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Einstein's clock: The doomed black hole to set your watch by

Ladies and gentlemen, your challenger. Meet a black hole new to the neighbourhood, weighing 140 million suns.

By Joshua Sokol

That's nothing to sneeze at: this plucky upstart is 35 times more massive than the black hole that holds court at the centre of our Milky Way.

And now, make way for the current champion: a black hole with a mass of 18 billion suns.

For front-row seats to this cosmic boxing match, you'll want to (cautiously) approach OJ 287, the core region of a galaxy 3.5 billion light years away. Here, the smaller black hole orbits its larger rival. With every trip around, it falls closer, on track to be swallowed up in about 10,000 years. But in the meantime, it's putting up an admirable fight.

Even though the system is so far away, OJ 287 releases enough energy to appear about as bright in the sky as Pluto. We've been capturing it on photographic plates since the 1880s, but it first caught the eye of Mauri Valtonen at Finland's Tuorla Observatory in Turku almost a century later. His team noticed that unlike other galactic centres, which brighten and dim sporadically, this one seemed to keep to a tight schedule. Every 12 years, it has an outburst.

Well, not exactly every 12 years. Not only do the outbursts look different each time, but the gap between them seems to grow shorter by about 20 days each cycle. In the decades since we noticed the pattern, we've gone a long way towards figuring out why.

Ancient enemies

OJ 287's situation is a window into what must have happened in galaxies all over the universe. Galaxies grow by eating their own kind, and almost all of them come with a supermassive black hole at the centre.

Once two galaxies merge, their black holes – now forced to live in one new mega-galaxy – will either banish their rival with a gravitational kick that flings their opponent out of the galaxy, or eventually merge into an even bigger black hole.

In OJ 287, the smaller black hole is en route to becoming a snack for the larger one. The larger one is also growing from a surrounding disc of gas and dust, the material from which slowly swirls down the drain. Each time the smaller black hole completes an orbit, it comes crashing through this disc at supersonic speeds.

That violent impact blows bubbles of hot gas that expand, thin out, and then unleash a flood of ultraviolet radiation – releasing as much energy as 20,000 supernova explosions in the same spot. You could stand 36 light years away and tan faster than you would from the sun on Earth.

The cymbal clash to come

Even with all this thrashing, the smaller black hole has no chance of escape. Energy leaches away from the binary orbit, bringing the pair closer together and making each cycle around the behemoth a little shorter than the last.

Although the outbursts may be impressive, the black holes' orbital dance emits tens of thousands of times more energy as undulations in space time called gravitational waves.

Last year, the Laser Interferometer Gravitational-Wave Observatory (LIGO) in the US offered a preview of the endgame of OJ 287 in miniature. Twice in 2015, LIGO heard gravitational waves from the final orbits of black-hole pairs in which each black hole was a few dozen times the size of the sun, and then the reverberations of the single one left behind.

Because its black holes are so massive, the ultimate collision at the heart of OJ 287 will be too low-frequency for LIGO to hear. But the outcome will be much the same. Where once two black holes from two separate galaxies tussled, one black hole will remain, smug and secure at the centre.

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Why Don't Bats Get Ebola?

They're infected with the virus, but it causes them no harm—and the same goes for more than 60 other pathogens they transmit to humans, often with lethal effect

By Anna Fagre on July 18, 2016

Ebola, rabies, SARS, Nipah, and MERS-CoV all have something in common. They are all viruses, spread by bats, that often cause lethal disease in humans—the 2014-2015 Ebola outbreak killed over 11,000 people[1]—yet they don't sicken or kill their bat hosts. When animals efficiently transmits disease for long periods of time in the absence of disease themselves, they are known as reservoirs.

So what is it about bats that allow them to act as reservoirs for over 60 human pathogens? This question has plagued the scientific community for decades, starting with the discovery of bats as the reservoir for rabies virus in 1932 and continuing today with the recent Ebola outbreak and the ongoing search for novel viruses that may cause the next pandemic[2]. Part of my work focuses on this – digging in to the genome of these new viruses to investigate how closely related they may be to known viruses that infect humans.

A number of lifestyle factors make bats unique which may help explain their seeming resistance to pathogens causing significant illness and death across human populations. Above all, it is unusual for a mammal to use powered flight and hibernate in high densities like bats do with other species. They are also

remarkably long-lived compared to other mammals of their size (10-20 years compared to a rat's average of two years).

Other characteristics sometimes shared by other mammals but potentially increasing bats' potential to act as a reservoir for these pathogens include their gregarious social behavior and mutual grooming patterns, ability to travel long distances, nocturnal activity, and broad species diversity (the second highest after rodents). This handful of unique characteristics makes bats difficult to study in controlled laboratory environments and has caused obstacles in obtaining information on why these animals are so efficient at transmitting lethal diseases to humans.

Here are a few theories scientists have on how bats transmit disease without becoming sick themselves.

Flight as fever

During the process of propelled flight over long distances, the bat's increased metabolic body rate and body temperature could potentially result in the same protective host defenses as the immune system's reaction to inflammation or an infectious insult[3]. Although we may take Tylenol or other fever-reducers to manage our body temperatures during flu or other illness, fever exists as a way to bolster our existing immune responses and decrease the severe effects of these pathogens. So, in comparing the immune system of bats to that of humans, the daily flight-associated oscillation of body temperature and associated immune responses may help explain bats' coexistence with pathogens that they are then able to shed into the environment, causing sickness and death in species lacking this protective effect. Studies using live bats are needed to corroborate this hypothesis, which as previously alluded to is much easier said than done.

Genome contraction

Bats are also unique in that they display the evolutionary loss of specific genes, specifically those that code for proteins involved in the immune response[4]. By examining the genomes of different species and analyzing where they diverged in a phylogenetic tree, we may determine which genes may have been more recent 'additions or deletions'. This is considered a form of natural selection where redundant genes are deleted – the 'less is more' hypothesis. A recent study showed that bats lost an entire gene family that codes for proteins sensing foreign genetic material (e.g. viruses) and regulating the effects of aging and inflammation[5].

Ongoing immune signaling

Cytokines are cell signaling molecules within the immune system. One important cytokine in the immediate response of the body to any infectious insult is IFN-α. Scientists have recently discovered that bats continuously express IFN-α even in the absence of viral infection[6]. In other words, their immune system is constantly ramped up, knocking down any viral insult as it occurs without the bats' health being adversely affected at all. What about the impact of stress on bats' immune system? Events like pregnancy, extreme weather events, lack of food and resources, extreme age, or increased crowding density may impact the levels of baseline cytokine presence. Again, these are questions that may be answered utilizing live bats in the laboratory.

Each of these theories highlights unique features of the physiology and immunology of bats, perhaps hinting at a genetic "seeding out" of unnecessary genes while leaving specific genes turned on that provide them an extra first-line defense against these viruses. Consider these genetic discoveries in light of the bat's unique lifestyle, and it is clear that much work is left to be done studying these factors and the way that different stressors may influence the immune system and metabolism. Scientists are racing to unravel the fundamental differences in immunity between bats and humans to better understand what makes them seemingly resistant to viruses like Ebola, while humans remain susceptible.

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Mass. General study reveals how the body disposes of red blood cells, recycles iron

Accumulation and removal of aged or damaged cells found to take place mostly in the liver, rather than the spleen

What happens when red blood cells become damaged or reach the end of their normal life span, and how is the iron required for carrying oxygen recycled? A new study led by Massachusetts General Hospital (MGH) investigators contradicts previous thinking about where and how worn-out red blood cells are disposed of and their iron retained for use in new cells. Their findings, being

published online in Nature Medicine, may lead to improved treatment or prevention of anemia or iron toxicity.

"Textbooks tell us that red blood cells are eliminated in the spleen by specialized macrophages that live in that organ, but our study shows that the liver - not the spleen - is the major on-demand site of red blood cell elimination and iron recycling," says senior author Filip Swirski, PhD, of the MGH Center for Systems Biology. "In addition to identifying the liver as the primary site of these processes, we also identified a transient population of bone-marrow-derived immune cells as the recycling cells."

The average life span of healthy red blood cells (RBCs) is 120 days, but that can be shortened in pathologic conditions including sepsis and in illnesses like sickle cell disease that interfere with normal production of RBCs. The cells also can become damaged during coronary bypass surgery or dialysis, and blood transfusions may contain RBCs that were damaged in the process of collection, storage and administration. Damaged RBCs can release unbound forms of iron-carrying hemoglobin, which can cause kidney injury, and can lead to anemia, reducing the delivery of oxygen to tissues. If disease-associated RBC damage overwhelms the body's ability to clear aged RBCs, toxic levels of free iron can be released.

In the current study, the research team used several different models of RBC damage, including blood from human bypass patients, to investigate the mechanisms involved in clearance of the cells and the recycling of their iron. Experiments in mice revealed that the presence of damaged RBCs in the bloodstream led to a rapid increase in a specific population of monocytes that took up the damaged cells and traveled to both the liver and the spleen. But several hours later almost all of those RBCs were located within a population of specialized macrophages - cells produced by monocytes that engulf and dispose of debris, damaged cells, and microbes - that were observed only in the liver. Those macrophages eventually disappeared once they were no longer needed.

The investigators also showed that expression of chemokines - proteins that direct the movement of other cells - draws RBC-ingesting monocytes to the liver, resulting in the accumulation of the iron-recycling macrophages. Blocking that process led to several indicators of impaired RBC clearance, including toxic levels of free iron and hemoglobin and signs of liver and kidney damage.

"The fact that the liver is the main organ of RBC removal and iron recycling is surprising, as is the fact that the liver relies on a buffer system consisting of bone marrow-derived monocytes that consume damaged red blood cells in the blood and settle in the liver, where they become the transient macrophages capable of iron recycling," says Swirski, who is an associate professor of Radiology at Harvard Medical School. "The mechanism we identified could be either helpful or damaging, depending on the conditions. If overactive, it could remove too many RBCs, but if it's sluggish or otherwise impaired, it could lead to iron toxicity. Further study could provide us with details of how this mechanism occurs in the first place and help us understand how to harness or suppress it in various conditions."

The co-lead authors of the Nature Medicine paper are Igor Theurl, Ingo Hilgendorf and Manfred Nairz, MD, PhD, all of the MGH Center for Systems Biology. The study was performed in collaboration with Herbert Lin, MD, PhD, MGH Program of Membrane Biology and Division of Nephrology; Jodie Babitt, MD, Matthias Nahrendorf, MD, and Ralph Weissleder, MD, PhD, MGH Center for Systems Biology; Lorenzo Berra, MD, MGH Department of Anaesthesia; and Guenter Weiss, MD, Medical University of Innsbruck, Austria. Support for the study includes National Institutes of Health grants 1R01HL095612, R01HL128264, R56AI104695 and R01DK071837 and the Howard M. Goodman Fellowship of MGH.

http://www.eurekalert.org/pub_releases/2016-07/uoa-nkc071516.php

NASA's Kepler confirms 100+ exoplanets during its K2 mission

The largest haul of confirmed planets obtained since the space observatory transitioned to a different mode of observing includes a planetary system comprising four promising planets that could be rocky

An international team of astronomers led by the University of Arizona has discovered and confirmed a treasure trove of new worlds using NASA's Kepler spacecraft on its K2 mission. Among the findings tallying 197 initial planet candidates, scientists have confirmed 104 planets outside our solar system. Among the confirmed is a planetary system comprising four promising planets that could be rocky.

The planets, all between 20 and 50 percent larger than Earth by diameter, are orbiting the M dwarf star K2-72, found 181 light years away in the direction of the Aquarius constellation. The star is less than half the size of the sun and less bright. The planets' orbital periods range from five and a half to 24 days, and two of them may experience irradiation levels from their star comparable to those on Earth. Despite their tight orbits -- closer than Mercury's orbit around the sun -- the possibility that life could arise on a planet around such a star cannot be ruled out, according to lead author Ian Crossfield, a Sagan Fellow at the University of Arizona's Lunar and Planetary Laboratory.

The researchers achieved this extraordinary "roundup" of exoplanets by combining data with follow-up observations by earth-based telescopes including the North Gemini telescope and the W. M. Keck Observatory in Hawaii, the Automated Planet Finder of the University of California Observatories, and the

Large Binocular Telescope operated by the University of Arizona. The discoveries are published online in the Astrophysical Journal Supplement Series.

Both Kepler and its K2 mission discover new planets by measuring the subtle dip in a star's brightness caused by a planet passing in front of its star. In its initial mission, Kepler surveyed just one patch of sky in the northern hemisphere, measuring the frequency of planets whose size and temperature might be similar to Earth orbiting stars similar to our sun. In the spacecraft's extended mission in 2013, it lost its ability to precisely stare at its original target area, but a brilliant fix created a second life for the telescope that is proving scientifically fruitful.

After the fix, Kepler started its K2 mission, which has provided an ecliptic field of view with greater opportunities for Earth-based observatories in both the northern and southern hemispheres. Additionally, the K2 mission is entirely community-driven with all targets proposed for by the scientific community.

Because it covers more of the sky, the K2 mission is capable of observing a larger fraction of cooler, smaller, red-dwarf type stars, and because such stars are much more common in the Milky Way than sun-like stars, nearby stars will predominantly be red dwarfs.

"An analogy would be to say that Kepler performed a demographic study, while the K2 mission focuses on the bright and nearby stars with different types of planets," said Ian Crossfield. "The K2 mission allows us to increase the number of small, red stars by a factor of 20, significantly increasing the number of astronomical 'movie stars' that make the best systems for further study."

To validate candidate planets identified by K2, the researchers obtained high-resolution images of the planet-hosting stars as well as high-resolution optical spectroscopy data. By dispersing the starlight as through a prism, the spectrographs allowed the researchers to infer the physical properties of a star -- such as mass, radius and temperature -- from which the properties of any planets orbiting it can be inferred.

These observations represent a natural stepping stone from the K2 mission to NASA's other upcoming exoplanet missions such as the Transiting Exoplanet Survey Satellite and James Webb Space Telescope.

"This bountiful list of validated exoplanets from the K2 mission highlights the fact that the targeted examination of bright stars and nearby stars along the ecliptic is providing many interesting new planets," said Steve Howell, project scientist for Kepler and K2 at NASA's Ames Research Center in Moffett Field, California. "This allows the astronomical community ease of follow-up and characterization, and picks out a few gems for first study by the James Webb Space Telescope, which could perhaps provide information about their atmospheres."

This work was performed in part under contract with the Jet Propulsion Laboratory (JPL) funded by NASA through the Sagan Fellowship Program executed by the NASA Exoplanet Science Institute.

http://www.eurekalert.org/pub_releases/2016-07/ps-tro071516.php

Trees rely on a range of strategies to hunt for nutrient hot spots

On the surface, trees may look stationary, but underground their roots -- aided by their fungal allies -- are constantly on the hunt and using a surprising number of strategies to find food, according to an international team of researchers.

The precision of the nutrient-seeking strategies that help trees grow in temperate forests may be related to the thickness of the trees' roots and the type of fungi they use, according to David Eissenstat, professor of woody plant physiology, Penn State. The tree must use a variety of strategies because nutrients often collect in pockets -- or hot spots -- in the soil, he added.

"What we found is that different species get nutrients in different ways and that depends both on that species' type of root -- whether it's thin or thick -- and that species' type of mycorrhizal fungi, which is a symbiotic fungus," said Eissenstat. "What we show is that you really can't understand this process without thinking about the roots and the mycorrhizal fungi together."

Tree species with thicker roots -- for example, the tulip poplar and pine - avoid actively seeking nutrient hot spots and instead send out more permanent, longer-lasting roots. On the other hand, some trees with thinner roots search for nutrients by selectively growing roots that are more temporary, or by using their fungal allies to find hot spots.

Eissenstat added that fungi form mutually beneficial partnerships with trees. The fungi receive carbon from the trees while helping trees acquire nutrients.

Nutrient-gathering strategies in thin-rooted trees depend on their fungal partner, according to the researchers, who report their findings today (July 18) in the Proceedings of the National Academy of Sciences. One type of thin-rooted trees, including maples, which teams with fungi called arbuscular mycorrhizas, tend to grow their roots to find nutrient-rich hot spots. Another type of thin-rooted trees, including oaks, relies on fungi called ectomycorrhizas, which are capable of producing wide-spreading strands -- hyphae -- to bring in nutrients.

Trees approach their nutrient-seeking strategies similar to the way investors plan their speculations.

"The investment analogy is used quite a bit in ecology because there is this whole idea of cost versus benefit," said Eissenstat. "If you're building thick roots it's really expensive to put on new pieces because they have to live a long time and if they can't get their resources back for that investment, it's not a wise strategy. But,

if you're building thin cheap roots, then it's easier to build something and get it paid back quickly. They tend to die quickly, but are more opportunistic."

Understanding the function of roots and fungi could help researchers better predict the effect of climate change on forests, according to Weile Chen, doctoral candidate in ecology, Penn State, who worked with Eissenstat.

"From our study we know that different tree species may have different foraging strategies, so if the species change for some reason, such as because the climate changes, the foraging of the whole system may change," said Chen.

The researchers used a common garden at Penn State's Russell E. Larson Agricultural Research Center to conduct the study. The garden consisted of 16 tree species planted in eight similar blocks. In each block, researchers planted six individual trees from a specific species. The trees, which are now between 10 and 18 years old, are planted about 3 meters apart with 5 meters of spacing between neighboring plots. The distance helps keep the root systems separate.

"The unique experimental setting is important, too, because, in the forest there are a lot of different species of trees, but their roots are all intertwined, so it's hard to know what is really going on," said Eissenstat. "We established, about 20 years ago, a garden where each tree species is in its own block, so now we can study in the field a species' roots and that helps us overcome a big research barrier."

Unlike more widely known processes in tree biology, such as photosynthesis and water acquisition, the complex relationship between roots and fungi is only beginning to be understood, the researchers suggested

"This is a beginning process and it's an incremental process and we're just starting to pull away the curtains and try to understand what's going on," said Eissenstat. "Some of these findings may be widely supported in other forests, or they may not be supported."

Eissenstat and Chen also worked with Thomas S. Adams, senior project associate in ecosystem science and management, Penn State; Roger T. Koide, professor of biology, Brigham Young University; Jared L. DeForest, associate professor of environmental and plant biology, Ohio University and Lei Cheng, professor of ecology, Zhejiang University.

http://nyti.ms/29Qrjuk

Zika Virus Case in Utah Baffles Health Officials

New case of Zika does not appear to have been contracted through either of the known sources of transmission

WASHINGTON — In another puzzling twist to the Zika epidemic, the Utah Department of Health on Monday reported the diagnosis of a new case of the virus that did not appear to have been contracted through either of the known sources of transmission: a mosquito bite or sexual contact.

The patient, who has fully recovered, was a “family contact” who helped care for an older man who had become infected with the virus after traveling abroad. That man, from Salt Lake County, died in June. He also had other ailments, and it was unclear whether the virus had contributed to his death.

The Zika virus has caused more than 1,500 cases of birth defects, mostly in Brazil, where the epidemic began last year. In the United States and its territories, several hundred pregnant women have been infected with the Zika virus, with the largest concentration in Puerto Rico; many had traveled to countries where the virus is circulating.

Zika is known to be transmitted by the Aedes aegypti mosquito and through sex, but neither seemed to be a plausible explanation for what happened in Utah. The infected caregiver, who tended to the ailing man at home and in the hospital, had not traveled to a country where Zika is circulating and had not had sex with him, officials said.

Local health workers had been trapping mosquitoes since last year, but had found no Aedes aegypti. Joseph Conlon, a technical adviser to the American Mosquito Control Association, said neither Aedes aegypti nor a cousin, Aedes albopictus, is found in Salt Lake County.

“We have found no evidence that mosquitoes here in Utah are transmitting the Zika virus,” said Dr. Angela Dunn, the deputy state epidemiologist at the Utah Department of Health on a call with reporters. She said that for that reason the case was not a danger to the broader public.

Zika has surprised scientists with its ability to be transmitted by sex — both from men to women and, in a recent discovery in New York City, from women to men. But it is not known to be transmitted in any other way — without the help of a mosquito — so the Utah case is remarkable.

Disease sleuths are sifting through clues. The Utah man who died had a very high level of virus in his body, which may have increased the risk that his bodily fluids could infect others. But while the virus has been detected in blood, semen, vaginal fluid, saliva and urine, it had not been known to infect others through nonsexual contact.

“We don’t have any evidence that suggests Zika can be passed from one person to another by sneezing or coughing or kissing or sharing utensils,” said Dr. Thomas R. Frieden, the director of the Centers for Disease Control and Prevention, which has a team investigating the case. Dr. Frieden said other people who had come into contact with the Utah man were being tested. The results will take a few weeks.

The continental United States has become a useful laboratory for unusual transmission of Zika. There has yet to be a local spread through mosquitoes,

making sexual and other transmission easier to trace. There are more than 1,300 case of the Zika in the continental United States — all acquired through travel abroad.

“This raises some interesting questions,” said Dr. William Schaffner, an infectious disease specialist in Tennessee. “Was there a needle stick or injury? Or if not, possible contact with other bodily fluid like urine or saliva?”

http://www.eurekalert.org/pub_releases/2016-07/pc-sat071816.php

Scientists agree that cranberry benefits may extend to the gut, heart, immune system and brain

Investigations show that unique compounds in cranberry juice, dried cranberries and various cranberry extracts hold great potential for the entire body

CARVER, Mass. - While decades of cranberry research has found that regular consumption of cranberry products promotes urinary tract health, leading scientists studying the bioactive components of fruits and other foods reported that cranberries possess whole body health benefits. In a July 2016 Advances in Nutrition supplement, Impact of Cranberries on Gut Microbiota and Cardiometabolic Health: Proceedings of the Cranberry Health Research Conference 2015, a team of international researchers reviewed the complex, synergistic actions of compounds that are uniquely cranberry. Their discussion led them to conclude that this berry may be more than just a tart and tangy fruit.

"It has been established that cranberries rank high among the berry fruits that are rich in health-promoting polyphenols," notes lead author, Jeffrey Blumberg, PhD, of the Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts University in Boston, MA. "But now, recent investigations have shown that the cranberry polyphenols may interact with other bioactive compounds in cranberries that could protect the gut microbiota, and provide antioxidant and anti-inflammatory functions that benefit the cardiovascular system, metabolism and immune function."

Recognition of the important role gut microorganisms play in human health has gained attention of scientists, reaching all the way up to the White House with the National Microbiome Initiative. Emerging evidence has found that the gut microbiome may impact the health of the immune system and brain, as well as how the body balances energy and uses carbohydrates and fat. Preliminary investigations with cranberries, some of which were performed in animal models, have revealed that cranberry bioactives show promise in helping to strengthen the gut defense system and protect against infection.

The effect of cranberry products on cardiovascular health and glucose management was also explained in the review. Authors of the paper described promising links between cranberry products and blood pressure, blood flow and blood lipids. One study identified a potential benefit for glucose management with low-calorie cranberry juice and unsweetened dried cranberries for people living with type 2 diabetes. Benefits for heart health and diabetes management have been attributed to the antioxidant and anti-inflammatory effects of the polyphenols in cranberries.

Given the wide range of ways to consume cranberries - juice, fresh, sauce, dried, or as an extract in beverages or supplements - additional human studies will help determine all the ways that cranberries may influence health. The scientific community and the cranberry industry agree - the impressive potential that cranberry bioactives may have on public health is worthy of further exploration.

"The bioactives in cranberry juice, dried cranberries and a variety of other cranberry sources have been shown to promote an array of beneficial health effects," explains Dr. Blumberg. "Given the complex nature and diversity of compounds found in berry fruits and how they interact with each other, I believe we have only scratched the surface when it comes to identifying the potential power of the cranberry."

To read the proceedings in their entirety, the Advances in Nutrition supplement can be accessed here: Impact of Cranberries on Gut Microbiota and Cardiometabolic Health: Proceedings of the Cranberry Health Research Conference 2015.

The Cranberry Health Research Conference was sponsored by the Cranberry Institute, with grant support provided by the Cranberry Marketing Committee (CMC), an instrumentality of the United States Department of Agriculture, Agriculture Marketing Service (USDA/AMS), that administers the Cranberry Marketing Order, 7 Code of Federal Regulations 929, as authorized under the Agricultural Marketing Agreement Act of 1937, as amended, and the American Cranberry Growers Association.

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Scientists herald 'tipping point' in ability to predict academic achievement from DNA

Strongest prediction from DNA of a behavioural measure to date

Scientists from King's College London have used a new genetic scoring technique to predict academic achievement from DNA alone. This is the strongest prediction from DNA of a behavioural measure to date.

The research shows that a genetic score comprising 20,000 DNA variants explains almost 10 per cent of the differences between children's educational attainment at the age of 16. DNA alone therefore provides a much better prediction of academic achievement than gender or even 'grit', a personality trait thought to measure perseverance and passion for long-term goals.

Published today in Molecular Psychiatry, these findings mark a 'tipping point' in predicting academic achievement and could help with identifying children who are at greater risk of having learning difficulties.

Previous research on twin studies has found that 60 per cent of differences between individuals' educational achievement are due to differences in DNA. Whilst this may seem far from the 10 per cent predicted in this study, the authors note that twin studies examine the sum total of all genetic effects, including common and rare variants, interactions between genes, and gene-environment interactions. Twin studies can therefore tell us the overall genetic influence on a trait in a population. Polygenic scores however estimate genetic influence from common variants only, which explains the discrepancy between these DNA-based studies and twin studies (10 per cent vs 60 per cent).

As human traits are so complex and influenced by thousands of gene variants of very small effect, it is useful to consider the joint effects of all of these trait-associated variants - and this principle underlies the polygenic score method. The value of polygenic scores is that they allow us to estimate genetic effects for academic achievement, or any other trait, at an individual level, based on a person's DNA.

Calculating an individual's polygenic score requires information from a genome-wide association study (GWAS) that finds specific genetic variants linked to particular traits, in this case academic achievement. Some of these genetic variants, known as single nucleotide polymorphisms (SNPs), are more strongly associated with the trait, and some are less strongly associated. In a polygenic score, the effects of these SNPs are weighed by the strength of association and then summed to a score, so that people with many SNPs related to academic achievement will have a higher polygenic score and higher academic achievement, whereas people with fewer associated SNPs will have a lower score and lower levels of academic achievement.

This new King's research is based on a recent GWAS that examined almost 10 million SNPs and identified 74 genetic variants that were significantly associated with years of completed education. 'Years of education' was used as a proxy measure for education achievement and related traits.

Using the GWAS to guide their selection of DNA variants, the researchers measured academic achievement in Mathematics and English at ages 7, 12 and 16 (GCSE), in a sample of 5,825 unrelated individuals from the Twins Early Development Study (TEDS).

Their findings show that what makes students achieve differently in their educational achievement is strongly affected by DNA differences; on average those with a higher polygenic score would obtain a grade between A and B, whereas those with a lower score obtained an entire grade below in terms of GCSE scores at age 16. As well as this, 65 per cent of people in the higher polygenic group went on to do A-levels, whereas only 35 per cent from the lower group did so.

Saskia Selzam, first author from the MRC Social, Genetic & Developmental Psychiatry (SGDP) Centre at King's College London, said: 'We believe that, very soon, polygenic scores will be used to identify individuals who are at greater risk of having learning difficulties.

'Through polygenic scoring, we found that almost 10 per cent of the differences between children's achievement is due to DNA alone. 10 per cent is a long way from 100 per cent but it is a lot better than we usually do in predicting behaviour. For instance, when we think about differences between boys and girls in maths, gender explains around one per cent of the variance. Another example is 'grit', which describes the perseverance of an individual, and only predicts around five per cent of the variance in educational achievement.'

Professor Robert Plomin, senior author of the study, also from the MRC SGDP Centre at King's College London, added: 'We are at a tipping point for predicting individuals' educational strengths and weaknesses from their DNA.

'Polygenic scores could be used to give us information about whether a child may develop learning problems later on, and these details could guide additional support that is tailored to a child's individual needs. We believe personalised support of this nature could help to prevent later developmental difficulties.'

The Twins Early Development Study (TEDS) is supported by a programme grant from the Medical Research Council.

http://bit.ly/2a6S7p5

Why does using a period in a text message make you sound insincere or angry?

And you thought it just indicated the end of a sentence…

Lauren Collister

When it comes to texting, the period, full stop, point – whatever you call it – has been getting a lot of attention.

People have begun noticing slight changes to the way our smallest punctuation mark is deployed, from declarations that it's going out of style to claims that it's becoming angry.

What they're actually noticing is written language becoming more flexible, with texting possessing its own set of stylistic norms (sometimes informally called "textspeak" or "textese").

The period is merely one example of this shift, a change that has opened up new possibilities for communicating with written language. Just as we have different

styles of speaking in different situations, so do we have context-dependent styles of writing.

Reading between the periods

Though periods can still signal the end of a sentence in a text message, many users will omit them (especially if the message is only one sentence long). This tendency now subtly influences how we interpret them.

Because text messaging is a conversation that involves a lot of back-and-forth, people add fillers as a way to mimic spoken language. We see this with the increased use of ellipses, which can invite the recipient to continue the conversation. The period is the opposite of that – a definitive stop that signals, as linguistics professor Mark Liberman has explained, "This is final, this is the end of the discussion."

For some, this can appear angry or standoffish.

Earlier this year, psychologist Danielle Gunraj tested how people perceived one-sentence text messages that used a period at the end of the sentence. Participants thought these text messages were more insincere than those that didn't have a period. But when the researchers then tested the same messages in handwritten notes, they found that the use of a period didn't influence how the messages were perceived.

In a 2007 study by linguists Naomi Baron and Rich Ling, multi-sentence text messages often had punctuation to indicate where the sentences stopped, but only 29 percent of these texts had punctuation at the very end of the message. The reason, Baron and Ling explain, is that "the act of sending a message coincides with sentence-final punctuation."

Situational switches

But of all the things to feel when seeing a period at the end of a text message – why insincerity?

The answer could have something to do with a term used by linguist John J. Gumperz: "situational code-switching," which is when we change how we talk depending on where we are, who we're talking to or how we're communicating.

A common example is the way we talk in a job interview versus at a bar with friends. Typically, a speaker will use much more formal language in an interview than when hanging out with peers. If you talked to your friends the same way you talked during a job interview, it would probably give a stilted, distant feeling to the conversation.

Scholars originally investigated situational code-switching in spoken language because spoken language was used in both casual and formal settings. In the past, written language was almost always tinged with a level of formality because it was associated with permanence in books and written documents.

However, now that text messaging and social media have given their users an outlet for casual written language, differences between writing styles can be seen.

The use of the period is one example of situational code-switching: When using one in a text message, it's perceived as overly formal. So when you end your text with a period, it can come across as insincere or awkward, just like using formal spoken language in a casual setting like a bar.

A different form of sincerity

Another example of language change in casual written forms is the repetition of letters. Communication scholar Erika Darics has observed that the repetition of letters or punctuation marks adds intensity to messages ("stopppp!!!"). She writes that this creates "a display of informality through using a relaxed writing style."

Linguist Deborah Tannen described a similar phenomenon, noting that repeated exclamation points in a message can convey a sincere tone, like in the following text message:

JACKIE I AM SO SO SO SORRY! I thought you were behind us in the cab and then I saw you weren't!!!!! I feel soooooooo bad! Catch another cab and ill pay for it for youuuuu

Note that this message does not contain a message-final period, since that may convey insincerity that would contradict the apology being presented. Instead, the sender uses the non-standard long vowels in "sooooooo" and "youuuuu" as well as five exclamation points at the end of one sentence.

Compare this to a standardized version of the text message:

Jackie, I am so sorry. I thought you were behind us in the cab and then I saw you weren't. I feel so bad! Catch another cab and I'll pay for it for you.

This more formal version, according to the arguments made by Tannen and Darics, reads more like a work email sent to a colleague than one to a friend sincerely and fervently apologizing for a transportation mishap.

It's a bit counterintuitive, but using formal language may undermine the sincerity of the apology; in order to convey the "right" message, it's important to know the proper protocols. This may explain why some people's text messages seem stilted or awkward: they're used to writing with a formal style that doesn't translate to the casual medium.

Will texting erode our writing skills?

In the media, there's been a fair amount of debate about whether texting – or using overly casual language – can "ruin" someone's writing ability. (Examples include the LA Times, the BBC and The Daily Mail, to name a few.)

However, past research into situational code-switching in spoken language has shown that a person's ability to code-switch can signal social competency, can

affirm one's sense of identity or membership in a community and may be an indicator of high intellectual ability in children.

Studies like the recent work of psychologists Gene Ouellette and Melissa Michaud have shown that the use of text messaging and "textese" has little relationship to how someone will score on spelling, reading and vocabulary tests. Meanwhile, a study out of California State University found little use of "textisms" in formal letter writing assignments completed by students. This observation supports work like a study by psychologist Beverly Plester and colleagues, who found that an increased use of textese was correlated with higher scores on verbal reasoning ability tests. They suggested that the preteens in their study were able to "slip between one register of language and another, as they deem it appropriate."

This shows that frequent and fluent users of casual written language can often readily code-switch: they know to put that period at the end of every sentence in a formal writing assignment. Some educators are even beginning to incorporate lessons about formal and informal writing into their classrooms, which can help students identify those situations that require the use of different styles.

Instead of ignoring or deriding the variation in written language, embracing the change in language – and the ability of speakers and writers to code-switch – can lead to better communication skills in all contexts.

Knowing when a period might indicate insincerity is just one of them.

http://www.eurekalert.org/pub_releases/2016-07/acs-acs071416.php

American Cancer Society endorses HPV vaccine recommendations from CDC

Updated guideline recommends vaccinating males and females at ages 11 to 12

ATLANTA - The American Cancer Society (ACS) has endorsed HPV vaccination recommendations from the CDC's Advisory Committee on Immunization Practices (ACIP), the principal source of guidance on U.S. immunization policy. The ACS's updated guideline supports the ACIP recommendation to vaccinate males as well as females at ages 11 to 12 to protect against HPV, which is associated not only with cervical cancers, but also penile, anal, oropharyngeal (mouth/throat), and other cancers.

The ACS first published a guideline for the use of prophylactic HPV vaccines for the prevention of cervical cancer and pre-cancer in 2007. At the time, the vaccine was not approved for use in males and there was insufficient evidence for vaccinations beyond the age of 18.

Since then, additional studies have added to the evidence, new versions of the vaccine have been licensed for use in the United States, and there have been new immunization recommendations from ACIP.

Studies indicate that vaccination in males will be effective against cancers related to HPV in males, as it is in females. Those cancers include penile cancer in males, cervical, vaginal, and vulvar cancer in females, and anal and oropharyngeal cancers in males and females. Vaccinating males may also provide additional protection to females.

To update its recommendations, the ACS implemented a guideline endorsement process, similar to the approach taken by the American Society of Clinical Oncology (ASCO) for endorsing another organization's guidelines. The adapted ACS endorsement process for the HPV vaccine update included a methodologic assessment of the ACIP recommendations, a supplemental evidence review, a content review of the ACIP recommendations, approval of recommendations and endorsement statements by the ACS Guideline Development Group, review of the evidence report and endorsement manuscript by expert advisors, and finally approval of by the ACS National Board of Directors.

A summary of the recommendations:

Routine HPV vaccination of all children should be initiated at age 11 or 12. The vaccination series can be started beginning as early as age 9.

Vaccination is also recommended for females ages 13 to 26 and for males aged 13 to 21 who have not been vaccinated previously or who have not completed the 3-dose series. Males 22 through 26 years old may also be vaccinated.

o The guideline emphasizes that late vaccination for adolescents who were not vaccinated at the recommended age should be completed as soon as possible.

o Individuals ages 22 to 26 who were not previously vaccinated should be informed that vaccination at older ages is less effective in lowering cancer risk, which is not specifically recommended by the ACIP.

Vaccination of females is recommended with any of the three available vaccines: 2vHPV, 4vHPV (as long as this formulation is available), or 9vHPV*. Vaccination of males is recommended with 4vHPV (as long as this formulation is available) or 9vHPV.

Vaccination is also recommended through age 26 for men who have sex with men and for immunocompromised persons (including those with HIV infection) if not vaccinated previously.

"HPV vaccination has the potential to prevent tens of thousands of cancers and hundreds of thousands of pre-cancers each year," said Debbie Saslow, PhD, director of cancer control intervention for HPV vaccination and women's cancers, and lead author of the report. "It is critical that all stakeholders--families, health care providers, and others--make HPV vaccination a priority, so that prevention of the vast majority of cervical, vaginal, vulvar, anal, penile, and oropharyngeal cancers can become a reality."

The report appears early online in CA: A Cancer Journal for Clinicians.

**The 9-valent vaccine protects against 9 types of HPV that are responsible for about 90% of cancers related to HPV. Gardasil 9 is now the sole HPV vaccine available through government programs. There is not yet any information as to if or when 2vHPV and 4vHPV will be discontinued for private purchase.*

Article: Human Papillomavirus Vaccination Guideline Update: American Cancer Society Guideline Endorsement. CA: Can J Clin. doi: 10.3322/caac.21355.

http://onlinelibrary.wiley.com/doi/10.3322/caac.21355/abstract

http://www.eurekalert.org/pub_releases/2016-07/mu-rpf071916.php

Researchers produce first widely protective vaccine against chlamydia

The first steps towards developing a vaccine against an insidious sexual transmitted infection (STI) have been accomplished by researchers at McMaster University.

Hamilton, ON - Researchers at the Michael G. DeGroote Institute for Infectious Disease Research at McMaster have developed the first widely protective vaccine against chlamydia, a common STI that is mostly asymptomatic but impacts 113 million people around the world each year and can result in infertility.

In a study, recently published in the journal Vaccine, the researchers show that a novel chlamydial antigen known as BD584 is a potential vaccine candidate for the most common species of chlamydia known as Chlamydia trachomatis.

As most C. trachomatis infections are asymptomatic, chlamydia can often go untreated and lead to upper genital tract infections, pelvic inflammatory disease, and infertility. This is why the promise of a vaccine would be extremely beneficial, says David Bulir, co-author of the study.

"Vaccine development efforts in the past three decades have been unproductive and there is no vaccine approved for use in humans," said Bulir, who just finished his PhD in medical sciences at McMaster.

"Vaccination would be the best way to way to prevent a chlamydia infection, and this study has identified important new antigens which could be used as part of a vaccine to prevent or eliminate the damaging reproductive consequences of untreated infections."

In the research team's study, BD584 was able to reduce chlamydial shedding - a symptom of C. trachomatis - by 95 per cent. The antigen also decreased hydrosalpinx, another C. trachomatis symptom which involves fallopian tubes being blocked with serous fluids, by 87.5 per cent.

The results look very promising, said senior author James Mahony, a professor of Pathology and Molecular Medicine for McMaster's Michael G. DeGroote School of Medicine and a researcher at St. Joseph Healthcare Hamilton's Research Institute where the work was performed.

Co-author and McMaster PhD student, Steven Liang, explains, "not only is the vaccine effective, it also has the potential to be widely protective against all C. trachomatis strains, including those that cause trachoma."

Trachoma is an eye infection caused by chlamydia and is the leading cause of preventable blindness affecting millions of people in many resource-poor regions of the world.

"The vaccine would be administered through the nose. This is easy and painless and does not require highly trained health professionals to administer, and that makes it an inexpensive solution for developing nations," he said.

The next step is more testing for effectiveness against different strains of Chlamydia and in different formulations. The study was funded by the Canadian Institutes for Health Research.

http://www.eurekalert.org/pub_releases/2016-07/uoe-ejm071916.php

Elderly Japanese most resilient in wake of triple disaster, study finds

Older people in Japan are more resistant to the impacts of disasters on their health than younger generations, a study suggests

Research into the aftermath of the Fukushima earthquake, tsunami and subsequent nuclear meltdown found that the oldest were least likely to experience a deterioration of existing chronic conditions.

The study also reveals that the health of people living in the countryside was more resilient than that of urban dwellers following the triple disaster of 2011.

The findings are in contrast to previous studies that suggested that young, city-dwellers would be less susceptible to ill-health in the aftermath of a major disruptive event.

Experts from the University of Edinburgh worked with Dr Masaharu Tsubokura from the University of Tokyo to track 400 diabetic patients who were treated by a public hospital in Minamisoma City, 23km away from the Fukushima nuclear power plant.

They compared how well patients managed their blood sugar levels before the disaster in 2010 with how well they coped in the year following the earthquake.

Two-thirds experienced a deterioration in their body's ability to regulate diabetes, with the number classed as having acute problems controlling blood sugar levels increasing from 32 per cent to 41 per cent.

Age was the most significant factor in determining the level of robustness -- with each additional year providing more benefit.

Evacuation did not protect patients from deteriorating health. A third of the patients studied left the area in the wake of the disaster. This group suffered an

increased decline in its ability to control blood sugar, compared with those who remained.

Sarah Hill, director of the University of Edinburgh's Global Public Health Unit, said: "We were incredibly surprised by these results, as they run counter to received wisdom about the impact of disasters on health.

"Younger, urban diabetics may have experienced greater stress as a result of the disaster causing greater disruption to their lives. Older patients may have been more content to stay put, meaning less upheaval and stress. The longevity of Japanese pensioners is well-known, so their healthy diet and lifestyle may also be a factor. "The results will certainly help health professionals identify patients with chronic diseases who are most at risk in a disaster situation and ensure they get the appropriate help."

The findings are from a paper, Sociodemographic patterning of long-term diabetes mellitus control following Japan's 3.11 triple disaster: A retrospective cohort study, published in the journal BMJ Open.

http://www.eurekalert.org/pub_releases/2016-07/dc-dsw071916.php

Dartmouth study with aye-ayes and slow loris finds that prosimians prefer alcohol

Study sheds new light on the origins of human alcohol consumption

Alcohol is widespread in nature, existing in fermented nectars, saps and fruits. It is therefore a natural part of many primate diets, and it follows that primates have evolved to digest alcohol quickly to minimize toxic effects. But given that alcohol is also a source of calories, it is plausible that alcohol is attractive to some primates, including, hypothetically, our human ancestors. In fact, previous research found that humans and African great apes have a genetic mutation that radically accelerates alcohol digestion. However, this mutation is also shared with the aye-aye, one of the oddest animals on Earth. The question, then, is whether aye-ayes are attracted to alcohol. In the first controlled study of its kind, Dartmouth researchers found that two aye-ayes and another prosimian primate (a slow loris) could discriminate different concentrations of alcohol, and further, that each species preferred the highest concentrations of alcohol available to them. The findings of this Dartmouth study will be published in the open-access journal, "Royal Society Open Science." (A pdf of the study is available upon request).

The aye-aye is a nocturnal lemur endemic to Madagascar with a lineage dating back nearly 70 million years. They have an elongated, bony finger for detecting and extracting grubs from decaying tree trunks. "Aye-ayes are essentially primate woodpeckers" said Nathaniel J. Dominy, a professor of anthropology and biological sciences at Dartmouth. "So it is puzzling that they can digest alcohol so efficiently" he added. In the wet season, however, aye-ayes devote as much as 20 percent of their feeding time to the nectar of the traveler's tree, a primitive plant from Madagascar. "If the nectar is fermented, then the hyper-efficient alcohol digestion would make ecological sense" reasoned Samuel Gochman, a Dartmouth student and lead author of the study. "Since we didn't have access to such flowering trees for the study, instead, we tested whether aye-ayes are attracted to alcohol in a nectar-simulating solution of sucrose." The authors also tested the preferences of a slow loris, the only primate known to consume fermented nectar in the wild.

At the Duke Lemur Center in Durham, N. C., Gochman conducted multiple-choice feeding experiments with two aye-ayes, Morticia and Merlin, and a slow loris, Dharma, to test for an aversion or preference to varying concentrations of alcohol in simulated nectar. The alcohol concentrations were low (0.0 to 5.0%) to reflect levels found in nature. Each liquid treatment, together with two controls, was placed in a circular array of small-recessed containers in a round resin outdoor table. The position of the liquids was randomized and behavioral data were collected blind to the contents, to avoid observational bias. Each of the two aye-ayes participated in a trial once a day for 15 days for a total of 30 trials. The slow loris participated in a trial each day over five days for a total of five trials, as time was limited.

The authors found that the aye-ayes could discriminate between tap water and the varying concentrations of alcohol, and that they adjusted their intake accordingly. Further statistical analysis showed that the aye-ayes preferred the highest concentrations of alcohol. Unexpectedly, the aye-ayes continued to probe the containers with the highest concentrations long after they were emptied, suggesting that they wanted more. The five trials with the slow loris were too few to yield statistical results, but the pattern of discrimination and preference was practically identical. None of the animals exhibited signs of impaired coordination or behavior, as intoxication was not part of the study.

"This project has definitely fueled my interest in human evolution" said Samuel Gochman, referring to the larger implications of the study. "Our results support the idea that fermented foods were important in the diets of our ancestors." Some researchers have suggested that our genetic mutation for efficient alcohol digestion, which is shared with chimpanzees and gorillas, is linked to the consumption of fermented fruits on the forest floor, a dietary behavior that could have pre-adapted humans for the Neolithic Revolution. And some archaeologists have argued that making beer was our primary motivation for harvesting and ultimately domesticating cereals, the plant that give rise to complex societies. Perhaps a craving for alcohol made all the difference.

The study was conducted by: Samuel R. Gochman '18, a sophomore at Dartmouth College, who worked with animal subjects at the Duke Lemur Research Center; Michael B. Brown, a graduate student in ecology and evolutionary biology; and Nathaniel J. Dominy, professor of anthropology and adjunct professor of biological sciences at Dartmouth.

http://www.eurekalert.org/pub_releases/2016-07/tcob-wfd072016.php

World first discovery gets to the heart of birth defects

For the first time, scientists believe they've discovered a cause of multiple types of birth defects triggered by environmental stresses.

The breakthrough made by scientists at the Victor Chang Institute, shows that cellular stress could be the key to understanding why many babies are born with defects of the heart, vertebrae and kidney, among others.

Affecting 1 in 100 babies, childhood heart disease is the most common form of birth defect in the world. But despite its prevalence, surprisingly the genetic and environmental causes are very poorly understood.

The research, led by world renowned professor Sally Dunwoodie, analysed the effects of short term oxygen deficiency on heart development in an embryo.

"We obviously know that smoking is terrible for an unborn baby's health. But oxygen deficiency in an embryo can be caused by many things, for example prescription medications, high blood pressure, high altitude, a tangled umbilical cord, as well as carbon monoxide," Professor Dunwoodie explained.

Using a mouse model, the scientists reduced oxygen levels inside a chamber from the normal level of 21 percent to as low as 5.5 percent, for eight hours.

The scientists showed for the first time that reduced oxygen levels damaged the developing heart. The types of heart defects were the same as those most commonly found in humans. Crucially the scientists worked out exactly how the low oxygen was damaging the developing heart.

"We discovered that reduced oxygen triggered a stress response in the embryonic cells. The cells try to relieve the stress by stopping protein production. Suddenly those proteins aren't available to make the heart at a critical time and the heart couldn't develop properly," Professor Dunwoodie revealed.

Importantly, oxygen deficiency isn't the only trigger of this cellular stress. There are multiple factors which can set it off, such as a viral infections, increased temperature, high blood glucose, poor nutrition, and pollution.

"This cellular stress response could be the key to a variety of birth defects, not just heart defects. Now, we strongly suspect it's an underlying mechanism for many different types of birth defects, including those of the vertebrae, kidney and others."

"Surprisingly this cellular stress response has been used for hundreds of millions of years and it is only now that we have discovered that it can cause organs, such as the heart, not to form properly" added Professor Dunwoodie.

The study has recently been accepted for publication in the journal Development.

http://bit.ly/2aiySZ1

Menopause reversal restores periods and produces fertile eggs

Women who have already passed through the menopause may be able to have children following a blood treatment usually used to heal wounds

By Jessica Hamzelou

MENOPAUSE need not be the end of fertility. A team claims to have found a way to rejuvenate post-menopausal ovaries, enabling them to release fertile eggs, New Scientist can reveal.

The team says its technique has restarted periods in menopausal women, including one who had not menstruated in five years. If the results hold up to wider scrutiny, the technique may boost declining fertility in older women, allow women with early menopause to get pregnant, and help stave off the detrimental health effects of menopause.

“It offers a window of hope that menopausal women will be able to get pregnant using their own genetic material,” says Konstantinos Sfakianoudis, a gynaecologist at the Greek fertility clinic Genesis Athens.

“It is potentially quite exciting,” says Roger Sturmey at Hull York Medical School in the UK. “But it also opens up ethical questions over what the upper age limit of mothers should be.”

Women are thought to be born with all their eggs. Between puberty and the menopause, this number steadily dwindles, with fertility thought to peak in the early 20s. Around the age of 50, which is when menopause normally occurs, the ovaries stop releasing eggs – but most women are already largely infertile by this point, as ovulation becomes more infrequent in the run-up. The menopause comes all-too-soon for many women, says Sfakianoudis.

The age of motherhood is creeping up, and more women are having children in their 40s than ever before. But as more women delay pregnancy, many find themselves struggling to get pregnant. Women who hope to conceive later in life are increasingly turning to IVF and egg freezing, but neither are a reliable back-up option (see “The pregnancy pause“).

The menopause also comes early – before the age of 40 – for around 1 per cent of women, either because of a medical condition or certain cancer treatments, for example. “It offers hope that menopausal women will be able to get pregnant using their own genetic material“

To turn back the fertility clock for women who have experienced early menopause, Sfakianoudis and his colleagues have turned to a blood treatment that is used to help wounds heal faster.

Platelet-rich plasma (PRP) is made by centrifuging a sample of a person's blood to isolate growth factors – molecules that trigger the growth of tissue and blood vessels. It is widely used to speed the repair of damaged bones and muscles, although its effectiveness is unclear. The treatment may work by stimulating tissue regeneration.

Sfakianoudis's team has found that PRP also seems to rejuvenate older ovaries, and presented some of their results at the European Society of Human Reproduction and Embryology annual meeting in Helsinki, Finland, this month. When they injected PRP into the ovaries of menopausal women, they say it restarted their menstrual cycles, and enabled them to collect and fertilise the eggs that were released.

"I had a patient whose menopause had established five years ago, at the age of 40," says Sfakianoudis. Six months after the team injected PRP into her ovaries, she experienced her first period since menopause.

Sfakianoudis's team has since been able to collect three eggs from this woman. The researchers say they have successfully fertilised two using her husband's sperm. These embryos are now on ice – the team is waiting until there are at least three before implanting some in her uterus.

Older mothers

The team isn't sure how this technique works, but it may be that the PRP stimulates stem cells. Some research suggests a small number of stem cells continue making new eggs throughout a woman's life, but we don't know much about these yet. It's possible that growth factors encourage such stem cells to regenerate tissue and produce ovulation hormones. "It's biologically plausible," says Sturmey.

Fertilised eggs

Sfakianoudis's team says it has given PRP in this way to around 30 women between the ages of 46 and 49, all of whom want to have children. The researchers say they have managed to isolate and fertilise eggs from most of them. "It seems to work in about two-thirds of cases," says Sfakianoudis. "We see changes in biochemical patterns, a restoration of menses, and egg recruitment and fertilisation." His team has yet to implant any embryos in post-menopausal women, but hopes to do so in the coming months.

PRP has already been helpful for pregnancy in another group of women, says Sfakianoudis. Around 10 per cent of women who seek fertility treatment at his clinic have a uterus that embryos find difficult to attach to – whether due to cysts, scarring from miscarriages or having a thin uterine lining. "They are the most difficult to treat," says Sfakianoudis.

But after injecting PRP into the uteruses of six women who had had multiple miscarriages and failed IVF attempts, three became pregnant through IVF. "They are now in their second trimester," says Sfakianoudis.

Fertility aside, the technique could also be desirable for women who aren't trying to conceive. The hormonal changes that trigger menopause can also make the heart, skin and bones more vulnerable to ageing and disease, while hot flushes can be very unpleasant. Many women are reluctant to take hormone replacement therapy to reduce these because of its link with breast cancer. Rejuvenating the ovaries with PRP could provide an alternative way to boost the supply of youthful hormones, delaying menopause symptoms.

However, Sfakianoudis's team hasn't yet published any of its findings. "We need larger studies before we can know for sure how effective the treatment is," says Sfakianoudis.

Some have raised concerns about the safety and efficacy of the procedure, saying the team should have tested the approach in animals first. "This experiment would not have been allowed to take place in the UK," says Sturmey. "The researchers need to do some more work to make sure that the resulting eggs are OK," says Adam Balen at the British Fertility Society.

To know if the technique really does improve fertility, the team will also need to carry out randomised trials, in which a control group isn't given PRP.

Virginia Bolton, an embryologist at Guy's and St Thomas' Hospital in London, is also sceptical. "It is dangerous to get excited about something before you have sufficient evidence it works," she says. New techniques often find their way into the fertility clinic without strong evidence, thanks to huge demand from people who are often willing to spend their life savings to have a child, she says.

If the technique does hold up under further investigation, it could raise ethical questions over the upper age limits of pregnancy – and whether there should be any. "I lay awake last night turning this over in my mind," says Sturmey. "Where would the line be drawn?"

Health issues like gestational diabetes, pre-eclampsia and miscarriage are all more common in older women. "It would require a big debate," says Sturmey.

Sperm home test kit

How are the little swimmers doing? Low sperm counts or poor sperm quality are behind around a third of cases of couples who can't conceive. A visit to a clinic for a test can be awkward, but a smartphone-based system lets men determine whether that's necessary by checking their fertility at home.

Men often find it embarrassing to give a semen sample at a clinic, says Yoshitomo Kobori at the Dokkyo Medical University Koshigaya Hospital in Japan. So Kobori devised an alternative. "I thought a smartphone microscope could be an easy way to look at problems with male fertility," he says.

Kobori and his colleagues came up with a lens less than a millimetre thick that can be slotted into a plastic "jacket". Clipped on to the camera of a smartphone, it magnifies an image by 555 times – perfect for looking at sperm.

To do a home test, a man would apply a small amount of semen to a plastic sheet around five minutes after ejaculation and press it against the microscope.

Watch them swim

The phone's camera can then take a 3-second video clip of the sperm. When viewed enlarged on a computer screen, it is easy for someone to count the total number of sperm and the number that are moving – key indicators of fertility.

Kobori says the system works as well as the software used in fertility clinics. When the team ran 50 samples through both systems, they got almost identical results. The work was presented at the European Society of Human Reproduction and Embryology meeting in Helsinki this month.

The system can't assess the ability of sperm to fertilise an egg. "This method is only the simple version of semen analysis," says Kobori. But that could be enough for men to identify potential fertility problems, and decide whether to seek help from a doctor.

http://www.eurekalert.org/pub_releases/2016-07/bc-tpy071816.php

To protect yourself from malaria sleep with a chicken next to your bed

For the first time, scientists have shown that malaria-transmitting mosquitoes actively avoid feeding on certain animal species such as chickens, using their sense of smell.

Odors emitted by species such as chickens could provide protection for humans at risk of mosquito-transmitted diseases, according to a study in the open access Malaria Journal.

Researchers at the Swedish University of Agricultural Sciences and Addis Ababa University, Ethiopia found that Anopheles arabiensis, one of the predominant species transmitting malaria in sub-Saharan Africa, avoids chickens when looking for hosts to feed on. This indicates that, unlike humans, cattle, goats and sheep, chickens are a non-host species for An. arabiensis and that the mosquitoes have developed ways of distinguishing them from host species.

Rickard Ignell, the corresponding author, said: "We were surprised to find that malaria mosquitoes are repelled by the odors emitted by chickens. This study shows for the first time that malaria mosquitoes actively avoid feeding on certain animal species, and that this behavior is regulated through odor cues."

To find out which species the mosquitoes prefer, the research team collected data on the population of human and domestic animals in three Ethiopian villages. They also collected blood-fed mosquitoes to test for the source of the blood that the mosquitoes had fed on. People living in the areas in which the research was conducted share their living quarters with their livestock. The researchers found that while An. arabiensis strongly prefers human over animal blood when seeking hosts indoors, it randomly feeds on cattle, goats and sheep when outdoors, but avoids chickens in both settings, despite their relatively high abundance.

Since mosquitoes select and discriminate between their hosts mainly based on their sense of smell, the researchers collected hair, wool and feathers from potential host and non-host species to analyze the odor compounds present in them.

Identifying certain compounds that were only present in chicken feathers, the researchers used these and other compounds obtained from all species to test their ability to repel mosquitoes from mosquito traps. The traps were set up in 11 thatched houses in one of the villages for a total of 11 days. In each of the houses, a single volunteer aged between 27 and 36 years slept under an untreated bed net.

The researchers found that significantly fewer mosquitoes were caught in traps baited with chicken compounds than in control traps. Suspending a living chicken in a cage next to a trap had a similar repellent effect.

Because it feeds indoors and outdoors on various host species, An. arabiensis is difficult to control with existing methods, according to previous research. The results of this study suggest that, in combination with established control methods, the odors emitted by chickens and other non-host species could prove useful in controlling An. arabiensis.

Rickard Ignell said: "People in sub-Saharan Africa have suffered considerably under the burden of malaria over an extended period of time and mosquitoes are becoming increasingly physiologically resistant to pesticides, while also changing their feeding habits for example by moving from indoors to outdoors. For this reason there is a need to develop novel control methods. In our study, we have been able to identify a number of natural odour compounds which could repel host-seeking malaria mosquitoes and prevent them from getting in contact with people."

1. Chicken volatiles repel host-seeking malaria mosquitoes
Kassahun T. Jaleta, Sharon Rose Hill, Göran Birgersson, Habte Tekie and Rickard Ignell
Malaria Journal 2016 DOI: 10.1186/s12936-016-1386-3
http://malariajournal.biomedcentral.com/articles/10.1186/s12936-016-1386-3

http://www.eurekalert.org/pub_releases/2016-07/uop-ptd072016.php

Penn-led team develops plant-based Polio booster vaccine

Booster confers immunity against all three serotypes of polio

Jonas Salk created a vaccine against polio that has been used since 1955; Albert Sabin created another version that has been on the market since 1961. Together, these two vaccines have nearly eliminated polio from the face of the earth.

Emphasis on nearly. Outbreaks have persisted in developing nations in Asia, Africa and the Americas, in part due to limitations of these vaccines. Most recently, in 2013, Israel reported a "silent" outbreak of polio, in which no one got sick but the virus was found in the environment and in vaccinated individuals.

New research led by University of Pennsylvania scientists offers hope for an alternative. Collaborating with researchers from the U.S. Centers for Disease Control and Prevention and the U.S. Food and Drug Administration, the Penn team developed an oral vaccine booster by manipulating plants to express a protein found in the polio virus. Tests with sera from immunized mice show that the booster confers immunity against all three serotypes of polio.

"Our vaccine research has the potential to provide a timely solution to deal with polio outbreaks around the globe," said Henry Daniell, professor in the Department of Biochemistry in Penn's School of Dental Medicine and senior author on the work.

Daniell, whose plant-based system was used to create the vaccine, worked with lab members Hui-Ting Chan and Yuhong Xiao on the paper, as well as with William C. Weldon and Steven M. Oberste from the CDC and Konstantin Chumakov from the FDA. The paper appeared in Plant Biotechnology Journal.

Since the 1988 launch of the Global Polio Eradication Initiative, a collaboration spearheaded by the World Health Organization, Rotary International, the CDC and UNICEF that made polio vaccines widely available, the incidence of disease has been reduced by more than 99 percent, from 350,000 cases in 1988 to 74 in 2015. Yet challenges remain to ensure that the world is polio free.

Two vaccines, bivalent oral poliovirus vaccine, or bOPV, and the inactivated poliovirus vaccine, IPV, are currently used throughout the world to protect against polio. Each has distinct advantages; while IPV protects the individual, oral vaccines can help protect a community. Both have been critical in bringing the world closer than ever to eradication.

IPV is extremely safe but is substantially more expensive than bOPV, and, because it is given as a shot, it is not as easy to administer as bOPV, which is administered in oral drops. Also, it does not induce intestinal immunity, which means that vaccinated individuals can still shed the virus. This is what occurred in 2013 in Israel when poliovirus was found in sewage, and a rapid vaccination campaign with oral polio vaccine was instituted to prevent transmission to unvaccinated people.

bOPV induces superior intestinal immunity compared with IPV and, thus, has the potential to better prevent transmission of polioviruses. However, due to the live attenuated virus found in the oral polio vaccine, in rare instances in under-immunized communities the virus can mutate over time and revert into a form of the virus that can cause paralysis. This risk is what led to the global withdrawal of tOPV, the trivalent OPV that targets all three serotypes of the virus, in April. Eventually all forms of the oral polio vaccine will be withdrawn globally. However, the importance of maintaining intestinal immunity against poliovirus remains a concern.

In an effort to address the current vaccines' shortcomings, Daniell and colleagues aimed to design a booster vaccine that would not be based on live attenuated poliovirus and would induce mucosal immunity to all three serotypes of polio. In addition, whereas IPV and bOPV require refrigeration, the researchers wanted to design a vaccine that would be stable without refrigeration for very long periods, making storage, transport and administration at the point of care easier.

Daniell's plant-based drug-development platform was suited to the task. In it, plants are coaxed to grow a biomolecule of interest by bombarding the leaves with the gene until it is taken up by chloroplasts. The plant then produces the associated protein in its leaves, which can be grown and then freeze dried and encapsulated for oral administration.

To induce immunity against polio, the researchers decided to target viral protein 1, or VP1, a structural protein present in all three serotypes of polio. They fused it to carrier protein cholera toxin subunit B, which enables the protein to cross mucosal surfaces, then confirmed that they could stably express the fused protein in tobacco and lettuce plants.

Next they fed the freeze-dried plant material expressing the fused protein to mice to see if it could induce an immune response in mice that had already been primed with an IPV vaccination.

"The vaccine, when formulated with adjuvants, induced high levels of mucosal and systemic immunity in the mice," Daniell said, corresponding to IgA and IgG antibody responses, respectively. "And when the CDC performed tests on several hundred samples of sera from immunized mice, they found it could neutralize all three serotypes of polio virus."

The researchers hope to pursue FDA approval to conduct clinical studies in humans with this virus-free vaccine, which could be produced relatively inexpensively and does not require refrigeration or special handling and could therefore eventually contribute to a polio-free world. "We can ship capsules to

every corner of the world and boost that IPV inoculation," he said. "It's time to improve upon the vaccinations we've been using for 75 years."

In addition, Daniell said the concept of a low-cost booster vaccine could be used for many other viral diseases, as immunity can wane in old age, leading to reactivation of a latent virus. Shingles is a prime example.

"This could be avoided with a simple boosting," he said.

The work was supported by the Bill & Melinda Gates Foundation and National Institutes of Health.

http://www.eurekalert.org/pub_releases/2016-07/du-omb072016.php

Oceans may be large, overlooked source of hydrogen gas

Gas may lie near slow-spreading tectonic plates on the seafloor

DURHAM, N.C. -- Rocks formed beneath the ocean floor by fast-spreading tectonic plates may be a large and previously overlooked source of free hydrogen gas (H2), a new Duke University study suggests.

The finding could have far-ranging implications since scientists believe H2 might be the fuel source responsible for triggering life on Earth. And, if it were found in large enough quantities, some experts speculate that it could be used as a clean-burning substitute for fossil fuels today because it gives off high amounts of energy when burned but emits only water, not carbon.

Recent discoveries of free hydrogen gas, which was once thought to be very rare, have been made near slow-spreading tectonic plates deep beneath Earth's continents and under the sea.

"Our model, however, predicts that large quantities of H2 may also be forming within faster-spreading tectonic plates -- regions that collectively underlie roughly half of the Mid-Ocean Ridge," said Stacey L. Worman, a postdoctoral fellow at the University of Texas at Austin, who led the study while she was a doctoral student at Duke's Nicholas School of the Environment.

Total H2 production occurring beneath the oceans is at least an order of magnitude larger than production occurring under continents, the model suggests.

"A major benefit of this work is that it provides a testable, tectonic-based model for not only identifying where free hydrogen gas may be forming beneath the seafloor, but also at what rate, and what the total scale of this formation may be, which on a global basis is massive," said Lincoln F. Pratson, professor of earth and ocean sciences at Duke, who co-authored the study. The scientists published their peer-reviewed study in the July 14 online edition of the journal Geophysical Research Letters.

The new model calculates the amount of free hydrogen gas produced and stored beneath the seafloor based on a range of parameters -- including the ratio of a site's tectonic spreading rate to the thickness of serpentinized rocks that might be found there.

Serpentinized rocks -- so called because they often have a scaly, greenish-brown-patterned surface that resembles snakeskin -- are rocks that have been chemically altered by water as they are lifted up by the spreading tectonic plates in Earth's crust. Molecules of free hydrogen gas are produced as a by-product of the serpentinization process.

"Most scientists previously thought all hydrogen production occurs only at slow-spreading lithosphere, because this is where most serpentinized rocks are found. Although faster-spreading lithosphere contains smaller quantities of this rock, our analysis suggests the amount of H2 produced there might still be large," Worman said.

"Right now, the only way to get H2 -- to use in fuel cells, for example -- is through secondary processes," Worman explained. "You start with water, add energy to split the oxygen and hydrogen molecules apart, and get H2. You can then burn the H2, but you had to use energy to get energy, so it's not very efficient."

Mining free hydrogen gas as a primary fuel source could change that, but first scientists need to understand where the gas goes after it's produced. "Maybe microbes are eating it, or maybe it's accumulating in reservoirs under the seafloor. We still don't know," Worman said. "Of course, such accumulations would have to be quite significant to make hydrogen gas produced by serpentinization a viable fuel source."

If further research confirms the model's accuracy, it could also open new avenues for exploring the origin of life on Earth, and for understanding the role hydrogen gas might play in supporting life in a wide range of extreme environments, from the sunless deep-sea floor to distant planets.

Worman and Pratson conducted the study with Jeffrey Karson, professor of earth sciences at Syracuse University, and Emily Klein, professor of earth sciences at Duke.

"Global Rate and Distribution of H2 Gas Produced by Serpentinization within Oceanic Lithosphere," Stacey L. Worman, Lincoln F. Pratson, Jeffrey Karson, Emily Klein. Geophysical Research Letters, July 14, 2016. DOI: 10.1002/2016GL069066

http://www.eurekalert.org/pub_releases/2016-07/bu-atf071816.php

Asteroid that formed moon's Imbrium Basin may have been protoplanet-sized

Man in the Moon's right eye made by asteroid the size of New Jersey

PROVIDENCE, R.I. [Brown University] -- Around 3.8 billion years ago, an asteroid more than 150 miles across, roughly equal to the length of New Jersey, slammed into the Moon and created the Imbrium Basin -- the right eye of the fabled Man in

the Moon. This new size estimate, published in the journal Nature, suggests an Imbrium impactor that was two times larger in diameter and 10 times more massive than previous estimates.

"We show that Imbrium was likely formed by an absolutely enormous object, large enough to be classified as a protoplanet," said Pete Schultz, professor of earth, environmental and planetary sciences at Brown University. "This is the first estimate for the Imbrium impactor's size that is based largely on the geological features we see on the Moon."

Previous estimates, Schultz said, were based solely on computer models and yielded a size estimate of only about 50 miles in diameter.

These new findings help to explain some of the puzzling geological features that surround the Imbrium Basin. The work also suggests -- based on the sizes of other impact basins in the Moon, Mars and Mercury -- that the early solar system was likely well stocked with protoplanet-sized asteroids.

Imbrium sculpture

The Imbrium Basin -- seen from Earth as a dark patch in the northwestern quadrant of the Moon's face -- measures about 750 miles across. The basin is surrounded by grooves and gashes, large enough to be seen with even small telescopes from Earth, created by rocks blasted out of the crater when it was formed. These features, known as the Imbrium Sculpture, radiate out from the center of the basin like spokes on a wheel, but are concentrated on the basin's southeast side. That suggests that the impactor traveled from the northwest, impacting at an oblique angle rather than straight on.

But in addition to features radiating from the basin's center, there is a second set of grooves with a different alignment. These appear to come from a region to the northwest, along the trajectory from which the impactor came.

"This second set of grooves was a real mystery," Schultz said. "No one was quite sure where they came from."

Through hypervelocity impact experiments performed using the Vertical Gun Range at the NASA Ames Research Center, Schultz was able to show that those grooves were likely formed by chunks of the impactor that sheared off on initial contact with the surface. The grooves created by those chunks enabled Schultz to estimate the size of the impactor.

Laboratory impacts

The Vertical Gun Range employs a 14-foot cannon that fires small projectiles at up to 16,000 miles per hour, while impact plates and high-speed cameras record the ballistic dynamics. During his experiments with low-angle impacts, Schultz noticed that impactors tend to start breaking apart when they first make contact with the surface. That point of initial contact is actually behind or "up-range" of the final crater, where the bulk of the impactor digs into the surface. The chunks that break off up-range of the final crater continue to travel at a high rate of speed, scouring and grooving the surface.

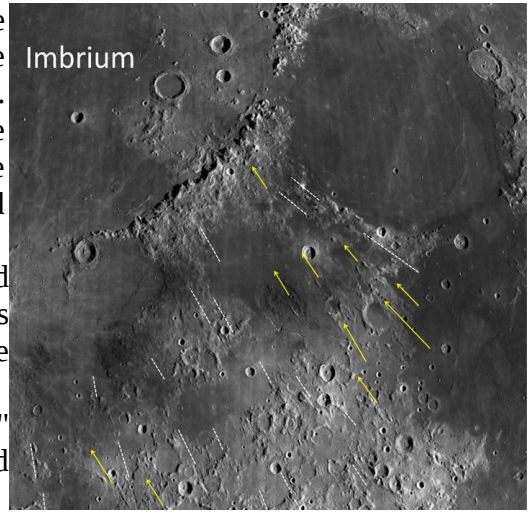
"The key point is that the grooves made by these chunks aren't radial to the crater," Schultz said. "They come from the region of first contact. We see the same thing in our experiments that we see on the Moon -- grooves pointing up-range, rather than the crater."

After seeing these features in the lab, Schultz worked with David Crawford of the Sandia National Laboratories to generate computer models showing that the same kind of physics would also happen at the colossal scales of a lunar impact.

With an understanding of how those grooves were created, Schultz could use them to find the Imbrium impact point. And because the fragments would have broken off from the either side of the impactor, the groove trajectories could be used to estimate the impactor's size.

Those calculations yielded an estimated diameter of 250 kilometers or 150 miles across, large enough for the object to be classified as a protoplanet.

"That's actually a low-end estimate," Schultz said. "It's possible that it could have been as large as 300 kilometers."



Grooves and gashes associated with the Imbrium Basin on the moon have long been puzzling. New research shows how some of these features were formed and uses them to estimate the size of the Imbrium impactor. The study suggests it was big enough to be considered a protoplanet. **NASA/Northeast Planetary Data Center/Brown University**

"Lost giants" and the Late Heavy Bombardment

Schultz and his colleagues used similar methods to estimate the sizes of impactors related to several other basins on the Moon created by oblique impacts. Those estimates -- for the Moscoviense and Orientale basins on the Moon's far side -- yielded impactor sizes of 100 and 110 kilometers across respectively, larger than some previous estimates.

Combining these new estimates with the fact that there are even larger impact basins on the Moon and other planets, Schultz concludes that protoplanet-sized asteroids may have been common in the early solar system. "The large basins we see on the Moon and elsewhere are the record of lost giants," Schultz said.

The research has several other significant implications, he said. The surviving fragments from these impactors would have littered the ancient surface of the Moon, slowly becoming mixed with native soil and rock. That could help explain why samples returned from the Apollo missions had such a high meteoritic content. That is particularly true of Apollo 16, which landed downrange from the Imbrium impact.

Furthermore, Schultz's work suggests fragments from these giants could account for a many of the impacts that occurred during a period called the Late Heavy Bombardment, which occurred from about 3.8 billion years ago to around 4 billion years, when scientists think most of the craters we see on the Moon and Mercury were formed.

The impact models Schultz and Crawford developed suggest that thousands of the chunks that crumbled off of the Imbrium impactor and others would have broken and kept going, escaping the Moon's gravity and flying off into space. On subsequent orbits around the sun, those chunks would have crossed the Earth and Moon orbits again and again, creating a strong possibility of subsequent impacts. Some of those objects would have been a kilometer or two across, large enough to create 20-kilometer craters.

"These chips off the old blocks could have contributed significantly to the impact record we see on the Moon and other terrestrial planets," Schultz said.

Schultz also said he continues to be amazed by what we can learn just by looking up at the Moon. "The Moon still holds clues that can affect our interpretation of the entire solar system," he said. "Its scarred face can tell us quite a lot about what was happening in our neighborhood 3.8 billion years ago."

The research was funded in part by a grant from NASA (NNX13AB75G).

http://www.eurekalert.org/pub_releases/2016-07/ru-tg072016.php

Titanium + gold = new gold standard for artificial joints

Rice lab discovers titanium-gold alloy that is 4 times harder than most steels

Titanium is the leading material for artificial knee and hip joints because it's strong, wear-resistant and nontoxic, but an unexpected discovery by Rice University physicists shows that the gold standard for artificial joints can be improved with the addition of some actual gold.

"It is about 3-4 times harder than most steels," said Emilia Morosan, the lead scientist on a new study in Science Advances that describes the properties of a 3-to-1 mixture of titanium and gold with a specific atomic structure that imparts hardness. "It's four times harder than pure titanium, which is what's currently being used in most dental implants and replacement joints."

Morosan, a physicist who specializes in the design and synthesis of compounds with exotic electronic and magnetic properties, said the new study is "a first for me in a number of ways. This compound is not difficult to make, and it's not a new material."

In fact, the atomic structure of the material -- its atoms are tightly packed in a "cubic" crystalline structure that's often associated with hardness -- was previously known. It's not even clear that Morosan and former graduate student Eteri Svanidze, the study's lead co-author, were the first to make a pure sample of the ultrahard "beta" form of the compound. But due to a couple of lucky breaks, they and their co-authors are the first to document the material's remarkable properties.

"This began from my core research," said Morosan, professor of physics and astronomy, of chemistry and of materials science and nanoengineering at Rice. "We published a study not long ago on titanium-gold, a 1-to-1 ratio compound that was a magnetic material made from nonmagnetic elements. One of the things that we do when we make a new compound is try to grind it into powder for X-ray purposes. This helps with identifying the composition, the purity, the crystal structure and other structural properties.

"When we tried to grind up titanium-gold, we couldn't," she recalled. "I even bought a diamond (coated) mortar and pestle, and we still couldn't grind it up."

Morosan and Svanidze decided to do follow-up tests to determine exactly how hard the compound was, and while they were at it, they also decided to measure the hardness of the other compositions of titanium and gold that they had used as comparisons in the original study. One of the extra compounds was a mixture of three parts titanium and one part gold that had been prepared at high temperature.

What the team didn't know at the time was that making titanium-3-gold at relatively high temperature produces an almost pure crystalline form of the beta version of the alloy -- the crystal structure that's four times harder than titanium. At lower temperatures, the atoms tend to arrange in another cubic structure -- the alpha form of titanium-3-gold. The alpha structure is about as hard as regular titanium. It appears that labs that had previously measured the hardness of titanium-3-gold had measured samples that largely consisted of the alpha arrangement of atoms.

The team measured the hardness of the beta form of the crystal in conjunction with colleagues at Texas A&M University's Turbomachinery Laboratory and at the National High Magnetic Field Laboratory at Florida State University, Morosan and Svanidze also performed other comparisons with titanium. For biomedical implants, for example, two key measures are biocompatibility and wear resistance. Because titanium and gold by themselves are among the most biocompatible metals and are often used in medical implants, the team believed titanium-3-gold would be comparable. In fact, tests by colleagues at the

University of Texas MD Anderson Cancer Center in Houston determined that the new alloy was even more biocompatible than pure titanium. The story proved much the same for wear resistance: Titanium-3-gold also outperformed pure titanium.

Morosan said she has no plans to become a materials scientist or dramatically alter her lab's focus, but she said her group is planning to conduct follow-up tests to further investigate the crystal structure of beta titanium-3-gold and to see if chemical dopants might improve its hardness even further.

Additional co-authors include Pulickel Ajayan, Sruthi Radhakrishnan and Chandra Sekhar Tiwary, all of Rice; Tiglet Besara, Yan Xin, Ke Han and Theo Siegrist, all of Florida State; Fevzi Ozaydin and Hong Liang, both of Texas A&M; and Sendurai Mani of MD Anderson. The research was supported by the National Science Foundation, the Department of Energy, Texas A&M's Turbomachinery Laboratory and the Florida State University Research Foundation.

http://wb.md/2arc9MW

Abdominal Pains: A Simple Exam Can Save Unnecessary Costs to Patients and Payers Alike

A Simple Examination for Abdominal Pains

David A. Johnson, MD|July 20, 2016

Hello. I'm Dr David Johnson, professor of medicine and chief of gastroenterology at Eastern Virginia Medical School in Norfolk, Virginia. Welcome back to another installment of GI Common Concerns -- Computer Consult .

Today I want to talk to you about unexplained abdominal pain.

Gastroenterologists and other clinicians often see abdominal pain complaints referred to us for sundry reasons. A lot of times we don't find the explanation that necessarily gives the diagnosis, and we kind of push the can down the road and refer it to somebody else, or the patient is left in the lurch without an explanation.

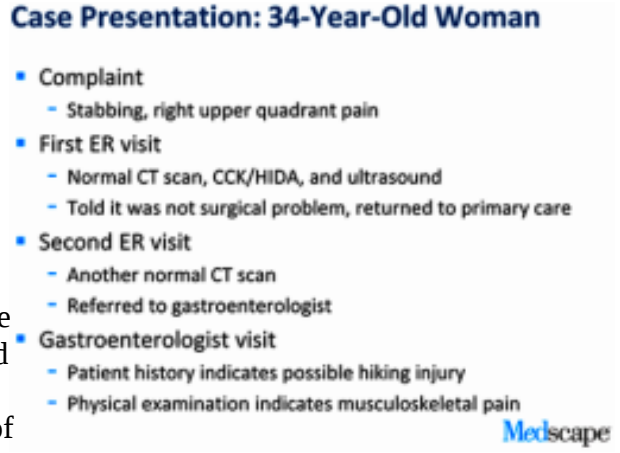
I want to leave you with a pearl of a physical technique that's all about back to basics, beginning with taking a good history and then confirming that with a physical finding.

Case Presentation: A Painful Vacation

Let me begin with a case scenario.

I recently saw a 34-year-old woman who had been in the emergency room (ER) twice in the course of the past month. She noted an onset of right upper quadrant pain that was fairly stabbing in nature, which had occurred during a trip to Europe. She was backpacking with her husband and child and was frequently struck by this pain. It was stabbing, somewhat positional, ameliorated with recumbency, never aggravated by meals, and became persistent and programmatically worsened over the course of the several days of the trip.

When she got back to the United States, she had such severe pain one night that she went to the ER. While there, she probably didn't get a physical exam, but she got a CT scan that showed nothing. They then referred her to a surgeon for possible biliary colic. The surgeon ordered an ultrasound and a CCK/HIDA scan, which was normal. The patient was told that it's not a surgical problem and that she could go back to her primary care doctor, which she did. There was really nothing else to be said in that intervention.



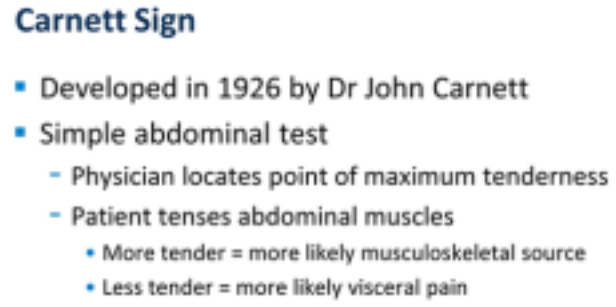
She then had another episode of abdominal pain, so she went back to the ER. Guess what she received yet again? Yes, another CT scan. The ER physician also suggested that she see a gastroenterologist, which is how we ended up seeing this young lady.

We took the history, during which she recalled that she had had this episode when she was backpacking, swinging the backpack, and also carrying her child on her right hip. Therefore, she really had a lot of unusual positional requirements over the course of that week when the onset of the pain started.

With that in mind, I started to think about what could potentially be causing a nongastrointestinal type of pain. When I examined her, I found that she was point tender in the right upper quadrant. Through a positional change and flexing her neck forward, the pain became exquisitely tender. I told her that this is all musculoskeletal pain.

The Carnett Sign: A 90-Year-Old Tool

Why was I able to tell her that? It goes back to something called the Carnett sign, which was first described by Dr John Carnett in 1926.



It basically involves a physical finding where, on an abdominal exam, you find the point of maximum tenderness. The way that Dr Carnett initially described it was that he would place his hands on that

point of maximum tenderness and have his patients cross their arms and then do a sit-up. If that pain got worse, that was much more compatible with a musculoskeletal rather than an intra-abdominal source.

With the increasing habitus of the patients that we see these days, it's a little hard for me to get them to do sit-ups. What I do instead is locate the point of maximum tenderness, have them flex their neck up, and then try and lift their shoulders off the table. Basically, that does the same thing, which is stretching the rectus sheath and the lateral obliques so that the abdominal muscles are tensed up. If it's more tender, it tells me that that is much more likely compatible with a musculoskeletal source, which, again, is what Dr Carnett's sign had inferred back in 1926.

How does this work?

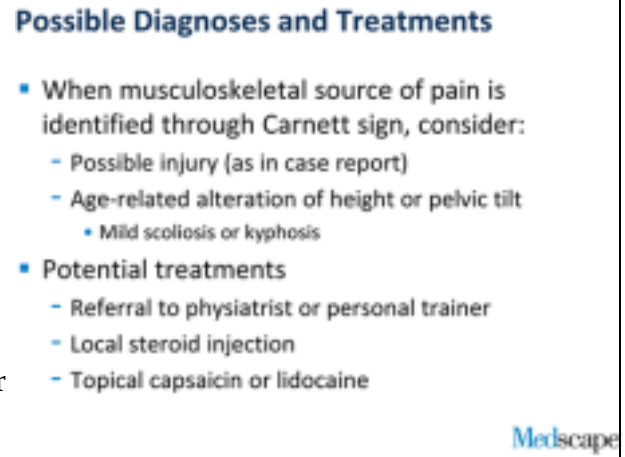
The way I explain it to my patients is that if you're pushing down in the abdomen and they experience an intra-abdominal pain, you have to push through to those muscles to get to the intra-abdominal cavity. When they tighten up like that, they're more or less "putting a roof on the house," as I say. You elevate the abdominal muscles up and pull the examining hand away from the peritoneal cavity into the muscle. If the muscle is already tender and stretched, it becomes even more tender.

It's a great physical finding and something that you can do very easily. Compared with a CT scan, it's something that doesn't cost $1000 and has no radiation exposure, which was twice incurred by my patient. CT scans don't always beat history and physical examination.

Locating a Proper Diagnosis

When I make that diagnosis, though, I naturally have to then explain to the patient why they have this pain.

In our patient's history, it was pretty clear that she had done several things over the course of the week during her trip that had naturally torqued her abdominal musculature.



However, what I see in a lot of patients is a compression with age where they lose vertical height. As the vertical height goes down, their abdominal muscles get a little bit out of sort. Often what I'll do during an examination is have them turn around and look at their pelvis. This allows me to inspect their pelvic balance, the pelvic brim. Sometimes what you'll see is a slight tilt, a leg-length discrepancy that occurs for whatever reason. They may have mild scoliosis or kyphosis, and this alteration of height or pelvic tilt will have changed their abdominal muscle bearing.

They may need a referral to a physiatrist for leg-length discrepancy or heel lift, for exercises to allow for relaxing, stretching, and core strengthening.

What you can't do is simply turn these patients away and say it's not gastrointestinal pain, which is what the surgeon who referred the patient to me had done. We can't leave these patients in the lurch. In these patients, we need to remember to use the Carnett sign, which is a great physical finding.

When you find musculoskeletal pain, look for the possible etiology so that you can suggest potential next steps to the patient.

A lot of these patients respond to some local heat. If you can understand the causality, you can then refer them to a personal trainer or a physiatrist.

There may also be injections that can be offered. There are some data indicating that local steroid injection or the topical application of capsaicin or lidocaine may be of some help. But again, this starts with a relatively simple physical finding.

Take a good history and do a good physical exam, which doesn't necessarily need to include a CT scan. It's about a back-to-basics approach that we were taught a long time ago in our initial training: Examine the patient, talk to them, and listen to them. Remember the Carnett sign the next time you have a patient with abdominal pain, which I hope will be very helpful to you. I guarantee you that it will be one of those things that you'll put in your quiver and keep there for a long time when you're evaluating abdominal pain complaints.

I am Dr David Johnson. Thanks again for listening, and see you next time.

Suggested Reading

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Vitamin D supplements 'advised for everyone'

Everyone should consider taking vitamin D supplements in autumn and winter, public health advice for the UK recommends.

By Smitha Mundasad Health reporter

It comes as a government-commissioned report sets the recommended levels at 10 micrograms of the vitamin a day. But officials are concerned this may not be achievable through diet alone, particularly when sunlight, which helps in vitamin

D production, is scarce. Low vitamin D levels can lead to brittle bones and rickets in children.

Top-ups

Limited amounts of the vitamin are found in foods such as oily fish, eggs and fortified cereals. But, for most people, the bulk of their vitamin D is made from the action of sunlight on their skin. And official estimates suggest one in five adults and one in six children in England may have low levels.

Now, an extensive review of the evidence, carried out by the Scientific Advisory Committee on Nutrition (SACN), suggests everyone over the age of one needs to consume 10 micrograms of vitamin D each day in order to protect bone and muscle health.And public health officials say, in winter months, people should consider getting this from 10 microgram supplements, if their diet is unlikely to provide it.

Why is vitamin D important?

Its main function is to regulate the amount of calcium and phosphate in the body, which are vital for the growth and maintenance of healthy bones, teeth and muscles. In extreme cases, low levels can lead to rickets in children - where the bones become soft and weak and misshapen as they continue to grow.

In adults, vitamin D deficiency can lead to osteomalacia - causing severe bone pain and muscle aches.

But there is a balance - too much vitamin D can lead to high levels of calcium in the blood which can cause heart and kidney problems. Anyone with a chronic condition or taking medication should seek advice from their doctor.

Meanwhile, children aged up to four should take supplements each day all year round, as should babies under one year - unless they already consume this in infant formula.

Prof Peter Selby, at the University of Manchester, welcomed the advice.

He said: "In particular, it dispels any doubt of the place of vitamin D in the maintenance of bone health and should ensure that all people will now be encouraged to receive vitamin D to reduce their risk of bone disease and fracture."

Previous advice that recommended top-up daily supplements for a few at-risk groups, including pregnant or breastfeeding women, and over-65s, still stands.

For example, people whose skin has little exposure to the sun, or who always cover their skin to go outside, should take the supplements throughout the year.

Black and Asian people should also consider the supplements all year round.

Dr Louis Levy, head of nutrition science at Public Health England, told BBC Radio 4's Today programme: "This is a change in advice, previously we have said that babies from six months to five years should have a supplement and only those people at risk of deficiency should take a supplement.

"Previously we felt that everybody would get enough from the sunlight. "This is new advice based on evidence looked at over the last five years."

He said those who apply sunscreen in the way the manufacturer recommended would not make enough vitamin D. "When you go out, you do need to have short bursts without sunscreen and make sure that you don't get sunburnt," he said.

NHS England says vitamin D supplements are available free of charge for low-income families, through the Healthy Start scheme. Separately, health officials in Scotland and Northern Ireland say they have updated their guidance in line with the new recommendations, but only for people aged over six months. They are currently considering whether to extend the advice to babies from birth.

SACN reviewed a growing body of evidence linking vitamin D to bone and muscle health. It also looked at studies suggesting Vitamin D levels might have an impact on cancers, cardiovascular disease and multiple sclerosis but found there was insufficient evidence to draw any firm conclusions.

http://bit.ly/2apMjpG

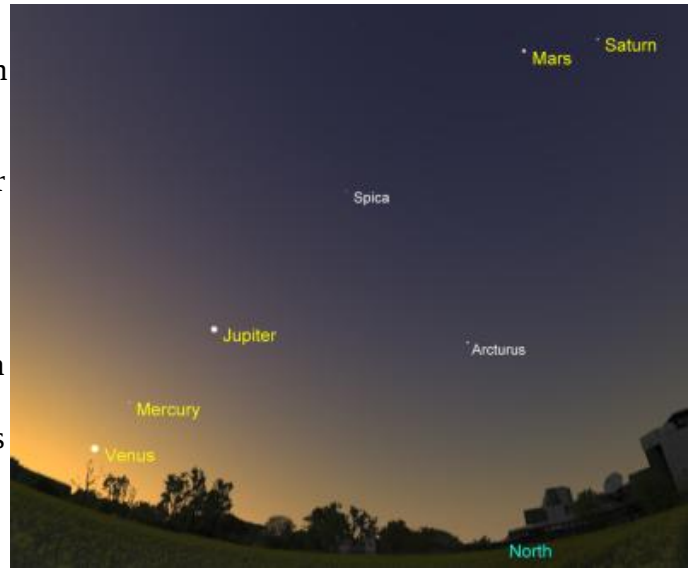
Your guide to see five planets after sunset

After sundown from late July through August, there's the chance to see five planets at once in the evening sky.

Tanya Hill

Mercury, Venus, Mars, Jupiter and Saturn are the only planets in our solar system bright enough to be seen with the naked eye. This August, they can be found together forming a line that stretches from low in the north-west to high overhead in the north.

The planets are visible from across Australia for an hour or so after local sunset. Venus, Jupiter, Mars and Saturn are bright enough to be seen during twilight when the rays of the setting sun still brighten the sky. Mercury, the faintest of the planets, is the one that's most easily drowned out and it's always a little tricky to spot.



All five planets can be seen across the evening sky during August. **Museum Victoria/Stellarium, CC BY-SA**

But don't leave it too long after sunset before looking for the planets. After about an hour or so, Venus and Mercury will disappear below the horizon. The earlier you see them, the higher they'll be.

Furthermore, throughout August Venus is drifting up to meet Mercury, so the view will get better as the month goes by. Of course, it's also important to have a clear, uninterrupted view of the north-west so you can catch the planets even as they approach the horizon.

Five ancient planets

These five bright planets have been observed since ancient times and we are fortunate today that even a modest backyard telescope can deliver amazing views of these unique worlds.

Saturn and its rings, Jupiter and its spot, Mars' reddish surface, the phases of Venus and the craters on Mercury – each planet has its own special features to explore and appreciate.

The line they form in the sky marks the ecliptic, the path that the sun appears to follow against the background stars. The planets are always huddled around the ecliptic because they orbit the sun in roughly the same plane as Earth.

Five planet season

Back in January, the five planets were visible in the morning sky for the first time in more than a decade. Now we've entered a kind of five planet season.

Think of the solar system as an athletics track, with each of the planets zipping around on their orbits. The closer they are to the sun the faster they travel, so Mercury completes an orbit in 88 days (or around three months), whereas Saturn takes a leisurely 29 years. For the last decade, Jupiter and Saturn have been on opposite sides of the race track. But now, we've entered a period where Jupiter and Saturn have caught up to each other.

As a result, the next few years will bring about a number of chances to spot the five planets. It'll occur whenever all five planets plus Earth briefly converge on the same side of the sun, as shown in the video below. You can also check it out yourself using the Tour the Solar System interactive by NOVA.

It's only ever possible to see the five planets together either just before dawn or just after sunset. Mars, Jupiter and Saturn can be seen at any time of the night, but Mercury and Venus being the inner planets, plot another course.

They never wander too far from the sun and are only visible low in the west after sunset or low in the east before sunrise, depending on which side of the sun they happen to be.

Check out the moon too

During the early part of August, the moon will wander past each of the planets. On August 3, a beautiful faint crescent moon will sit just above Venus, low to the north-west horizon. The following nights the crescent moon will partner with Mercury and then Jupiter.

By August 9, the moon will be near the star Spica, the brightest star in the constellation of Virgo. The moon's phase will have changed as well and on August 10, the First Quarter moon will sit right in the middle of the five planets line-up. Keep following the moon and by August 12, a bright gibbous moon will sit just below Mars and Saturn.

Dance of the planets

There's more too. Take a note of how the positions of the planets vary throughout the month. Mars and Saturn have been together in the constellation of Scorpius since the beginning of the year and they'll remain so throughout August.

On August 26, Mars will sit just to the right of Antares, a red supergiant star, whose name means 'rival of Mars'.

Towards the horizon, Jupiter will be approaching Venus and Mercury. As the two brightest planets, Venus and Jupiter always make a stunning pair whenever they meet together in the sky. Jupiter will cross paths with Venus on August 27 and 28.

Jupiter meets up with Mercury and Venus low to the north-west horizon on August 26. Museum Victoria/stellarium

So for the next month, when the sun goes down, look to the skies to collect the full set of visible planets.

http://www.eurekalert.org/pub_releases/2016-07/sfts-nrc071816.php

New review concludes that evidence for alcohol causing cancer is strong

Evidence supports a causal association between alcohol consumption and cancers at seven sites in the body

A new review of epidemiological evidence supports a causal association between alcohol consumption and cancers at seven sites in the body: oropharynx, larynx, oesophagus, liver, colon, rectum and female breast. This is a stronger statement than the long-recognised association between alcohol and cancer. An association means there is a relationship of some kind between the two variables. A causal association means there is evidence that alcohol consumption directly causes cancer.

The causal link was supported by evidence for a dose-response relationship, at least partial reversal of risk when alcohol consumption is reduced, statistical adjustment for other factors that might explain the association, and specificity of the association with some cancers and not others.

The epidemiological evidence for these conclusions comes from comprehensive reviews undertaken in the last 10 years by the World Cancer Research Fund and

American Institute for Cancer Research, the International Agency for Research on Cancer, the Global Burden of Disease Alcohol Group, and the most recent comprehensive meta-analysis undertaken by Bagnardi and colleagues*, building on meta-analyses of the effect of alcohol on single cancers.

The review cites evidence that alcohol caused approximately half a million deaths from cancer in 2012, 5.8% of cancer deaths worldwide. The highest risks are associated with the heaviest drinking, but a considerable burden is experienced by drinkers with low to moderate consumption.

The review also finds the current evidence that moderate drinking provides protection against cardiovascular disease is not strong.

The review is published online today by the scientific journal Addiction.

**Bagnardi V, Rota M, Botteri E, Tramacere I, Islami F, Fedirko V, et al. Alcohol consumption and site-specific cancer risk: a comprehensive dose-response meta-analysis. Br J Cancer. 2015;112(3):580-93.*

For editors: Connor J (2016) Alcohol consumption as a cause of cancer. Addiction 111: doi: 10.1111/add.13477

This paper is free to download for one month after publication from the Wiley Online Library: http://onlinelibrary.wiley.com/journal/10.1111/%28ISSN%291360-0443/earlyview or by contacting Jean O'Reilly, Editorial Manager, Addiction, jean@addictionjournal.org, tel +44 (0)20 7848 0853.

http://www.eurekalert.org/pub_releases/2016-07/uota-sbh071516.php

Some bacteria have lived in the human gut since before we were human

Suggests evolution plays a larger role than previously known in people's intestinal-microbe makeup

AUSTIN, Texas - Some of the bacteria in our guts were passed down over millions of years, since before we were human, suggesting that evolution plays a larger role than previously known in people's intestinal-microbe makeup, according to a new study in the journal Science.

The bacteria that the researchers studied guide the early development of our intestines, train our immune systems to fight pathogens and may even affect our moods and behavior.

The research, which included an international team of scientists, was led by Howard Ochman, a professor of integrative biology at The University of Texas at Austin, and Andrew Moeller, a former graduate student at UT Austin, currently a postdoctoral researcher at the University of California, Berkeley.

"It's surprising that our gut microbes, which we could get from many sources in the environment, have actually been co-evolving inside us for such a long time," says Ochman, who noted that the microbes were passed down over hundreds of thousands of host generations.

As humans and the African great apes evolved into distinct species from a common ancestor, bacteria present in their common ancestor also evolved into distinct strains associated with each host, the scientists found.

Adding further weight to the analysis, the scientists found genetic evidence that the bacteria split into distinct strains at about the same times as their hosts were splitting into distinct species. One such bacterial split happened about 15.6 million years ago as the gorilla lineage diverged from the other hominids. The other bacterial split happened about 5.3 million years ago as the human lineage separated from the lineage leading to chimps and bonobos.

"We've known for a long time that humans and our closest relatives, the great apes, harbor these bacteria in our guts," says Moeller, "and the biggest question we wanted to answer is, where did these bacteria come from? Did we get them from our environment or from our evolutionary history? And how long have they persisted in host lineages?"

Before this study, scientists disagreed about whether strains of gut microbes have continued within individual hominid lineages over timescales long enough to lead to cospeciation, a process by which two species evolve in parallel. The persistence of some microbes might have been threatened by changes in diet, geography or the use of antibiotics.

The researchers studied fecal samples collected from wild African great apes--chimpanzees, bonobos and gorillas--and also from people living in Connecticut. Fossil and genetic evidence have established that all four species, known as hominids, evolved from a common ancestor that lived more than 10 million years ago.

Fecal samples contain microbes shed from a host animal's gut. The scientists used gene sequencing to analyze all the different versions of one specific bacterial gene present in each fecal sample. From these data, they reconstructed evolutionary trees for three groups of gut bacteria that make up over 20 percent of the human gut microbiome.

For two of those groups, Bacteriodaceae and Bifidobacteriaceae, the bacterial evolutionary trees closely resemble the hominid evolutionary tree. There are some subtle differences, however, such as an individual bacterial strain disappearing from one of the four host species over time.

The third bacterial family tree, for a group known as Lachnospiraceae, was more complicated. There were apparently at least four times when these bacteria were transferred between different host species. The researchers speculate that because these bacteria form spores and can thus survive outside their hosts for long periods, they were easily passed between species.

The researchers are not certain how these three ancient strains of microbes were passed down from one host generation to the next for millions of years. Prior research shows that we receive our first inoculation of gut microbes from our mothers as we pass through the birth canal. Throughout life, we also receive microbes from social interactions. The researchers suspect both modes of transmission are responsible for maintaining our multigenerational relationship with our bacterial BFFs.

"What's most exciting to me is the possibility that this codiversification between bacteria and hosts could extend much further back in time," says Moeller. "Maybe we can trace our gut microbes back to our common ancestors with all mammals, all reptiles, all amphibians, maybe even all vertebrates. If that's true, it's amazing."

In addition to Ochman and Moeller, the study's co-authors are: Alejandro Caro-Quintero at Corpoicá C.I Tibaitata (Colombia); Deus Mjungu at the Gombe Stream Research Center (Tanzania); Alexander Georgiev at Northwestern University and Harvard University; Elizabeth Lonsdorf at Franklin & Marshall College; Martin Muller at the University of New Mexico; Anne Pusey at Duke University; Martine Peeters at the University of Montpellier (France); and Beatrice Hahn at the University of Pennsylvania.

This work was supported by funding from the National Institutes of Health, the Agence Nationale de Recherche sur le Sida, the Jane Goodall Institute, the Arthur L. Greene Fund and Harvard University.

http://www.eurekalert.org/pub_releases/2016-07/tuom-uom071816.php

University of Montana research unveils new player in lichen symbiosis

Dating back nearly 150 years, a classic example of symbiosis has been the lichen: a mutually helpful relationship between an alga and a fungus.

Now, that well-known dualistic relationship is being challenged. Researchers at the University of Montana, working together with colleagues from Austria, Sweden and Purdue University, have found that some of the world's most common lichen species actually are composed of three partners -- not the widely recognized two.

Their work, led by UM postdoctoral researcher Toby Spribille, will be published as the cover article in the July 29th issue of the journal Science. By using recent advances in genomic sequencing, the research team showed that many lichens contain not only the expected alga (the photosynthesizing partner) and fungus, but also a previously unknown second fungus that had never before been detected.

"This is a pretty fundamental shake-up of what we thought we knew about the lichen symbiosis," Spribille said. "It forces a reassessment of basic assumptions about how lichens are formed and who does what in the symbiosis."

This discovery came about when Spribille, working as part of UM microbiologist John McCutcheon's team, set out to answer why one of two closely related lichen species, common in western Montana, contains substances toxic to mammals while the other does not.

Previous DNA studies concluded that the toxic and nontoxic forms of the known fungal and algal partners of these lichens were identical, leaving unsolved the mystery of how one lichen acquires its toxic properties while the other does not. In fact, a longstanding riddle in lichen research has been that even in cases where the two known symbiotic partners are exactly the same, they sometimes combine to form lichens that differ wildly in appearance and in chemistry.

Spribille, who has studied the biology and taxonomy of lichens for 15 years, teamed up with McCutcheon, whose lab uses advanced genomic and microscopic tools to study insect symbioses, to see if they together could solve the mystery.

"When it comes to the study of lichens, he's one of the world's best -- a really high-class scientist," McCutcheon said. "What my lab could offer was experience with genomics on difficult samples, and -- because we traditionally work on insect systems -- a different perspective on symbiosis."

Spribille began by performing deep sequencing of ribonucleic acid, or RNA, from lichens. He ground up whole lichens - both the toxic and nontoxic samples -- and compared their RNA, whose job is to act as a messenger carrying instructions from DNA. To his surprise, he found that each lichen contained not one but two fungal species. What is more, he found that the toxic lichens contained far more of the extra fungus, which the team identified as a previously unknown form of yeast.

The researchers next began to suspect that this result was not an isolated phenomenon.

They began to check other lichens and eventually sampled material from all over the world. It turns out, the second fungus was found in common lichens worldwide -- from Antarctica and Japan to South America and the highlands of Ethiopia.

"It's everywhere," McCutcheon said. "This thing has basically been hidden in plain sight for more than 100 years. People were probably looking right at it, and they thought they knew what they were seeing, but they were actually seeing something else."

Now that the research team understands that the new fungus is globally distributed and seems to be an integral part of the symbiosis, they will set out to understand what it really does.

"The word symbiosis in part comes from the study of lichens," McCutcheon said. "The textbook definition of lichen has always been restricted to one fungus and one fungus only. Our work shows that this definition doesn't seem to be correct."

The paper is available online at http://science.sciencemag.org/lookup/doi/10.1126/science.aaf8287.

http://www.eurekalert.org/pub_releases/2016-07/p-nn-071916.php

Neural networks -- why larger brains are more susceptible to mental illnesses

Understanding neural networks in the mammalian brain -- a universal framework might explain why larger brains are more susceptible to mental illnesses

In humans and other mammals, the cerebral cortex is responsible for sensory, motor, and cognitive functions. Understanding the organization of the neuronal networks in the cortex should provide insights into the computations that they carry out. A study publishing on July 21st in open access journal PLOS Biology shows that the global architecture of the cortical networks in primates (with large brains) and rodents (with small brains) is organized by common principles. Despite the overall network invariances, primate brains have much weaker long-distance connections, which could explain why large brains are more susceptible to certain mental illnesses such as schizophrenia and Alzheimer disease.

In earlier work, Zoltán Toroczkai, from the University of Notre-Dame, USA, Mária Ercsey-Ravasz, from Babes-Bolyai University, Romania and Henry Kennedy, from the University Lyon, France, and colleagues combined tracing studies in macaques, which visualize connections in the brain, with network theory to show that the cortical network structure in this primate is governed by the so-called exponential distance rule (EDR).

The EDR describes a consistent relationship between distances and connection strength. Consistent with the tracing results, the EDR predicts that there are many fewer long-range axons (nerve fibers that function as transmission lines of the nervous system) than short ones, and this can be quantified by a mathematical equation. At the level of cortical areas (such as visual cortex or auditory cortex) examined by the tracing studies, this means the closer two areas are to each other, the more connections exist between them.

In this study, the researchers compare the features of the cortical networks in the macaque - a mammal with a large cortex - with those in the mouse, with its much smaller cortex. They used detailed tracing data to quantify connections between functional areas, and those formed the basis for the analysis. Despite the substantial differences in the cortex size between the species and other apparent differences in cortex organization, they found that the fundamental statistical features of all networks followed the EDR.

Based on these results, the researchers hypothesize that the EDR describes an effective design principle that remains constant during the evolution of mammalian brains of different sizes. They present mathematical arguments that support the universal applicability of the EDR as a governing principle of cortical connectivity, as well as further experimental support from high-resolution tracer experiments in small brain areas from macaque, mouse, and mouse lemur (a primate with a very small brain).

Their results, the researchers conclude, "suggest that the EDR plays a key role across the mammalian order to optimize the layout of the inter-areal cortical network allowing larger-brained animals to maintain communication efficiencies combined with increased neuron numbers".

As the EDR predicts and the tracing data here confirm, neuronal connections weaken exponentially with distance. Assuming the EDR can be applied to all mammalian brains, this suggests that long-distance connections could be quite weak in the human cortex, which is approximately five times larger than that of the macaque. If true, the researchers say, one could speculate that the low weight of human long-range connections may contribute to an increased susceptibility to disconnection syndromes, such as have been proposed for Alzheimer disease and schizophrenia".

please use this URL to provide access to the freely available article in PLOS Biology: http://dx.doi.org/10.1371/journal.pbio.1002512

Citation: Horvát S, Gamanut R, Ercsey-Ravasz M, Magrou L, Gamanut B, Van Essen DC, et al. (2016) Spatial Embedding and Wiring Cost Constrain the Functional Layout of the Cortical Network of Rodents and Primates. PLoS Biol 14(7): e1002512. doi:10.1371/journal.pbio.1002512

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http://www.eurekalert.org/pub_releases/2016-07/uobc-dtm072116.php

Do think-tanks matter? A UBC professor says 'think again'

A UBC professor is suggesting government policy makers and advisors need to do a re-think when it comes to giving validity to reports coming across their desks.

Carey Doberstein, an assistant professor of political science at UBC's Okanagan campus, recently published an experimental study of public sector workers and

determined that many give a written report or study purported to be from a university more credibility than one from a think-tank or advocacy group.

Doberstein conducted a randomized controlled survey experiment involving British Columbia public service staff, asking them to read and assess the credibility of various policy studies. For half of the respondents, the authorship of the studies was randomly switched but the content remained the same. Doberstein then compared the average credibility assessments between the control and experimental groups.

"There were systematic and at times extraordinarily large differences between the credibility assessments provided by these policy professionals on precisely the same policy studies, when the only part I changed was the label of who wrote it," said Doberstein. "Irrespective of the content and just by virtue of presenting it as written by an academic, the report suddenly becomes more credible in the eyes of bureaucrats."

The results surprised him, in part due to the magnitude of the differences observed. For one report, originally authored by the Fraser Institute, the credibility skyrocketed among study participants when they read the same document thinking it came from a university academic.

Another policy study, this time written by a university economist, received very high credibility assessments in the control group. But when authorship was changed to be purportedly written by the Canadian Centre for Policy Alternatives think-tank, its credibility plummeted dramatically.

"Put simply, the think-tank affiliation was a significant drag on the perceived credibility of their report and analysis," said Doberstein. The same was true for reports said to be written by research-based advocacy groups.

Some may interpret this finding positively," he said. "That analysts in government are skeptical of reports or studies that emerge from think tanks or advocacy organizations offering analysis and conclusions that tend to align with the organization's obvious ideological position."

Yet Doberstein says having a report's credibility increase simply by changing the name of the source is concerning as it can appear that policy-relevant research contained within its pages is being ignored by government policy advisors.

"We expect public servants to objectively examine the research evidence available to them," he said. "However, it seems many are taking shortcuts, and in essence giving academics a free pass."

And while this study examined the biases among policymakers in BC, Doberstein notes similar results were observed his subsequent replication experiment involving provincial policy analysts in Ontario, Saskatchewan and Newfoundland. Doberstein's study was recently published in Policy Studies Journal.

http://www.eurekalert.org/pub_releases/2016-07/slu-slu072216.php

Saint Louis University research: Plant compounds give '1-2' punch to colon cancer

Components in turmeric and milk thistle hold promise in treating colon cancer

ST. LOUIS -- The combination of two plant compounds that have medicinal properties - curcumin and silymarin - holds promise in treating colon cancer, according Saint Louis University research published in the June 23 issue of the Journal of Cancer.

Curcumin is the active ingredient in the spice turmeric, which is present in spicy curry dishes, and silymarin is a component of milk thistle, which has been used to treat liver disease.

The researchers and their students studied a line of colon cancer cells in a laboratory model. They found treating the cells initially with curcumin, then with silymarin was more effective in fighting cancer than treating the cells with either phytochemical alone, said Uthayashanker Ezekiel, Ph.D., corresponding author and associate professor of biomedical laboratory science at Saint Louis University.

"The combination of phytochemicals inhibited colon cancer cells from multiplying and spreading. In addition, when the colon cancer cells were pre-exposed to curcumin and then treated with silymarin, the cells underwent a high amount of cell death," Ezekiel said.

"Phytochemicals may offer alternate therapeutic approaches to cancer treatments and avoid toxicity problems and side effects that chemotherapy can cause."

Ezekiel noted the research is a preliminary cell study, with more research ahead before scientists know if the compounds are an effective treatment for people who have colon cancer. He saw promise in using the phytochemicals to help prevent colon cancer, which frequently is caused by lifestyle factors, such as diet.

Scientists next would need to study how the curcumin and silymarin impact the actions of molecules, such as genetic transcription and expression, that cause cells to change, Ezekiel said. Then the compounds would be studied in an animal model, then in humans.

"Concentrations of curcumin and silymarin that are too high could be harmful to people," he said. "We still have much to learn, and for now, it's so much safer to add a little spice to your diet and get your curcumin from foods that contain turmeric, such as curry, rather than taking high doses of the compound."

A team of SLU students and another researcher from SLU's Doisy College of Health Sciences joined Ezekiel as authors of the paper. They are Amanda Montgomery, a former student in nutrition and dietetics; Temitope Adeyeni, a former graduate student in health science and information and biomedical laboratory science; KayKay San, a former student in biomedical

laboratory science; and Rita Heuertz, Ph.D., professor of biomedical laboratory science at SLU.

A DeNardo Education and Research Foundation grant supported the work of the students. The President's Research Fund at SLU provided financial support for Ezekiel.

http://www.eurekalert.org/pub_releases/2016-07/tl-tls072116.php

The Lancet: Simpler, cheaper psychological treatment as effective as cognitive behavioural therapy for treating depression

Behavioral activation treatment could offer cost savings of over 20 percent

A simple and inexpensive psychotherapy or talking therapy known as behavioural activation (BA) is as effective at treating depression in adults as the gold-standard cognitive behavioural therapy (CBT), and can be delivered by non-specialist staff with minimal training at far less cost, according to new research published in The Lancet.

With long waiting lists and limited access to services, many people who need CBT for depression cannot get treatment. The findings from this new study--one of the largest trials of psychological treatment for depression to date--suggest that behavioural activation therapy could be delivered by junior mental health workers, leading to considerable savings for the NHS and other health services.

"Our findings challenge the dominance of CBT as the leading evidence-based psychological therapy for depression", says David Richards, lead author and Professor of Mental Health Services Research at the University of Exeter, UK. "Behavioural activation should be a front-line treatment for depression in the UK and has enormous potential to improve reach and access to psychological therapy worldwide."[1]

Depression is a common mental health disorder affecting around 350 million people worldwide. Untreated depression is expected to cost the global economy US$5.36 trillion between 2011 and 2030. Currently, talking therapies like CBT are delivered by specialist clinicians and therapists who are expensive to train and employ. In many countries, access is limited to people who can afford to pay, or those with health insurance, and waiting lists can be long. For example, in England, 1 in 10 people have been waiting over a year to receive talking therapy, whilst in the USA, only about a quarter of people with depression have received any type of psychological therapy in the last 12 months.

Until now, the UK National Institute for Health and Clinical Excellence (NICE) has said there is insufficient evidence to recommend behavioural activation as a first-line treatment in clinical guidelines, and has called for a large non-inferiority study to establish whether behavioural activation is an effective alternative to CBT for treating depression [2].

The Cost and Outcome of Behavioural Activation versus Cognitive Behavioural Therapy for Depression (COBRA) trial recruited 440 adults with depression from primary care and psychological therapy services in three areas of England. Participants were randomly assigned to receive either a maximum of 20 sessions of behavioural activation treatment delivered by junior mental health workers [3] (221 participants), or CBT delivered by experienced psychological therapists (219). Between 20-30% of participants in each group did not attend the minimum number of 8 therapy sessions or dropped out, a common problem in psychological therapy services, and were not included in the analysis (figure 1).

"Behavioural activation is an 'outside in' treatment that focuses on helping people with depression to change the way they act. The treatment helps people make the link between their behaviour and their mood. Therapists help people to seek out and experience more positive situations in their lives. The treatment also helps people deal with difficult situations and helps them find alternatives to unhelpful habitual behaviours," explains Professor Richards. "In contrast, CBT is an 'inside out' treatment where therapists focus on the way a person thinks. Therapists help people to identify and challenge their thoughts and beliefs about themselves, the world, and their future. CBT helps people to identify and modify negative thoughts and the beliefs that give rise to them."[1]

One year after the start of treatment, behavioural activation was found to be non-inferior (not worse than) CBT, with around two-thirds of participants in both groups reporting at least a 50% reduction in depressive symptoms (tables 2 and 3). Participants in both groups also reported similar numbers of depression free days and anxiety diagnoses, and were equally likely to experience remission. Three participants receiving behavioural activation and eight receiving CBT reported depression-related, but not treatment-related, serious adverse events (self harm and overdose).

Importantly, the average intervention costs were significantly lower for behavioural activation than CBT (£974.81 vs £1235.23 per person); amounting to a 20% financial saving for health care systems (table 4). Additionally, cost-effectiveness analysis showed that behavioural activation is highly cost-effective and affordable compared with CBT, mainly due to the low cost of non-specialist mental health providers.

According to Professor Richards, "Our findings indicate that health services worldwide, both rich and poor, could reduce the need for costly professional training and infrastructure, reduce waiting times, and increase the availability of psychological therapies. However, more work still needs to be done to find ways to effectively treat up to a third of people with depression who do not respond to CBT or behavioural activation."[1]

Writing in a linked Comment, Dr Jonathan Kanter from the University of Washington, Seattle, USA, and Dr Ajeng Puspitasari from Indiana University, Indiana, USA, say, "Now that we have support for BA as a treatment that is clinically effective and cost-effective, we can shift our efforts to focus on what is necessary to produce sustainable large-scale BA implementation across diverse geographical and cultural settings."

They add, "Substantial obstacles to successful international dissemination and implementation of any evidence-based practice exist at multiple provider, patient, organisational, and sociopolitical levels...Common obstacles include lack of training and support for providers, patients' low acceptability of and stigma towards treatment, organisational climates and cultures that are incompatible with evidence-based practices, and an absence of governmental policies and support for mental health service delivery. BA is a promising treatment to consider in international research efforts to overcome these obstacles."

NOTES TO EDITORS:

This study was funded by the National Institute for Health Research.

[1] Quotes direct from authors and cannot be found in text of Article.

[2] National Institute for Health and Care Excellence. Depression in adults: recognition and management. London: National Institute for Health and Care Excellence, 2016 https://www.nice.org.uk/guidance/cg90?unlid=898178356201622021253

[3] The junior mental health workers were graduates without professional mental health qualifications or formal training in psychological therapies who received just 5 days training in behavioural activation and 1 hour of clinical supervision every fortnight.

http://www.medscape.com/viewarticle/866189?src=rss

Should You Keep Doing Pelvic Exams? How to Decide

Discussion of the routine pelvic examination and a clinician's evolving perspective

Andrew M. Kaunitz, MD|July 22, 2016

Hello. I'm Andrew Kaunitz, professor and associate chair of the Department of Obstetrics and Gynecology at the University of Florida College of Medicine in Jacksonville. Today I'd like to discuss the routine pelvic examination and a clinician's evolving perspective.

Major changes in how we screen for cervical cancer have focused attention on the merits of routine pelvic examinations. Two years ago, the American College of Physicians released guidance recommending against routine pelvic examinations except for cervical cancer screening.[1-3] At that time, I produced a video indicating that I planned to continue to perform routine pelvic examinations in most of my patients presenting for well-woman visits.[4]

Now, the US Preventive Services Task Force (USPSTF) has issued its own guidance on this same topic, concluding that "there is no direct evidence on the overall benefits and harms of the pelvic examination as a one-time or periodic screening test. In addition, there is limited evidence regarding the diagnostic accuracy and harms of the routine screening pelvic examination to guide practice in asymptomatic primary care populations."[5] The concluding remarks called for more research in this area, particularly in the current environment of less frequent cervical cancer screening. Of note, the Task Force's painstaking review identified only eight studies assessing the value of pelvic examinations in asymptomatic women. Given the dearth of data addressing this issue, recommendations regarding when to perform pelvic examinations should be individualized and based on clinical experience.

Based on my experience, here are some observations and recommendations. Please keep in mind that these relate only to women presenting for well-woman visits and do not apply to those with such complaints as pain, abnormal bleeding, discharge, or other symptoms suggestive of a gynecologic condition.

Although most women who present to a gynecologist's office for a well-woman visit are prepared to have a pelvic examination, our patients are best served by a clinician who performs such examinations on an individualized basis. When I see symptom-free adolescents, including those who present to initiate short-acting hormonal or implantable contraception, I order urine screening for sexually transmitted infections, but I do not perform a pelvic exam. These young women are so relieved to learn that they will remain fully dressed and avoid the dreaded "pelvic." For symptom-free patients in their 20s, I perform pelvic examinations only when indicated for cervical cancer screening.

When seeing new older adult patients, my preference is to proceed with a pelvic examination. Failing to perform an examination in this setting may miss relevant conditions that my review of history may have failed to detect or that a patient may have been reluctant to disclose or simply have been unaware of. Examples include pelvic prolapse, genital atrophy, lichen sclerosis or other vulvar conditions, and vaginitis. When I see adult return patients, I do not recommend performing a pelvic examination unless a focused history reveals gynecologic symptoms. In menopausal patients who return for well-woman visits, I periodically perform external genital inspections without speculum or bimanual examinations. My rationale is that women benefit from recognizing when changes of genital atrophy are present, even if they do not currently choose to treat this condition.

Pelvic examinations are unpleasant and intrusive. Although some of my adult patients prefer to have a complete pelvic examination with each well-woman visit, I note that more and more are delighted to avoid this time-honored, but not always indicated, ritual. I appreciate you taking the time to view this video and look forward to your thoughts. Thank you. I am Andrew Kaunitz.

Editor's Note: The USPSTF is asking for public input on its draft recommendations through July 25. Click here to leave a comment.

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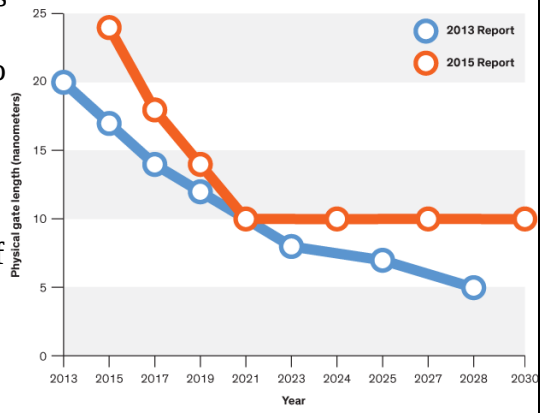
Transistors Will Stop Shrinking in 2021, Moore's Law Roadmap Predicts

The trajectory of transistor feature sizes (the physical gate length of transistors in high-performance logic is shown here) could take a sharp turn in 2021.

By Rachel Courtland

After more than 50 years of miniaturization, the transistor could stop shrinking in just five years. That is the prediction of the 2015 International Technology Roadmap for Semiconductors, which was officially released earlier this month. After 2021, the report forecasts, it will no longer be economically desirable for companies to continue to shrink the dimensions of transistors in microprocessors. Instead, chip manufacturers will turn to other means of boosting density, namely turning the transistor from a horizontal to a vertical geometry and building multiple layers of circuitry, one on top of another.



A plot of the physical gate length of transistors, which could stop getting smaller as early as 2021. **Illustration: Erik Vrielink**

For some, this change will likely be interpreted as another death knell for Moore's Law, the repeated doubling of transistor densities that has given us the extraordinarily capable computers we have today. Compounding the drama is the fact that this is the last ITRS roadmap, the end to a more-than-20-year-old coordinated planning effort that began in the United States and was then expanded to include the rest of the world.

Citing waning industry participation and an interest in pursuing other initiatives, the Semiconductor Industry Association—a U.S. trade group that represents the interests of IBM, Intel, and other companies in Washington and a key ITRS sponsor—will do its own work, in collaboration with another industry group, the Semiconductor Research Corporation, to identify research priorities for government- and industry-sponsored programs. Other ITRS participants are expected to continue on with a new roadmapping effort under a new name, which will be conducted as part of an IEEE initiative called Rebooting Computing.

These roadmapping shifts may seem like trivial administrative changes. But "this is a major disruption, or earthquake, in the industry," says analyst Dan Hutcheson, of the firm firm VLSI Research. U.S. semiconductor companies had reason to cooperate and identify common needs in the early 1990's, at the outset of the roadmapping effort that eventually led to the ITRS's creation in 1998. Suppliers had a hard time identifying what the semiconductor companies needed, he says, and it made sense for chip companies to collectively set priorities to make the most of limited R&D funding.

But the difficulty and expense associated with maintaining the leading edge of Moore's Law has since resulted in significant consolidation. By Hutcheson's count, 19 companies were developing and manufacturing logic chips with leading-edge transistors in 2001. Today, there are just four: Intel, TSMC, Samsung, and GlobalFoundries. (Until recently, IBM was also part of that cohort, but its chip fabrication plants were sold to GlobalFoundries.)

These companies have their own roadmaps and can communicate directly to their equipment and materials suppliers, Hutcheson says. What's more, they're fiercely competitive. "They don't want to sit in a room and talk about what their needs are," Hutcheson says. "It's sort of like everything's fun and games when you start off at the beginning of the football season, but by the time you get down to the playoffs it's pretty rough."

"The industry has changed," agrees Paolo Gargini, chair of the ITRS, but he highlights other shifts. Semiconductor companies that no longer make leading-edge chips in house rely on the foundries that make their chips to provide advanced technologies. What's more, he says, chip buyers and designers—companies such as Apple, Google, and Qualcomm—are increasingly dictating the

requirements for future chip generations. “Once upon a time,” Gargini says, “the semiconductor companies decided what the semiconductor features were supposed to be. This is no longer the case.”

This final ITRS report is titled ITRS 2.0. The name reflects the idea that improvements in computing are no longer driven from the bottom-up, by tinier switches and denser or faster memories. Instead, it takes a more top-down approach, focusing on the applications that now drive chip design, such as data centers, the Internet of Things, and mobile gadgets.

The new IEEE roadmap—the International Roadmap for Devices and Systems—will also take this approach, but it will add computer architecture to the mix, allowing for “a comprehensive, end-to-end view of the computing ecosystem, including devices, components, systems, architecture, and software,” according to a recent press release.

Transistor miniaturization was still a part of the long-term forecast as recently as 2014, when the penultimate ITRS report was released. That report predicted that the physical gate length of transistors—an indicator of how far current must travel in the device—and other key logic chip dimensions would continue to shrink until at least 2028. But since then, 3D concepts have gained momentum. The memory industry has already turned to 3D architectures to ease miniaturization pressure and boost the capacity of NAND Flash. Monolithic 3D integration, which would build layers of devices one on top of another, connecting them with a dense forest of wires, has also been an increasingly popular subject of discussion.

The new report embraces these trends, predicting an end to traditional scaling—the shrinking of chip features—by the early 2020’s. But the idea that we’re now facing an end to Moore’s Law “is completely wrong,” Gargini says. “The press has invented multiple ways of defining Moore’s Law but there is only one way: The number of transistors doubles every two years.”

Moore’s Law, he emphasizes, is simply a prediction about how many transistors can fit in a given area of IC—whether it’s done, as it has been for decades, in a single layer or by stacking multiple layers. If a company really wanted to, Gargini says, it could continue to make transistors smaller well into the 2020s, “but it’s more economic to go 3-D. That’s the message we wanted to send.”

There are other changes on the horizon. In the coming years, before 3-D integration is adopted, the ITRS predicts that leading-edge chip companies will move away from the transistor structure used now in high-performance chips: the FinFET. This device has a gate draped around three sides of a horizontal, fin-shaped channel to control the flow of current. According to the roadmap, chipmakers will leave that in favor of a lateral, gate-all-around device that has a horizontal channel like the FinFET but is surrounded by a gate that extends underneath as well. After that, transistors will become vertical, with their channels taking the form of pillars or nanowires standing up on end. The traditional silicon channel will also be replaced by channels made with alternate materials, namely silicon germanium, germanium, and compounds drawn from columns III and V of the periodic table.

These changes will allow companies to pack more transistors in a given area and so adhere to the letter of Moore’s Law. But keeping to the spirit of Moore’s Law—the steady improvement in computing performance—is another matter.

The doubling of transistor densities hasn’t been linked to improvements in computing performance for some time, notes Tom Conte, the 2015 president of the IEEE Computer Society and a co-leader of the IEEE Rebooting Computing Initiative.

For a long time, shrinking transistors meant faster speeds. But in the mid-1990’s, Conte says, the extra metal layers that were added to wire up increasing numbers of transistors were adding significant delays, and engineers redesigned chip microarchitectures to improve performance. A decade later, transistor densities were so high that their heat limited clock speeds. Companies began packing multiple cores on chips to keep things moving.

“We’ve been living in this bubble where the computing industry could rely on the device side to do their job, and so the computer industry and the device industry really had this very nice wall between them,” says Conte. “That wall really started to crumble in 2005, and since that time we’ve been getting more transistors but they’re really not all that much better.”

This crumbling wall was a strong motivation for the IEEE Rebooting Computing Initiative to begin collaborating with the ITRS last year, before the launch of the IRDS. “I like to say we could see the light at the end of the tunnel, and we knew it was an oncoming train,” says Conte.

The initiative held a summit last December that covered a gamut of potential future computing technologies, including new kinds of transistors and memory devices, neuromorphic computing, superconducting circuitry, and processors that use approximate instead of exact answers.

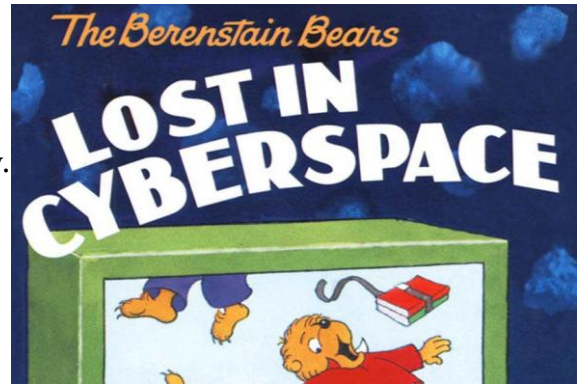
The first international Rebooting Computing conference will be held in October this year; IRDS meetings will coincide with such events, Conte says. The IRDS will still track “Moore’s Law to the bitter end,” Conte explains. But the roadmapping focus has changed: “This isn’t saying this is the end of Moore’s Law,” he says. “It’s stepping back and saying what really matters here—and what really matters here is computing.”

http://www.snopes.com/2016/07/24/the-mandela-effect/

The Mandela Effect

The Mandela Effect is a collective misremembering of a fact or event. Various theories have been proposed to explain what causes it, some more sensible than others.

David Emery



Human memory is a peculiar thing, at once astonishing in its scope and power and dismaying in its fallibility. There's much we don't know about how memory works, but suffice it to say it isn't perfect. Particularly vexing is the phenomenon of false memories, erroneous or unconsciously fabricated recollections of past events that feel so real and true that people who experience them refuse to accept evidence to the contrary.

Psychologists call the phenomenon confabulation. The term is used clinically to refer to memory defects experienced by patients with brain damage, and also to describe everyday phenomena like embellishing the truth when recounting events and inventing facts on the fly to fill in gaps in memory. We've all done these things at one time or another, though we're rarely conscious of it when we do.

When Did Nelson Mandela Die?

One type of memory glitch that has generated a lot of Internet buzz in recent years is called the "Mandela Effect." In simplest terms, the Mandela Effect is an instance of collective misremembering. Examples include lines from famous movies that everyone gets wrong (e.g., Humphrey Bogart's saying "Play it again, Sam" in *Casablanca*) erroneous dates and numbers (apparently many people answer "52" when asked how many states there are in the U.S.), and historical misconceptions (are you among those who recall learning in school that cotton gin inventor Eli Whitney was black?).

The term "Mandela Effect" was coined by self-described "paranormal consultant" Fiona Broome, who has written on her web site that she first became aware of the phenomenon after discovering that she shared a particular false memory — that South African human rights activist and president Nelson Mandela died in prison during the 1980s (he actually died in 2013) — with many other people. Then she began noticing other examples:

One of the most recent and prevalent is the death of Billy Graham. Though some claim that people are confusing that with Mr. Graham's retirement, or perhaps the televised funeral of Mr. Graham's wife, those who clearly remember the events disagree heartily.

Many people recall a painted portrait of Henry VIII holding a turkey leg in one hand. It's among my memories, too. It was a classic painting of Henry VIII, in the Holbein style (at right), but Henry is shown enjoying a hearty meal. I recall something that looked like a turkey leg in one hand. (I thought it was his left hand — on the right side of the canvas — but I may be wrong.)

... Apparently, the "turkey leg" portrait doesn't exist. It never did… not in this timestream, anyway.

Do you recall the fast food chain as McDonald's or MacDonald's?

This is an especially odd alternate memory, since the "golden arches" are such a familiar symbol, most Americans can describe the brand icon, Ronald McDonald, without having to look him up, online, and so on.

History in this reality: The original restaurant was started in 1940 by Dick and "Mac" McDonald. The restaurant was always McDonald's.

"These aren't simple errors in memory," Broome observed (rightly or wrongly). "They exceed the normal range of forgetfulness. Even stranger, *other people seem to have identical memories.*"

The Berenstain/Berenstein Bears

No single example of the Mandela Effect has generated more online buzz than that of the children's book series and animated TV show *The Berenstain Bears*. Quite a few people who grew up with the series, it turns out, remember the title being *The Beren**stein** Bears*, with the name ending in "ein" instead of "ain" (with some even going to go so far as to maintain that the fictional bears' surname was changed along the way to make it "less Jewish"):

A page on Broome's web site cites a number of testimonials:

I too clearly remember it as 'Berenstein' even though I never read the books. Why would anyone change that? Seems irrelevant.

Does anyone remember the Berenstein Bears? I do. Although somewhere along the line the name has changed to the Berenstain Bears. No record of "stein" which is definitely how it was when i was younger. No question about it.

I would like to say that I VERY CLEARLY remember "Berenstain Bears" being Berenstein Bears. I very specifically remember it being pronounced "STEIN" on the show.

Didn't it used to be the Berenstein Bears? Now, suddenly it's the Berenstain bears? Is this some sort of anti-semitic cover-up? Or have those of us who grew up in the 1980's been misinformed, misread, and mispronounced?

Clearly, something of interest is going on here, but what? How to explain the fact that many different people can share the same false memory? This, unfortunately, is where much of the Internet discussion on the topic veers into woo-woo territory.

Parallel Universes and Virtual Realities

One theory based on principles of quantum mechanics holds that people who experience the Mandela Effect may have "slid" between parallel realities (à la the science fiction TV series *Sliders*). After growing up in a universe where it was "Berenstein" Bears, for example, some people one day woke up to find themselves in an alternate universe with "Berenstain" Bears.

Another theory posits that unbeknownst to ourselves, we all exist within something resembling a "holodeck" (a device in the world of the *Star Trek* series that creates a virtual reality experience for recreational purposes). On this model, apparent memory glitches are actually software glitches that cause inconsistencies in our perception of reality. Can you prove this isn't the case?

There's nothing inherently wrong with this sort of speculation — it's fun, in fact — but it yields no practical explanation or testable hypotheses. Nor is it necessary. We don't have to conduct thought experiments about the ultimate nature of reality to explain why we misremember things — or even why we misremember some of the same things the same way.

The Glitch Is in Your Memory, Not the Matrix

A leading psychological theory holds that memory is constructive, not reproductive — i.e., the brain builds memories out of various bits and pieces of information on the fly as opposed to playing them back like a recording. Memories aren't pure. They can be distorted by any number of factors, including bias, association, imagination, and peer pressure.

Getting back to the Berenstain vs. Berenstein quandary, one explanation for the variant spelling is that names ending in "stein" are far more common than those ending in "stain." People's recollections are distorted by prior associations and expectations.

Why do some people remember Nelson Mandela dying 30 years before he did? Perhaps it's simply a case of two isolated bits of knowledge — that Nelson Mandela spent a long time in prison and that he's dead — being pieced together into a false memory in the absence of an actual recollection of the announcement of his death.

Memory is fallible — have we said this enough? The list of psychological and social factors that can disrupt and distort recollection is very long indeed. It's to these we should look first for an explanation of the Mandela Effect.

For more, see "The Seven Sins of Memory" by cognitive scientist Daniel Schachter and the list of common explanations for the Mandela Effect on the *Debunking Mandela Effects* web site.

http://nyti.ms/29UP4BD