute Professor at the Massachusetts Institute of Technology

10. Can we avoid a "sixth extinction"?

"It can be slowed, then halted, if we take quick action. The greatest cause of species extinction is loss of habitat. That is why I've stressed an assembled global reserve occupying half the land and half the sea, as necessary, and in my book *Half-Earth,* I show how it can be done. With this initiative (and the development of a far better species-level ecosystem science than the one we have now), it will also be necessary to discover and characterize the 10 million or so species estimated to remain; we've only found and named two million to date. Overall, an extension of environmental science to include the living world should be, and I believe will be, a major initiative of science during the remainder of this century."

—Edward O. Wilson, University Research Professor emeritus at Harvard University

11. Can we feed the planet without destroying it?

"Yes. Here's what we need to do: reduce crop waste, consumer waste and meat consumption; integrate appropriate seed technologies and management practices; engage consumers about the challenges farmers face in both the developed and the developing world; increase public funding for agricultural research and development; and focus on advancing the socioeconomic and environmental aspects of farming that characterize sustainable agriculture."

*—Pamela Ronald, professor in the Genome Center and the department of plant pathology at the University of California, Davis**

12. Will we ever colonize outer space?

"That depends on the definition of 'colonize.' If landing robots qualifies, then we've already done it. If it means sending microbes from Earth and having them persist and maybe grow, then, unfortunately, it's not unlikely that we've done that as well—possibly on Mars with the Phoenix spacecraft and almost certainly inside the Curiosity rover, which carries a heat source and was not fully baked the way Viking had been.

If it means having humans live elsewhere for a longer period of time, but not reproduce, then that's something that might happen within the next 50 years or so. (Even some limited degree of reproduction might be feasible, recognizing that primates will be primates.) But if the idea is to construct a self-sustaining environment where humans can persist indefinitely with only modest help from Earth—the working definition of a 'colony,' according to the various European colonies outside of Europe—then I'd say this is very far in the future, if it's possible at all. We currently have a very inadequate understanding of how to build closed ecosystems that are robust to perturbation by introduced organisms or nonbiological events (*Biosphere 2*, for example), and I suspect that the contained ecosystem problem will turn out to be much more challenging than the vast majority of space colonization advocates realize. There are a wide range of technical problems to solve, another being air handling. We haven't bothered to colonize areas underwater on Earth yet. It's far more challenging to colonize a place where there's hardly any atmosphere at all."

—Catharine A. Conley, NASA planetary protection officer

13. Will we discover a twin Earth?

"My money's on yes. We've found that planets around other stars are far more abundant and diverse than scientists imagined just a couple of decades ago. And we've also found that the crucial ingredient for life on this planet—water—is common in space. I'd say nature seems to have stacked the deck in favor of a wide range of planets, including Earth-like planets. We just have to look for them."

—Aki Roberge, research astrophysicist focusing on exoplanets at NASA Goddard Space Flight Center

14. Will there ever be a cure for Alzheimer's?

"I am not sure if there will be a cure, per se, but I am very hopeful that there will be a successful disease-modifying therapy for Alzheimer's disease within the next decade. We have now started prevention trials that are testing biological interventions even before people show clinical symptoms of the disease. And we don't have to cure Alzheimer's—we just need to delay dementia by five to 10 years. Estimates show that a five-year delay in the terrible and expensive dementia stage of the disease would reduce Medicare dementia costs by nearly 50 percent. Most important, that would mean that many older people could die while out ballroom dancing rather than in nursing homes."

—Reisa Sperling, professor of neurology at Harvard Medical School and director of the Center for Alzheimer Research and Treatment

15. Will we use wearable technologies to detect our emotions?

"Emotions involve biochemical and electrical signals that reach every organ in our bodies—allowing, for example, stress to impact our physical and mental health. Wearable technologies let us quantify the patterns in these signals over long periods of time. In the coming decade wearables will enable the equivalent of personalized weather forecasts for our health: 80 percent increased probability in health and happiness for you next week, based on your recent stress/sleep/social-emotional activities. Unlike with weather, however, smart wearables can also identify patterns we might choose to change to reduce unwanted 'storm' events: Increase sleep to greater than or equal to nine hours per night and maintain current low-moderate stress, for a 60 percent reduced likelihood of seizure in the next four days. Over the next 20 years, wearables, and analytics derived from them, can dramatically reduce psychiatric and neurological disease."

—Rosalind Picard, founder and director of the Affective Computing research group at the M.I.T. Media Lab

16. Will we ever figure out what dark matter is?

"Whether we can determine what dark matter is depends on what it turns out to be. Some forms of dark matter allow detection through small interactions with ordinary matter that have so far evaded detection. Others might be detectable through their influence on structures such as galaxies. I'm hopeful we will learn more through experiments or observations. But it's not guaranteed."

—Lisa Randall, Frank B. Baird, Jr., professor of science in theoretical physics and cosmology at Harvard University

17. Will we get control of intractable brain diseases like schizophrenia or autism?

"Diseases like autism and schizophrenia remain elusive because neuroscience hasn't found a structural problem to fix. Some interpret this to mean future answers lie purely in biochemistry, not neural circuits. Others argue the key is for the neuroscientist to start to think in terms of overall brain architecture—not specific neural failures. Still, when thinking about the future, I am reminded of the Nobelist Charles Townes's remark that the wonderful thing about a new idea is you don't know about it."

—Michael Gazzaniga, director of the SAGE Center for the Study of the Mind at the University of California, Santa Barbara

18. Will technology eliminate the need for animal testing in drug development?

"If human organs on chips can be shown to be robust and consistently recapitulate complex human organ physiology and disease phenotypes in unrelated laboratories around the world, as suggested by early

proof-of-concept studies, then we will see them progressively replace one animal model at a time. That will eventually lead to significant reductions in use of animal testing. Importantly, these devices also will open up new approaches to drug development not possible with animal models today, such as personalized medicines and development of therapeutics for specific genetic subpopulations using chips created using cells from particular patients."

—Donald E. Ingber, founding director, Wyss Institute for Biologically Inspired Engineering at Harvard University

19. Will gender equality be achieved in the sciences?

"Gender equality can be achieved, but we can't just sit back and wait for it to happen. We need to 'fix the numbers' by recruiting more women into science and technology. We need to fix the institutions by implementing dual-career hiring, family-friendly policies, and new visions of what it means to be a leader. And, most importantly, we need to fix the knowledge by harnessing the creative power of gender analysis for discovery and innovation."

—Londa Schiebinger, John L. Hinds Professor of History of Science at Stanford University

20. Do you think we will one day be able to predict natural disasters such as earthquakes with warning times of days or hours?

"Some natural disasters are easier to see coming than others. Hurricanes approach over days, volcanoes often build up to an eruption over days to hours, tornadoes strike within a few minutes. Earthquakes are perhaps the greatest challenge. What we know about the physics of earthquakes suggests that we will not be able to predict earthquakes days in advance. But what we can do is predict the damaging ground shaking just before it arrives and provide seconds to minutes of warning. Not enough time to get out of town, but enough time to get to a safe location."

—Richard M. Allen, director, Berkeley Seismological Laboratory, University of California, Berkeley

http://bbc.in/2d32utA

Prostate cancer treatment 'not always needed'

Just keeping an eye on prostate cancer results in the same 10-year survival rate as treating it, a study suggests.

By James Gallagher Health and science reporter, BBC News website

The UK researchers warned too many men were having procedures that damaged their sex life and caused incontinence. A trial of 1,643 men with small prostate cancers resulted in the same 99% survival rate after a decade for those who had had surgery, radiotherapy or simply monitored the tumour. Experts said the results were "extremely reassuring" for men.

"It's a global problem that patients are over-treated," Prof Freddie Hamdy from the University of Oxford, told the BBC. "It's understandable, if a 55-year-old man is told they have cancer, and they have a family, they don't want to take any risks."

Price to surveillance

In the trial, men whose prostate cancer had been detected by testing for a chemical - prostate-specific antigen (PSA) - in the blood were either monitored, had surgery to remove the prostate or radiotherapy to kill the tumour.

The study, backed by the research wing of the NHS - the National Institute for Health Research - then followed the men for 10 years. The survival rates were the same, but there was a higher risk of side-effects with treatment. There was double the risk of incontinence and problems with sex in those having surgery. Radiotherapy increased the risk of bowel problems.

But there was a price to the surveillance option - the prostate cancer progressed in one in five cases. These men could be treated, but it may affect their long-term survival beyond the 10-year study.

Prof Jenny Donovan, from the University of Bristol, said: "This is the first time radiotherapy, surgery and active monitoring treatments for prostate cancer have been compared directly. "Each treatment has

different impacts and effects, and we need longer follow up to see how those balance out over the next 10 years."

'**Anxiety**'

The findings, in the New England Journal of Medicine, apply only to early stage tumours - those found at a more advanced stage should be treated aggressively.

Dr Matthew Hobbs, from the charity Prostate Cancer UK, said: "At the moment, many men decide against active surveillance because of the uncertainty about the impact of that choice and the anxiety it causes. "It is extremely reassuring to hear that, when it is performed to a high standard, active surveillance gives men the same chance of survival."

http://bit.ly/2cesmFX

Corydalis yanhusuo extract for use as an adjunct medicine for low to moderate chronic pain

Root extracts from the flowering herbal plant Corydalis yanhusuo, (延胡索) or YHS, has widely used for centuries as a pain treatment.

Root extracts from the flowering herbal plant Corydalis yanhusuo, or YHS, has widely used for centuries as a pain treatment. Yet few studies have investigated how it works on different forms of pain, and little is known about its molecular mechanisms.

In a new study, Olivier Civelli, professor and chair of pharmacology at the University of California, Irvine, and colleagues show how YHS effectively treats different forms of pain.

Most notably it can reduce chronic neuropathic pain which is poorly treated with common medicines. They also show that YHS seems to not lose its potency over time, as happens with many analgesics. Study results appear in one open-access online journal, PLOS ONE.

The researchers analyzed YHS pain relief properties in mouse tests that monitor acute, persistent inflammatory and chronic neuropathic pain, respectively, while in vitro tests revealed its mechanism of action as a prominent dopamine receptor blocker. Interestingly, in mice that have no dopamine D2 receptor, YHS effect is weakened in neuropathic pain.

Dopamine is an important neurotransmitters that when released from nerve cells to send signals to other nerves. It is known to be involved in reward but studies have also shown that dopamine may play a role in maintaining chronic pain, and that removing dopamine-containing cells can reduce this pain.

Additionally, the researchers found that YHS use did not lead to tolerance. They administered YHS four times over a seven-day period and measured the mice responses in acute pain, noting that YHS kept its potency while morphine lost its.

Since YHS is a dietary supplement commercially available in the United States, Civelli suggests that it might be an adjunct medicine for alternative pain treatment. "YHS is not a highly potent medicine when compared to morphine," he said. "But I would propose that it can be used for low to moderate chronic pain."

Lien Wang, Yan Zhang, Zhiwei Wang, Nian Gong, Tae Dong Kweon, Benjamin Vo, Chaoran Wang, Xiuli Zhang, Jae Yoon Chung, Amal Alachkar, Xinmiao Liang, David Z. Luo, Olivier Civelli. The Antinociceptive Properties of the Corydalis yanhusuo Extract. PLOS ONE, 2016; 11 (9): e0162875 DOI: 10.1371/journal.pone.0162875

http://bbc.in/2cDL1GO

Long daytime naps are 'warning sign' for type-2 diabetes

Napping for more than an hour during the day could be a warning sign for type-2 diabetes, Japanese researchers suggest.

They found the link after analysing observational studies involving more than 300,000 people.

UK experts said people with long-term illnesses and undiagnosed diabetes often felt tired during the day.

But they said there was no evidence that napping caused or increased the risk of diabetes.

The large study, carried out by scientists at the University of Tokyo, is being presented at a meeting of the European Association for the Study of Diabetes in Munich.

Their research found there was a link between long daytime naps of more than 60 minutes and a 45% increased risk of type-2 diabetes, compared with no daytime napping - but there was no link with naps of less than 40 minutes.

Sleeping patterns

The researchers said long naps could be a result of disturbed sleep at night, potentially caused by sleep apnoea.

And this sleeping disorder could increase the risk of heart attacks, stroke, cardiovascular problems and other metabolic disorders, including type-2 diabetes.

Sleep deprivation, caused by work or social life patterns, could also lead to increased appetite, which could increase the risk of type-2 diabetes. But it was also possible that people who were less healthy or in the early stages of diabetes were more likely to nap for longer during the day.

Shorter naps, in contrast, were more likely to increase alertness and motor skills, the authors said.

'Early warning sign'

Naveed Sattar, professor of metabolic medicine at the University of Glasgow, said there was now a lot of evidence of some kind of link between sleep disturbances and diabetes.

"It's likely that risk factors which lead to diabetes also cause napping. This could include slightly high sugar levels, meaning napping may be an early warning sign of diabetes," he said.

But proper trials were needed to determine whether sleeping patterns made a difference to "real health outcomes".

Dr Benjamin Cairns, from the cancer epidemiology unit at the University of Oxford, said the findings should be treated with caution.

"In general, it is not possible to make conclusions about cause and effect based on observational studies alone, because usually they cannot rule out alternative explanations for their findings," he said.

http://bit.ly/2cDS2Hx

What you eat when you're sick may determine if you'll get better

Feels like flu? Let your body decide what to eat

By Debora MacKenzie

Crave chicken soup when you have a cold? There may be a good reason for that. Research in mice has found that changing eating habits could be crucial for surviving the body's own immune responses to different types of infection.

Ruslan Medzhitov at Yale University and his team have found that giving mice with flu glucose saved their lives, but it killed those that were infected with bacteria. Amazingly, this effect worked in the absence of the actual pathogens – glucose had the same effect on mice injected only with inflammation-triggering molecules either from bacteria or viruses.

Protecting the brain

Inflammation is a general activation of the immune system that occurs when an invader is detected. It causes most disease symptoms, and can damage and even kill the host it is trying to save. Researchers increasingly believe that surviving an infection is as much about tolerating your own immune response as it is about killing the invaders.

Mice seem to survive their own immune responses thanks to feeding strategies. Like sick humans, all the infected mice initially lost their appetites, but the mice with flu quickly resumed eating. This could be because bacteria and viruses trigger different inflammatory responses, and feeding is helpful for surviving the viral response, but harmful when fighting off bacteria.

To test this, the team administered or blocked the sugar glucose, or interfered with various metabolic processes within the mice, while giving them molecules that triggered either a viral-like or bacterial-like inflammation response. They found that, when responding to a virus, the mice needed glucose to protect their brain cells from being

damaged by inflammation. Without glucose, one specific anti-viral response killed cells in their brains.

Ketogenic diet

But when mice were in bacterial defence mode, they benefitted from a lack of sugar. As many dieters know, not eating sugar pushes the body to metabolise fat instead, generating chemicals called ketones.

This "ketogenic" switch seems to benefit mice with bacterial inflammation. If these mice were given glucose, or their ketogenic metabolism was blocked in some other way, they died from epileptic-like seizures caused by neuron damage. Medzhitov believes this was because too many highly reactive free radicals were generated both by digestion of glucose and by inflammation due to bacteria, and that the radicals damaged the neurons. Inflammation due to viruses, however, does not produce radicals.

Intriguingly, evidence from brain disorders in people suggests that abandoning glucose also helps our neurons when they are stressed. A ketogenic diet seems to protect brain cells in those who have epilepsy, and some are trying it as a way to fight brain cancer.

Chicken soup

The findings may help explain the ancient adage that it's best to feed a cold, but starve a fever. Colds are usually caused by viruses, while fevers would traditionally have been more likely to be down to a bacterial infection. Most diets were historically heavy on carbohydrates, which release glucose in our bodies.

The discovery may also save lives. Sepsis – a severe systemic inflammation of the body that often occurs in response to an infection – kills around a third of those who develop it. Efforts to fight sepsis with fasting or feeding have yielded no clear results. That could be because so far, none of these studies distinguished or recorded whether patients had bacterial or viral sepsis.

New diagnosis methods might help. "We are planning to conduct our own clinical trial where we will separate patients based on causes of sepsis," says Medzhitov. It may be that feeding those infected with bacteria or viruses differently boosts their survival rates. As the northern hemisphere's cold and flu season approaches, what does this mean? "We think during illness one changes food preferences to support the appropriate metabolic program," says Medzhitov.

He believes chicken soup does help in some way, but says that, when he has flu, he prefers tea with honey more than anything else. His mice would agree.

Journal reference: Cell, DOI: 10.1016/j.cell.2016.07.026

Read more: Bacteria lurking in blood could be culprit in countless diseases

http://bit.ly/2ctC88t

No Groom, No Gloom: Never-Married Women Just as Happy

Once women hit age 60, those who are married and those who have never been married are equally happy, new research finds.

By Laura Geggel, Senior Writer | September 15, 2016 01:18pm ET

In a survey of more than 51,000 adults in the United States, married people generally reported the highest happiness levels, and people who were widowed, divorced or never married reported lower happiness levels. But the exception was older, never-married women.

"Married people are happier than others, but there are plenty of exceptions to that," said study co-researcher Gary Ralph Lee, a professor emeritus of sociology at Bowling Green State University in Ohio.

The survey didn't reveal why older women comprise one of these exceptions, but it could be that these women have found paths to happiness through their careers, friends or family, Lee said.

Marriage and happiness

Lee and his co-author, Krista Payne, a family and marriage research analyst at Bowling Green, did the investigation because although there are countless studies showing that married people are happier than nonmarried people, there is less research about the relative happiness levels of widowed and divorced adults, Lee said.

The researchers used data gathered over 38 years from the General Social Survey, an ongoing nationally representative survey conducted by researchers at the University of Chicago. Survey participants answered the question, "Taken all together, how would you say things are these days — would you say that you are very happy, pretty happy or not too happy?"

The researchers compared the reported happiness levels of different groups of men and women: married, unmarried, divorced and widowed people. Also, because widowed and divorced people are often older, on average, than married people, the researchers did a separate analysis for people age 60 and older.

Happy as a clam

The researchers were surprised to find that the reported happiness levels of "never-married, older women are, in a lot of years [of the survey], indistinguishable from [those of] married, older women," Lee said. That trend didn't hold for older, never-married men, who reported less happiness than older, married men did, Lee noted.

"The never-married, older men are, in general, significantly less happy than the married men and generally not distinguishable from the divorced and widowed [men]," Lee said.

Furthermore, while widowed and divorced people tended to be less happy than married people were, widows and divorcees were at pretty much the same happiness levels as one another, Lee said.

"In some years, the divorced were a little better off than the widowed, and in other years that was reversed," Lee said. "The overall message is that being formerly married, whether it's [due to] divorce or widowhood, is associated with lower levels of happiness."

He added that it's not clear why married people tend to be happier. It could be that happy people get married or that marriage makes people happy, Lee said. He presented the research at the American Sociological Association's annual meeting, which took place this year in Seattle in August. The study has yet to be published in a peer-reviewed journal.

http://bit.ly/2cTxxYg

Midwest Is 'Space Storm Alley,' Map Reveals

Certain regions of the upper Midwest are uniquely vulnerable to space storms

By Glenn McDonald, Discovery News

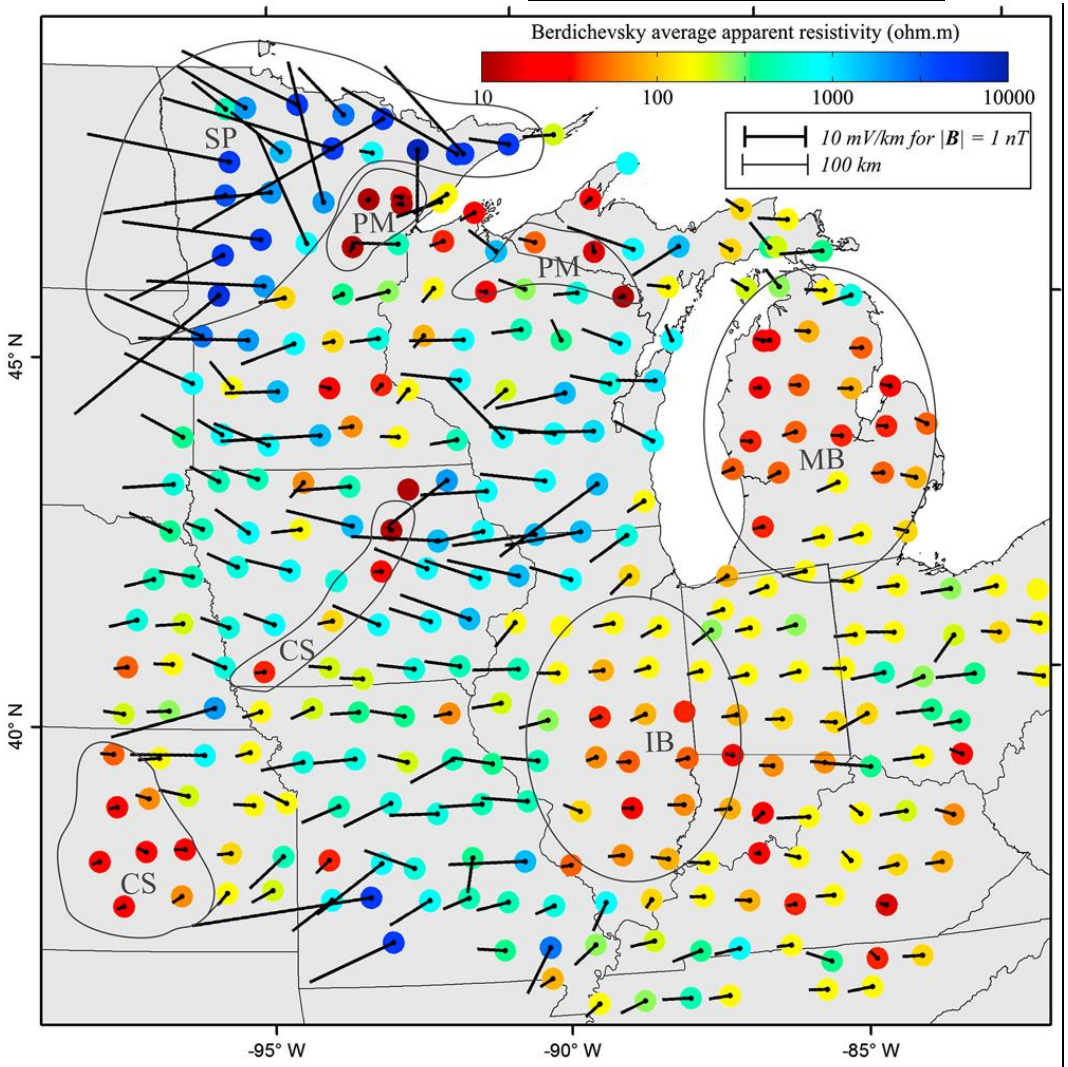
Power outages are often triggered by storms, and certain regions are more vulnerable to certain kinds of storms. Hurricanes threaten the Gulf Coast, ice storms menace New England and Tornado Alley, of course, earned that name for a reason.

Now comes word that power grids in certain regions of the upper Midwest are uniquely vulnerable to space storms — torrents of charged particles from the Sun that can short-circuit entire electrical networks. In fact, scientists working with the U.S. Geological Survey (USGS) have created a set of detailed geoelectric hazard maps, designed to predict where such storms are likely to be most severe.

The new research — published last week in Geophysical Review Letters — is informed by years of survey data from both above and below. According to a helpful breakdown over at Science magazine, the strength of geoelectric storms is determined by complex interactions between space weather, the Earth's magnetic field, and the conductivity of particular rocks in the Earth's crust.

It works like this: When charged material ejected from the sun comes our way, it sends electrical currents that flow through the planet's surface. Our donut-shaped magnetic field deflects some of this, but the rest travels toward the ground near Earth's magnetic poles. A power grid closer to these poles is more likely to experience trouble during a geoelectric storm.

But the severity of the problems is also determined by local geology, in that some areas of the Earth's crust are more conductive than others. In the U.S., the upper Midwest region is dominated by two kinds of rock that together facilitate strong, local electrical currents during space storms.



This graphical map, from earlier USGS research, shows how geoelectric vectors can vary with specific location during a magnetic storm. **Paul Bedrosian, USGS**

The new mapping data crunches the numbers from earth and sky, providing critical information that can help utility companies defend against space storms. It was a team effort, to be sure: The new maps are based on survey data collected by the National Science Foundation's (NSF) EarthScope Program and the USGS, plus observatory data collected by the USGS and the worldwide INTERMAGNET consortium.

It's serious business, too. According to the USGS report, a severe geomagnetic storm could disrupt the nation's power grid for months, potentially leading to widespread blackouts. Resulting damage could cost more than $1 trillion.

http://bit.ly/2cj12Vp

Drug-loaded synthetic nanoparticles can distinguish lung cancer cells from healthy cells

Synthetic polymer can that transport a drug into lung cancer cells without going inside of normal lung cells successfully developed

Researchers with the Harold C. Simmons Comprehensive Cancer Center successfully developed a synthetic polymer that can transport a drug into lung cancer cells without going inside of normal lung cells.

Since conventional chemo drugs indiscriminately kill all rapidly dividing cells to halt the growth of cancer, these selective nanoparticles could decrease side effects by reducing drug accumulation in normal cells.

"The discovery that nanoparticles can be selective to certain cells based only on their physical and chemical properties has profound implications for nanoparticle-based therapies because cell type specificity of drug carriers could alter patient outcomes in the clinic," said corresponding author Dr. Daniel Siegwart, Assistant Professor of Biochemistry at UT Southwestern Medical Center and with Simmons Cancer Center. "At the same time, a deeper understanding of nanoparticle interactions in the body opens the door to predict patient responses to existing liposome and nanoparticle therapies, and offers the potential to create future drug carriers customized according to individual genetic profiles." The findings appear in the Proceedings of the National Academy of Sciences.

The scientists tested hundreds of polymers to make the surprising discovery that cells could respond differently to the same drug carrier, even when those cancerous and normal cells came from the lungs of the same patient.

"These functional polyester nanoparticles provide an exciting alternative approach for selective drug delivery to tumor cells that may improve efficacy and reduce adverse side effects of cancer therapies," said co-author Dr. John Minna, Professor and Director of the Nancy B. and Jake L. Hamon Center for Therapeutic Oncology Research, and Director of the W.A. "Tex" and Deborah Moncrief Jr. Center for Cancer Genetics at UT Southwestern.

The researchers developed new chemical reactions to create a diverse library of polymers that could deliver nucleic acid drugs while possessing enough structural diversity to discover cancer cell-specific nanoparticles. This is an important step to improving tailored cancer therapies to an individual's specific genetic makeup.

"The ability to specifically target cancer cells using nanoparticles could alter how we administer drugs to patients," said Dr. Minna, Professor of Pharmacology and Internal Medicine, and with Simmons Cancer Center, who holds the Sarah M. and Charles E. Seay Distinguished Chair in Cancer Research, and the Max L. Thomas Distinguished Chair in Molecular Pulmonary Oncology. "It is already possible to use genetic sequencing to customize drug regimens for each patient. We may also be able to customize the drug carrier to predictably improve patient responses."

Nanoparticles are tiny spheres (1,000 times smaller than the width of a human hair) that can improve the solubility and delivery of drugs to cells. In this study, Cancer Center researchers delivered short interfering RNA (siRNA)-based drugs to disrupt the functioning and growth of tumor cells by eliminating the proteins the cells need to survive.

Amazingly, the cancer selective nanoparticles stayed inside of tumors in mice for more than one week, while nonselective control nanoparticles were cleared within a few hours. This translated to improved siRNA-mediated cancer cell death and significant suppression of tumor growth.

Yunfeng Yan, Li Liu, Hu Xiong, Jason B. Miller, Kejin Zhou, Petra Kos, Kenneth E. Huffman, Sussana Elkassih, John W. Norman, Ryan Carstens, James Kim, John D. Minna, Daniel J. Siegwart. Functional polyesters enable selective siRNA delivery to lung cancer over matched normal cells. Proceedings of the National Academy of Sciences, 2016; 201606886 DOI: 10.1073/pnas.1606886113

http://bbc.in/2cC9H5x

Dinosaur's camouflage pattern revealed

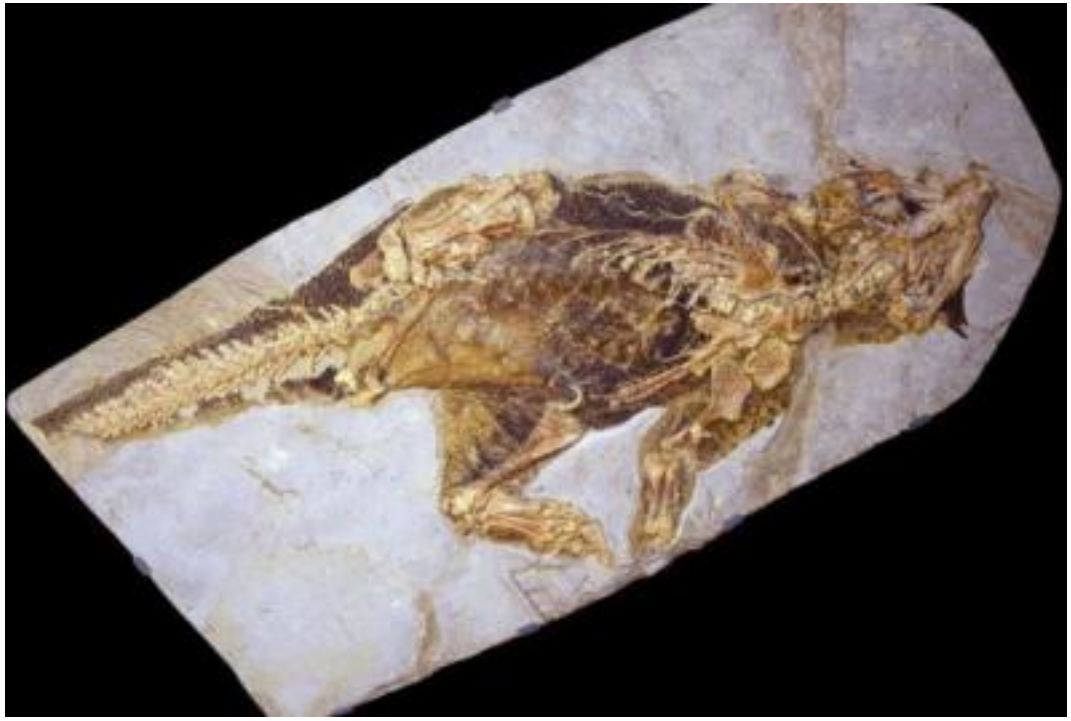
Scientists have recreated the colour patterns of a dinosaur, revealing a camouflage used by animals today.

A study of a well-preserved Chinese Psittacosaurus fossil shows it had a light underside and was darker on top - an arrangement called counter-shading. This suggests the species lived in an environment with diffuse light, such as a forest.

As part of their research, the scientists teamed up with an artist to produce a 3-D model of the creature. The findings by an international team of researchers have been published in Current Biology journal.

Co-author Jakob Vinther, from the University of Bristol, UK, said the camouflage pattern sported by this particular dinosaur "has been shown to function by counter-illuminating shadows on a body, thus making an animal appear optically flat to the eye of the beholder".

The researchers teamed up with a palaeo-artist to create a 3-D model of the dinosaur **Jakob Vinther**



The fossil from China is exquisitely preserved **Jakob Vinther / Robert Nicholls**

It may have protected them against predators that use patterns of shadow on an object to determine their shape - just as humans do.

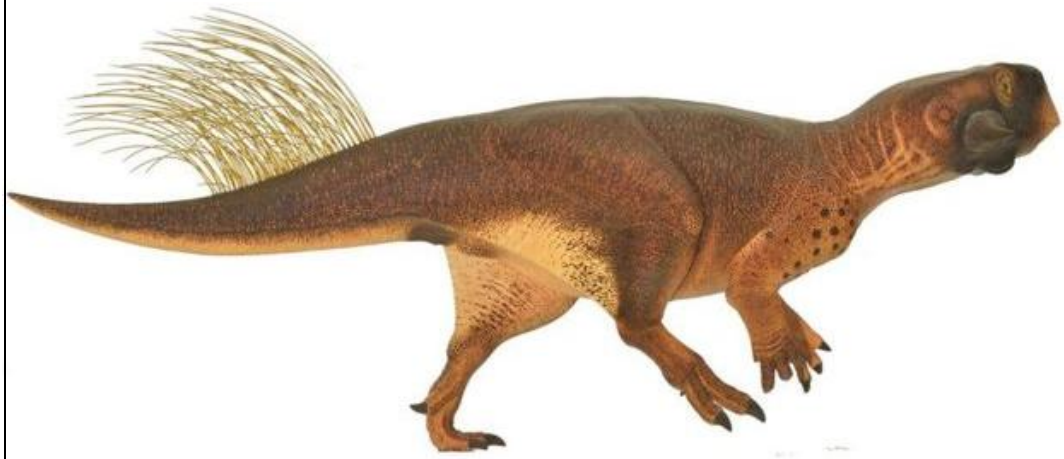
Psittacosaurus - which means "parrot-lizard" in reference to its parrot-like beak - was an early relative of the three-horned dinosaur Triceratops, in a group known as the Ornithischians.

Previously, scientists have discovered that some fossils preserve "melanosomes" - small structures that carry melanin pigments found in the feathers and skin of many animals.

In some specimens, such as the Psittacosaurus, it's possible to make out the patterns of preserved melanin without the aid of a microscope.

The researchers projected the colour patterns found in the fossil onto a life-size model to explore how they might have helped the creature stay hidden. They teamed up with Bristol-based palaeo-artist Bob Nicholls to build the physical recreation.

He said: "Our Psittacosaurus was reconstructed from the inside-out. There are thousands of scales, all different shapes and sizes, and many of them are only partially pigmented. "It was a painstaking process but we now have the best suggestion as to what this dinosaur really looked like."



This artist's impression offers a detailed look at the dinosaur's camouflage pattern **Other**

The team members describe it as the most scientifically accurate life-size model of a dinosaur with its real colour patterns. They also made a cast of this model which they painted in a uniform shade of grey. The scientists then investigated how shadows were cast on the animal. This data could then be compared to the camouflage pattern to determine what kind of lighting was best at hiding the dinosaur.

Dr Vinther said: "We predicted that the psittacosaur must have lived in a forest. This demonstrates that fossil colour patterns can provide not only a better picture of what extinct animals looked like, but they can also give new clues about extinct ecologies and habitats.

"We were amazed to see how well these colour patterns actually worked to camouflage this little dinosaur."

The specimen is part of what's known as the Jehol Biota - animals which flourished in north-eastern China from 133 million - 120 million years ago.

http://bit.ly/2d9O9yq

Computer program beats physicians at brain cancer diagnoses

A computer program has been developed that uses radiomic features found in routine MRI scans to distinguish between radiation necrosis and recurrent brain cancer. In a comparison, the program was nearly twice as accurate as a pair of neruoradiologists.

Computer programs have defeated humans in Jeopardy!, chess and Go. Now a program developed at Case Western Reserve University has outperformed physicians on a more serious matter.

The program was nearly twice as accurate as two neuroradiologists in determining whether abnormal tissue seen on magnetic resonance images (MRI) were dead brain cells caused by radiation, called radiation necrosis, or if brain cancer had returned.

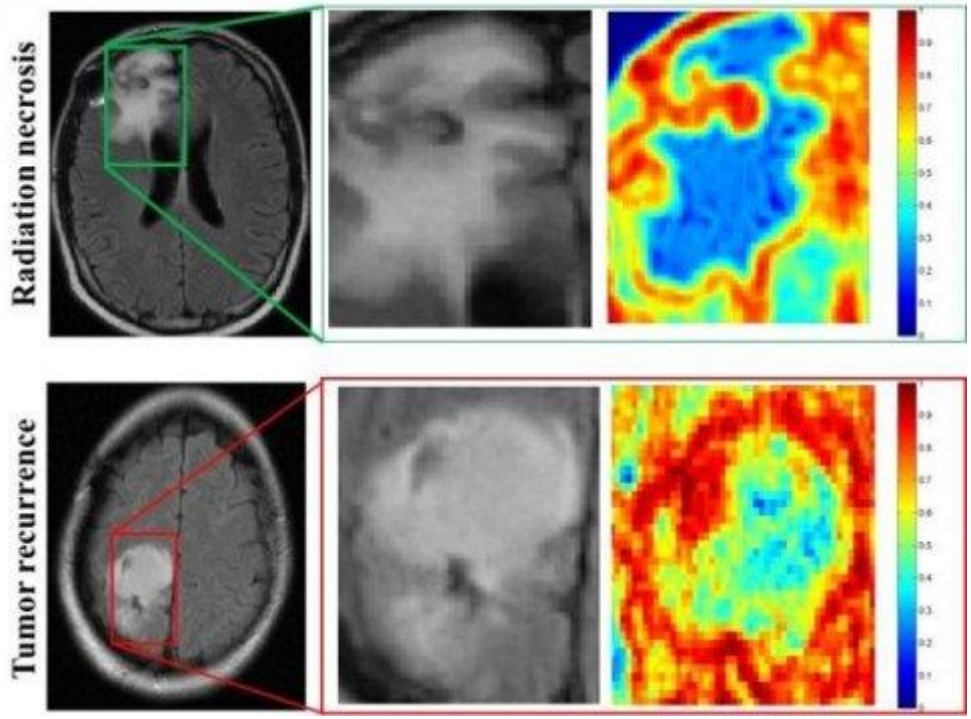
The direct comparison is part of a feasibility study published in the *American Journal of Neuroradiology* today.

"One of the biggest challenges with the evaluation of brain tumor treatment is distinguishing between the confounding effects of radiation and cancer recurrence," said Pallavi Tiwari, assistant professor of biomedical engineering at Case Western Reserve and leader of the study. "On an MRI, they look very similar."

But treatments for radiation necrosis and cancer recurrence are far different. Quick identification can help speed prognosis, therapy and improve patient outcomes, the researchers say.

With further confirmation of its accuracy, radiologists using their expertise and the program may eliminate unnecessary and costly biopsies Tiwari said. Brain biopsies are currently the only definitive test but are highly invasive and risky, causing considerable morbidity and mortality.

To develop the program, the researchers employed machine learning algorithms in conjunction with radiomics, the term used for features extracted from images using computer algorithms. The engineers, scientists and physicians trained the computer to identify radiomic features that discriminate between brain cancer and radiation necrosis, using routine follow-up MRI scans from 43 patients. The images were all from University Hospitals Case Medical Center.



MRI scans of patients with radiation necrosis (above) and cancer recurrence (below) are shown in the left column. Close-ups in the center column show the regions are indistinguishable on routine scans. Radiomic descriptors unearth subtle differences showing radiation necrosis, in the upper right panel, has less heterogeneity, shown in blue, compared to cancer recurrence, in the lower right, which has a much higher degree of heterogeneity, shown in red. **Pallavi Tiwari**

The team then developed algorithms to find the most discriminating radiomic features, in this case, textures that can't be seen by simply eyeballing the images. "What the algorithms see that the radiologists don't are the subtle differences in quantitative measurements of tumor heterogeneity and breakdown in microarchitecture on MRI, which are higher for tumor recurrence," said Tiwari, who was appointed to the

Department of Biomedical Engineering by the Case Western Reserve School of Medicine.

More specifically, while the physicians use the intensity of pixels on MRI scans as a guide, the computer looks at the edges of each pixel, explained Anant Madabhushi, F. Alex Nason professor II of biomedical engineering at Case Western Reserve, and study co-author. "If the edges all point to the same direction, the architecture is preserved," said Madabhushi, who also directs the Center of Computational Imaging and Personalized Diagnostics at CWRU. "If they point in different directions, the architecture is disrupted -- the entropy, or disorder, and heterogeneity are higher. "

In the direct comparison, two physicians and the computer program analyzed MRI scans from 15 patients from University of Texas Southwest Medical Center. One neuroradiologist diagnosed seven patients correctly, and the second physician correctly diagnosed eight patients. The computer program was correct on 12 of the 15.

Tiwari and Madabhushi don't expect the computer program would be used alone, but as a decision support to assist neuroradiologists in improving their confidence in identifying a suspicious lesion as radiation necrosis or cancer recurrence.

Next, the researchers are seeking to validate and the algorithms' accuracy using a much larger collection of images from across different sites.

P. Tiwari, P. Prasanna, L. Wolansky, M. Pinho, M. Cohen, A.P. Nayate, A. Gupta, G. Singh, K. Hattanpaa, A. Sloan, L. Rogers, and A. Madabhushi. ***Computer-Extracted Texture Features to Distinguish Cerebral Radionecrosis from Recurrent Brain Tumors on Multiparametric MRI: A Feasibility Study***. American Journal of Neuroradiology, *September 2016 DOI: 10.3174/ajnr.A4931*

http://bit.ly/2chxrNA

New mosquito-borne disease detected in Haiti

Researchers have identified a patient in Haiti with a serious mosquito-borne illness that has never before been reported in the Caribbean nation.

University of Florida researchers have identified a patient in Haiti with a serious mosquito-borne illness that has never before been reported in the Caribbean nation.

Known as "Mayaro virus," it is closely related to chikungunya virus and was first isolated in Trinidad in 1954. Most reported cases, however, have been confined to small outbreaks in the Amazon. Whether this case signals the start of a new outbreak in the Caribbean region is currently unknown.

"While current attention has been focused on the Zika virus, the finding of yet another mosquito-borne virus which may be starting to circulate in the Caribbean is of concern," said Glenn Morris, M.D., M.P.H., director of the UF Emerging Pathogens Institute. "Hopefully we will not see the same massive epidemics that we saw with chikungunya, dengue and now Zika. However, these findings underscore the fact that there are additional viruses 'waiting in the wings' that may pose threats in the future, and for which we need to be watching."

The case was identified from a blood sample taken in January 2015 from an 8-year-old boy in rural Haiti. The patient had a fever and abdominal pain but no rash or conjunctivitis. Because faculty from the UF Emerging Pathogens Institute were in the region during and after the 2014 chikungunya outbreak, plasma samples were obtained from febrile children and analyzed for the presence of chikungunya virus RNA using a genetic identification technique known as reverse transcription polymerase chain reaction.

The plasma samples, which were examined by UF's Maha Elbadry, Ph.D., in Gressier, Haiti, were then sent to EPI for additional virology and molecular analyses, focusing on the detection of chikungunya, dengue and Zika viruses. Dengue virus was detected in the patient, in addition to a "new" virus that was subsequently identified as Mayaro.

"The virus we detected is genetically different from the ones that have been described recently in Brazil, and we don't know yet if it is unique to Haiti or if it is a recombinant strain from different types of Mayaro

viruses," said John Lednicky, Ph.D., an associate professor in the environmental and global health department at the UF College of Public Health and Health Professions and the study's lead author.

The findings were published online Aug. 26 in the Centers for Disease Control and Prevention's journal Emerging Infectious Diseases.

The symptoms of Mayaro fever are similar to those of chikungunya fever: fever, joint pain, muscle pain and rashes. Abdominal pain is also a feature of Mayaro fever, however, and joint pain can last longer.

John Lednicky, Valery Madsen Beau De Rochars, Maha Elbadry, Julia Loeb, Taina Telisma, Sonese Chavannes, Gina Anilis, Eleonora Cella, Massinno Ciccozzi, Bernard Okech, Marco Salemi, J. Glenn Morris. Mayaro Virus in Child with Acute Febrile Illness, Haiti, 2015. Emerging Infectious Diseases, 2016; 22 (11) DOI: 10.3201/eid2211.161015

http://bbc.in/2cPE0X4

Teenage hormones 'turn pupils off school for three years'

Adolescence and boredom can turn pupils off learning for three years in early secondary school, suggests a study.

By Judith Burns Education reporter

The overwhelming majority of pupils start secondary school with "initial enthusiasm" but this wanes during the first two years, figures suggest. The proportion who "feel good about school" falls 10 percentage points to 84% between ages seven and 14, suggests a GL Assessment poll of 32,000 pupils. Head teachers' leaders said schools were working hard to address the issue.

'Hormones'

"While a whole host of factors come into play at this point in a child's development - hormones, friendships, growing up, taking control - the transition to secondary school marks a significant change for students and it is at this point that we begin to see a change in their attitudes," say the authors. This decline is important because a positive attitude to learning is crucial to attainment, they argue.

The effect is long recognised by experts - last year, an Ofsted report into the early years of secondary was entitled "The Wasted Years".

The new report suggests pupils' difficulties in coping with a larger school, up to 10 different subject teachers and a more complex curriculum, can last well into Year Nine - the third year of secondary school.

The survey, carried out in the year to April 2016, among 31,873 primary and secondary pupils in England and Wales, found most of the fall in positive attitudes happened after Year Seven.

	Year Three	Year Six	Year Seven	Year Eight	Year Nine
I feel good about school	94%	93%	91%	86%	84%
Positive attitude to teachers	93%	92%	90%	86%	84%
Positive attitude to school attendance	90%	89%	89%	84%	82%

And a third (32%) of Year Nine pupils said they were bored at school, compared with 19% of Year Threes.

By contrast, the figures also revealed that children responded well to the more demanding secondary curriculum and also felt more confident about their abilities to tackle new work.

Suzanne O'Farrell, a curriculum and assessment specialist with the Association of School and College Leaders, who contributed to the report, said some schools were reversing the dip by giving the first two years of secondary "a very high profile and investment" as "the bedrock of later learning". "It's about really making sure that pupils are resilient independent learners, able to react independently to feedback. "All those things should be embedded," Ms O'Farrell told the BBC.

Year Nine then becomes an "acceleration" year to inject a new challenge, before the examination year: "In this way momentum is sustained throughout each phase through new expectations and priorities," she argued.

Paul Foxton, assistant head teacher at Ashlawn School in Warwickshire, told the researchers that secondary transfer can be tough. "They might have been the top of the class in primary school and performing in the middle of the class now and that can hit some students very hard."

Mr Foxton agreed building resilience was key: "We need to build grit and determination and talk about how everyone needs to make mistakes to learn more effectively," he argued.

http://bit.ly/2cGBPET

Donating Blood Kept Man's Disease at Bay

An 83-year-old man kept the symptoms of a genetic disease at bay — without even knowing he had it — thanks to his years of donating blood, according to a recent report of his case.

By Sara G. Miller, Staff Writer

The disease, called hereditary haemochromatosis, causes the body to absorb too much iron from food, said Dr. Kohtaro Ooka, an internal medicine resident at Yale School of Medicine and the lead author of the case report.

Too much iron in the body, also called iron overload, can have wide-ranging effects, Ooka told Live Science. *[Here's a Giant List of the Strangest Medical Cases We've Covered]*

The liver, where iron is stored, is particularly vulnerable to the effects of excess iron, Ooka said. A buildup of iron in the liver can lead to damage and scarring, he said. When the organ is severely scarred, it's called cirrhosis. Too much iron can also lead to joint pain and problems with the pancreas, including diabetes, Ooka said.

But the man, who didn't find out he had the condition until he was 83, had none of these symptoms, Ooka added.

Men with hereditary haemochromatosis generally start to show symptoms in their 40s or 50s, said Dr. Tamar Taddei, an associate professor of digestive diseases at Yale and the senior author of the report, which was published in August in the journal BMJ Case Reports. The symptoms take a long time to show up because it takes many years for the level of iron in the body to rise to the point that it causes these symptoms, she said.

To treat the disease, doctors need to remove iron from the body. To do so, they draw blood, which is filled with iron, said Taddei, who is also a physician at the VA Connecticut Health System. In this case, it appears the man's decades of giving blood acted as a form of protection from the symptoms of the disease, Taddei said.

Hereditary haemochromatosis is one of the few diseases that doctors still treat with bloodletting, which people used for centuries to treat many maladies, Taddei told Live Science.

Taddei added that women with hereditary haemochromatosis tend to develop symptoms much later than men do, normally in their 60s. Women are less likely to accumulate excess iron in their bodies, because of menstruation, which causes them to lose blood each month, she said.

But getting too much iron is rarely an issue for most people, she added. Normally, the amount of iron that's absorbed from food is highly regulated by the body, Taddei said. The body usually does not absorb more than 2 milligrams of the mineral a day, and anything extra is excreted from the body, she said.

Abnormal test results

The doctors discovered that the man had the condition when he came to doctors because of "vague abdominal pain," according to the report.

The pain turned out to be unrelated to the condition, but it led the doctors to run some tests, one of which revealed that the man had high levels of iron in his blood, Taddei said. Additional tests revealed that the man had a cancerous mass in his liver, and that his liver was filled with iron, Taddei said.

Liver cancer is common in people who have hereditary haemochromatosis, but only if they also have cirrhosis, Taddei said. The type of cancer that the man had is "almost unheard of" in a person without cirrhosis, she added.

The man told the doctors that starting in his 20s he donated blood regularly, and continued doing so for more than 20 years, according to the report.

http://wb.md/2cvYukl

Farm Living Study Confirms the Hygiene Hypothesis

Innate Immunity and Asthma Risk in Amish and Hutterite Farm Children

Gary Stadtmauer

Background

The hygiene hypothesis of atopy was first introduced in 1989,[1] but there has not been a uniform definition of the term. The surge in atopic disease has been ascribed to reduced childhood viral infections owing to vaccination, increased antibiotic use, reduced helminth exposure, and urban living.[2]

Although some of these theories are debatable,[3] the inverse correlation between farm animal exposure and atopy has been one of the more intriguing observations. However, the mechanism of and the degree of exposure necessary for this protection had not been established.

The Study

Stein and colleagues compared the Amish community of Indiana with the Hutterites of South Dakota. These two insular farming communities are strikingly similar genetically and environmentally, except that the Amish practice "traditional farming" on single-family farms, whereas the Hutterites' farms are highly industrialized.

Past studies have noted that the respective rates of atopy and asthma are much higher in the Hutterites (33% and 21%, respectively)[4] than the Amish (7% and 5%).[5]

The study looked at asthma prevalence and the clinical and immunologic characteristics of atopic disease of children in both groups, and assessed the human and mouse model responses to house dust.

None of the 30 Amish children had asthma, but six of the 30 Hutterite children did (20%). The Amish children had much lower total and allergen-specific levels of immunoglobulin (Ig) E and eosinophil counts, despite having similar exposure to allergens.

Amish children had higher neutrophil counts and lived in homes with much more endotoxin (levels nearly seven times higher) than those of the Hutterites. A pooled dust sample identified differences in bacterial profiles as well.

To investigate the suspicion that the house dust was in itself the immune-modifying agent, the investigators compared the effects of Amish vs Hutterite house dust in a classic ovalbumin mouse model of allergic asthma.

Hutterite dust was not protective against ovalbumin-induced allergic inflammation. Amish dust extracts, however, were able to significantly inhibit ovalbumin-induced airway hyperresponsiveness, bronchoalveolar lavage eosinophilia, and serum ovalbumin-specific IgE.

The results clearly show that something in Amish house dust is capable of preventing allergic sensitization, probably owing to endotoxin or other microbial products. Those in turn act on the innate immune system.

The study found differences in proportions and gene-expression profiles of peripheral blood immune cells and in the genes involved in innate immune responses to microbes. The amount and phenotypes of neutrophils, eosinophils, and monocytes were also different. Genes associated with innate immune pathways seem to have been turned on by the microbes in the Amish environment.

Viewpoint

These are exciting times in the field of allergy and asthma. Expensive biologicals offer hope for patients with severe asthma, but who will pay for them?

Primary prevention of atopy and asthma is the best way to contain costs, and now it appears that there may a way—but only if the innate immune-stimulating elements of the microbes can be isolated.

Abstract ***Innate Immunity and Asthma Risk in Amish and Hutterite Farm Children***

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http://bit.ly/2d7WzU1

TSRI Study Suggests Repurposed Deworming Drugs Could Combat C. Difficile Epidemic

Serendipitous Discovery Points to Possible Treatment for Potentially Fatal Intestinal Infection

LA JOLLA, CA - Scientists at The Scripps Research Institute (TSRI) have discovered a potential new weapon against Clostridium difficile, a bacterium that causes hundreds of thousands of severe intestinal infections in the U.S. every year and is frequently fatal.

The researchers found that several members of a class of existing anti-worm drugs known as salicylanilides are effective against a broad selection of C. difficile strains, including epidemic "hypervirulent" strains that frequently recur despite standard antibiotic treatment. The drugs kill even the non-growing, toxin-producing C. difficile cells that resist standard antibiotic therapies.

"These salicylanilide compounds have all the right features, and they've long been used in animals, so I think they can be quickly repurposed against C. difficile infections in people," said senior author Kim D. Janda, the Ely R. Callaway, Jr. Professor of Chemistry, Director of the Worm Institute for Research & Medicine (WIRM) and member of The Skaggs Institute for Chemical Biology at TSRI.

As part of the study, Janda and first author Major Gooyit, a research associate in the Janda laboratory, created new salicylanilides with improved anti-C. difficile properties. They now plan to license one of these compounds to a pharmaceutical company for further development into a new drug.

A Major Public Health Threat

The study, published online before print in Scientific Reports on September 16, 2016, comes as C. difficile continues to be a major public health threat. The U.S. Centers for Disease Control and Prevention estimates that in 2011—the most recent year for which they have made such an analysis—C. difficile caused more than 450,000 infections in the U.S. and nearly 30,000 deaths.

C. difficile infections usually arise as a side effect of long-term therapy with broad-spectrum antibiotics, which can kill competing "good" bacteria in the gut. C. difficile may be already resident in the gut or it may get there after a patient touches a contaminated surface—in a hospital, for example—and ingests the microbe. The absence of other gut bacteria species allows toxigenic C. difficile to proliferate relatively unchecked.

Existing therapies for C. difficile infections include the older antibiotics metronidazole and vancomycin, as well as the relatively new fidaxomicin. But even with a full course of fidaxomicin therapy, one in seven patients experiences a recurrent infection—and the recurrence rate rises to one in four for the most common hypervirulent strain of the bacterium, known as the BI/NAP1/027 strain.

Janda's interest in finding better drugs against C. difficile was prompted recently by his own difficult bout with it. "It definitely gave me an incentive," he said.

Surprising Effectiveness

However, the subsequent discovery of the salicylanilides' power against the deadly bacterium was largely serendipitous. "We started looking at other compounds for their effects on C. difficile and happened to be using a salicylanilide called closantel as a control," said Janda. Closantel (Flukiver) is a veterinary drug, commonly used for deworming cattle, sheep and goats.

After noting closantel's surprising effectiveness, Gooyit and Janda began testing it and three other salicylanilides—rafoxanide, niclosamide and oxyclozanide—against a variety of lab-dish-cultured strains of C. difficile. "We found that these salicylanilides inhibited the growth of a broad selection of strains, including the BI/NAP1/027 strain, with similar and sometimes greater in vitro activity than metronidazole's and vancomycin's," said Gooyit.

Rafoxanide and oxyclozanide, like closantel, are FDA-approved only for veterinary use, but niclosamide is also approved for treating tapeworm infections in humans.

In further experiments, Gooyit and Janda found that the two best-performing salicylanilides, closantel and rafoxanide, maintained their effectiveness against non-growing, "stationary-phase" cells of C. difficile. By contrast, metronidazole and vancomycin—generally considered growth-inhibitors rather than outright killers of C. difficile—had little effect on stationary-phase cells.

Stationary-phase cells are important targets for C. difficile therapy because they are the main producers of the protein toxins that damage the gut wall and induce inflammation in C. difficile infections—and in hypervirulent strains often do so severely enough to kill the patient or necessitate surgical removal of the inflamed colon.

Stationary-phase cells also produce the hardy, seed-like, bacterial "spores" of C. difficile that can survive for long periods on surfaces such as toilets or washbasins and account for the microbe's high transmission rates in hospitals.

Desirable Properties

As C. difficile-killers, the salicylanilides have a further desirable property: When taken orally, in pill form, they are not well absorbed into the bloodstream; thus they stay in the gut where they are needed, which helps maximize their potency and minimize side effects elsewhere.

Examining C. difficile strains that had been exposed to salicylanilide for long periods, Gooyit and Janda saw no evidence that the bacteria evolved significant resistance to the drugs. They also found with lab-dish experiments that the salicylanilides had minimal impact on "good" gut bacteria.

How do the salicylanilides manage to kill C. difficile cells so effectively?

Prior studies suggested that these compounds can alter the electrical properties of bacterial cell membranes—thereby disrupting processes that are essential for survival, even in non-growing cells.

Gooyit and Janda made new salicylanilide compounds with structures designed to enhance this membrane-targeting effect, finding that the new compounds have significantly improved properties against C. difficile strains including stationary-phase cells.

"We're now testing these compounds in animal models of C. difficile infections," said Gooyit.

Janda added that negotiations are under way to license the salicylanilides to a pharmaceutical company for further development as a C. difficile therapy.

Support for the study, "Reprofiled anthelmintics abate hypervirulent stationary-phase Clostridium difficile," came from TSRI's Skaggs Institute for Chemical Biology.

http://on.bchil.org/2cvZo0l

Antibiotic gel squirted into the ear could provide a one dose cure for ear infections

Approach could revolutionize care, reducing side effects and drug resistance

BOSTON - A single-application bioengineered gel, squirted in the ear canal, could deliver a full course of antibiotic therapy for middle ear infections, making treatment of this common childhood illness much easier and potentially safer, finds a preclinical study led by Boston Children's Hospital in collaboration with investigators at Boston Medical Center and Massachusetts Eye and Ear.

The findings were published September 14 by the journal Science Translational Medicine.

Middle-ear infection, or otitis media, affects 95 percent of children, prompting 12 to 16 million clinical visits per year in the U.S. alone. It's the number one reason for pediatric antibiotic prescriptions, but as parents know, getting oral antibiotics into young children several times a day for 7 to 10 days is a daunting task.

"Force-feeding antibiotics to a toddler by mouth is like a full-contact martial art," says Daniel Kohane, MD, PhD, the study's senior investigator and director of the Laboratory for Biomaterials and Drug Delivery at Boston Children's.

Children also seem to get better within a few days, so parents often stop treatment too soon. Incomplete treatment and frequent recurrence of otitis media (40 percent of children have four or more episodes) encourage the development of drug-resistant infections. And because high doses are needed to get enough antibiotic to the ear, side effects like diarrhea, rashes and oral thrush are common.

"With oral antibiotics, you have to treat the entire body repeatedly just to get to the middle ear," says Rong Yang, PhD, a chemical engineer in Kohane's lab and first author on the paper. "With the gel, a pediatrician could administer the entire antibiotic course all at once, and only where it's needed."

Penetrating the eardrum

Squirted into the ear canal, the gel quickly hardens and stays in place, gradually dispensing antibiotics across the eardrum into the middle ear.

"Our technology gets things across the eardrum that don't usually get across, in sufficient quantity to be therapeutic," says Kohane.

Previously, the eardrum (also called the tympanic membrane) was an impenetrable barrier. The bioengineered gel gets drugs past it with the help of chemical permeation enhancers (CPEs), compounds FDA-approved for other uses that are structurally similar to the lipids in the stratum corneum, the eardrum's outermost layer. The CPEs insert themselves into the membrane, opening up molecular pores that allow the antibiotics to seep through.

When tested in chinchillas (rodents with a hearing range and ear structure similar to those of humans), the gel dispensed high concentrations of the antibiotic ciprofloxin in the middle ear and completely cured ear infections due to Haemophilus influenzae in 10 of 10 animals. Ordinary ciprofloxacin ear drops cleared the infection in only 5 of 8 animals by day 7.

There was no observable toxicity, and no antibiotic was detected in the animals' blood. Yang and Kohane observed a slight hearing loss, similar to that caused by earwax. Giving less of the gel alleviated the problem.

"Transtympanic delivery of antibiotics to the middle ear has the potential to enable children to benefit from the rapid antibacterial activity of antimicrobial agents without systemic exposure and could reduce emergence of resistant microbes," says Stephen Pelton, MD, a pediatric infectious disease physician at Boston Medical Center and a coauthor on the paper.

The work recently won a poster competition at the 2016 Massachusetts Life Sciences Innovation Day. Kohane has received a large, five-year NIH grant to further the work and an award from Boston Children's Hospital's Technology Development Fund to move the patented technology toward clinical use. Though further studies are needed, Kohane hopes to form a company that would begin testing the gel in patients in the next few months.

The study was done in collaboration with the Division of Pediatric Infectious Diseases at Boston Medical Center. Co-authors were Stephen Pelton and Vishakha Sabharwal of Boston Medical Center; John Rosowski of Massachusetts Eye and Ear; and Obiajulu Okonkwo, Nadya Shlykova, Rong Tong, Lily Yun Lin, Weiping Wang and Shutao Guo of Boston Children's Hospital.

Funding was provided by the Center for Integration of Medicine and Innovative Technology (U.S. Army Medical Research Acquisition Activity subcontract #W81XWH-09-2-0001), the Shereta Seelig Charitable Foundation Trust, the National Institutes of Health (DC015050) and the Department of Anesthesia at Boston Children's Hospital.

http://bit.ly/2cTAZ6J

E-cigarette use linked to successful attempts to quit smoking

Findings go against concerns that e-cigs undermine motivation and quit attempts

Growth in the use of e-cigarettes in England has been associated with a higher rate of successful attempts to quit smoking, reveals a study published by The BMJ.

In 2015, use of e-cigarettes may have resulted in an additional 18,000 long-term ex-smokers in England, the study estimates, and the authors say "although these numbers are relatively small, they are clinically significant because of the huge health gains from stopping smoking."

They explain that a 40-year-old smoker who quits permanently can expect to gain nine life years compared with a continuing smoker.

Nevertheless, as with any observational study, firm conclusions about cause and effect cannot be drawn, they say.

Meanwhile, no clear evidence emerged for an association between e-cigarette use and rate of quit attempts, use of nicotine replacement therapy (NRT) bought over the counter, overall use of prescription treatment, or use of NHS stop-smoking services. The authors explain that the results "conflict with the hypothesis that an increase in population use of e-cigarettes undermines quitting in general."

However, e-cigarette use in quit attempts was negatively associated with use of NRT on prescription, perhaps because patients using e-cigarettes having already tried NRT, explain the authors. They say more research would be needed to confirm this.

The team of UK based researchers used a time series analysis to explore the relation between changes in prevalence of e-cigarette use and changes in prevalence of quit attempts, success of those attempts, use of licensed and prescribed medication on prescription and over the counter, and behavioural support.

They assessed data from the Smoking Toolkit Study, which involves monthly household surveys of a representative sample of individuals aged 16 years and older in England. Data were aggregated on 43,000 smokers between 2006 and 2015.

Statistics on the use of NHS stop smoking services were obtained from the NHS Information Centre, which reported a total of 8,029,012 quit dates being set with the programme during the same period.

The researchers tried to take account of tobacco control policies, mass media expenditure and smoking prevalence in their analyses.

In a linked editorial, John Britton from the University of Nottingham, says the results suggest that "successful quitting through substitution with electronic cigarettes is a likely contributor to the falling prevalence of smoking."

A number of potential factors -- both those measured and unaccounted for -- may have influenced the results, and "it therefore remains unclear whether, or by how much, the availability of e-cigarettes has influenced quitting behaviour in the UK," he explains.

Nevertheless, he notes that the significant year-on-year fall in smoking "indicates that something in UK tobacco control policy is working, and successful quitting through substitution with e-cigarettes is one likely major contributor. The challenge for public health is to embrace the potential of this new technology, and put it to full use."

http://tcrn.ch/2daH8qO

SpaceX's Mars Colonial Transporter can go "well beyond" Mars

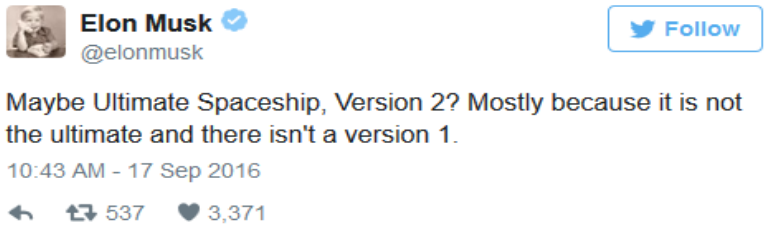
Elon Musk just teased that one of SpaceX's more future-focused projects might be more ambitious than previously thought.

Darrell Etherington

On Twitter, the SpaceX CEO revealed that the company's Mars Colonial Transporter (MCT) will need a new name, since in fact, it "can go well beyond Mars."

This then promptly turned into a naming contest among Musk's followers, with some great

suggestions including “Heart of Gold,” which is lifted from Hitchhiker’s Guide to the Galaxy and which Musk said was his “favorite fictional spaceship.” Sorry, Serenity – at least Millennium Falcon got a shout-out for SpaceX’s existing reusable rocket line. Musk threw out his own suggestion, too:



The MCT is SpaceX’s personnel transport craft, designed to be used with the company’s large Raptor rocket engine to transport the first humans to Mars, with a pilot unmanned launch planned for 2022, and a first flight with people on board slated for 2024. Musk’s teaser is timely – we should find out more about the MCT and its mission at the International Astronautical Congress on September 27, where the Spacex CEO is a special keynote speaker, and will deliver an address called “Making Humans a Multiplanetary Species.”

http://bbc.in/2cjfSqc

Glass of beer 'makes people more sociable'

Researchers from Switzerland have confirmed what most of us already know - drinking a single glass of beer can make people more sociable.

The team from University Hospital in Basel tested 60 healthy people, with an equal number of men and women drinking alcoholic and non-alcoholic beer. They took part in a range of tasks, including a face recognition test, empathy test and sexual arousal test.

The lead researcher said there had been little previous research in this area. Prof Matthias Liechti explained: "Although many people drink beer and know its effects through personal experience there is surprisingly little scientific data on its effects on the processing of emotional social information."

The desire to be with others, in a happy, talkative and open environment increased in the group which drank the alcoholic beer and was more marked in women and those with higher initial inhibitions.

As well as enabling the participants to recognise happy faces more quickly, the beer also enhanced participants' emotional empathy, particularly in those with lower levels of initial empathy.

Participants were also shown pictures of explicit sexual content.

After drinking non-alcoholic beer, participants rated them as less pleasant than neutral pictures - but they were rated as more pleasant by those who drank alcoholic beer. This was most marked in the women participants, but researchers found it did not actually enhance sexual arousal.

Earlier this year, the government revised the UK guidelines on drinking alcohol. The advice is now that men and women should drink no more than 14 units of alcohol a week - the equivalent of six pints of average strength beer or seven glasses of wine.

They were revised due to the stronger evidence available that the risk of cancers, especially breast cancer, increases directly in line with consumption of alcohol.

Conventional wisdom

Commenting on the research, Prof Wim van den Brink, past chairman of the ECNP scientific programme committee, said: "This is an interesting study confirming conventional wisdom that alcohol is a social lubricant and that moderate use of alcohol makes people happier, more social and less inhibited when it comes to sexual engagement.

"The sex differences in the findings can either be explained by differences in blood alcohol concentration between males and females with the same alcohol intake, differences in tolerance due to differences in previous levels of alcohol consumption or by socio-cultural factors."

He also pointed out that "alcohol-related emotions and cognitions as studied are not always consistent with actual behaviours".

The study is being published in the journal Psychopharmacology and presented at the European College of Neuropsychopharmacology Congress Conference in Vienna.

http://bit.ly/2cJ3XY7

Hormone EPO shown to improve brain sharpness in patients with depression and bipolar disorder

Erythropoietin may improve cognitive functioning in patients suffering from bipolar disorder or depression

A study has found that EPO (erythropoietin) – best known as a performance-enhancing drug in sport – may improve cognitive functioning in patients suffering from bipolar disorder or depression. This raises hope for the first long-term treatment for this problem, which affects hundreds of millions of patients throughout the world. The work is presented today at the ECNP conference in Vienna*.

The hormone EPO, mostly produced by the kidney, is essential for the production of red blood cells. EPO gives the blood a greater capacity to carry oxygen, and it is this characteristic which makes it attractive as a performance-enhancing drug (the cyclist Lance Armstrong admitted to using EPO to improve physical performance). Medically, recombinant EPO is used for the treatment of anaemia.

Most people think of disorders such as bipolar disorder and depression as conditions which affect mood, but in reality they also affect cognitive function - how quickly and how well a brain functions. This slow-down in thinking can have serious effects on sufferers, making it more difficult to retain a job, pass an exam, or maintain a relationship. Now a group of Danish Scientists have discovered that EPO can help restore cognitive function in patients suffering from these mental disorders.

In two randomized controlled trials, the researchers assessed cognitive function in 79 patients suffering from depression or bipolar disorder. They assigned 40 of the patients to be given EPO for 9 weeks, with the remaining 39 being given a placebo. They found that EPO had beneficial effects on patients' completion of a range of cognitive tests, including tests on verbal memory, attention span, and planning ability. Tests showed that this improvement was maintained for at least 6 weeks after treatment finished (the longest follow-up time in the trials).

Lead researcher, Dr Kamilla Miskowiak said:

"EPO treated patients showed a five times greater cognitive improvement from their individual baseline levels compared with placebo treated patients. EPO-treated patients showed 11% improvement while placebo treated patients improved only by 2%. This effect of EPO on cognition was maintained six weeks after patients had completed their treatment".

In an interesting twist, it was found that patients who performed poorly in neuropsychological tests showed remarkably greater cognitive benefits when given EPO. Dr Miskowiak, commented:

"This is interesting, as it means that we may be able to target patients for EPO treatment –and perhaps other future cognition treatments - based on how they do on neuropsychological tests".

She continued

"We need bigger studies to confirm that the effects we have seen can be replicated, to confirm dosage, frequency of use and so on. EPO is already used medically, so we know quite a lot about safety. Although EPO is generally safe if patients' red blood cell levels are controlled regularly, there are certain groups for whom the risk of blot clots is too high – for example people who smoke or who have previously had blood clots. So although these results hold out great promise, EPO treatment is not ready to be rolled out as a treatment just yet and may not be for everyone".

The WHO estimates that around 350 million people suffer from depression, with a further 60 million suffering from bipolar disorder**, but the drugs normally used to treat depression and bipolar disorders don't have any major effect on cognition. Up to 70% of patients in remission from bipolar disorder, and up to 40% in remission from depression continue to have cognitive problems. Currently there is no available effective treatment to target cognitive problems in these patients.

Commenting, Professor Eduard Vieta (Chair of the Department of Psychiatry and Psychology at the University of Barcelona Hospital Clinic and treasurer of the ECNP) said:

"The results of this study, albeit preliminary, give hope to people suffering from mood disorders and associated neurocognitive symptoms. Those symptoms are now recognized as a core part of affective disorders and are not appropriately tackled by the currently available pharmacological armamentarium, despite their close association with relevant clinical outcomes such as the ability to return to work".

**This presentation is based on work just published in the August 2016 edition of the peer-reviewed journal, European Neuropsychopharmacology, see http://www.europeanneuropsychopharmacology.com/article/S0924-977X(16)30088-8/abstract "The effect of erythropoietin on cognition in affective disorders – Associations with baseline deficits and change in subjective cognitive complaints",*
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