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Lifestyle Changes Do a Number on PSA Values

Simple, temporary lifestyle changes may spare men with mildly increased prostate-specific antigen levels from having to endure a prostate biopsy

Neil Osterweil

BARCELONA, Spain — Simple, temporary lifestyle changes may be able to spare men with mildly increased prostate-specific antigen (PSA) levels from having to endure a prostate biopsy, results of a controlled study suggest.

Men who avoided eating spicy foods, drinking alcohol or coffee, and riding a bicycle had a repeat PSA reading approximately 1.5 ng/mL lower than their first reading a median of 8 weeks earlier.

Nearly half of men who adopted the lifestyle changes had a drop in PSA below the minimum threshold for biopsy, reported Alexandre Zlotta, MD, director of Uro-Oncology at Mount Sinai Hospital and professor of surgery (urology) at the University of Toronto, Ontario, Canada.

In an interview with *Medscape Medical News* here at the European Association of Urology (EAU) 2019 Congress, Zlotta said that spicy food has something in common with alcohol, caffeine, and biking.

"Spicy food induces inflammation, and inflammation directly translates into increase in PSA," he said.

"This is just food for thought," he added. "It's by no means definitive, and we're going to embark on a randomized study to test this further, but I think the noise of the signal is strong enough and robust enough to signal that we should at least pay attention."

Zlotta explained that repeat biopsy decisions are not based on a single PSA but that the new intervention might be a good idea before a repeat PSA test.

Although PSA is a fairly sensitive marker for prostatic enlargement, it has poor specificity for prostate cancer. Nonmalignant conditions such as benign prostatic hyperplasia and inflammation can cause PSA elevations that are large enough raise suspicion of prostate cancer and trigger a biopsy, the investigators noted.

Two Thirds of Men in Study Spared Biopsy

To see whether specific lifestyle modifications could affect serum PSA levels in asymptomatic men with PSA levels from 2 to 10 ng/mL and normal digital rectal exam (DRE), the authors conducted a retrospective study of 189 men. The sample included 67 men who adopted lifestyle changes and 122 matched controls who did not. Men with suspicious DRE findings or who were taking 5-alpha reductase inhibitors were excluded from the study.

The lifestyle intervention involved abstinence from spicy foods, alcohol, caffeine, and bike riding for a minimum of 8 weeks before repeat PSA testing.

There were no significant differences at baseline between the intervention and control groups in family history of prostate cancer, age (median 59 vs 60 years), median prostate volume (42.0 vs 46.5 cc), median total PSA values (5.20 vs 5.68 ng/mL), or median free-to-total PSA ratio values (0.16 vs 0.15).

The authors found that those in the lifestyle modification group had significantly lower total PSA on repeat testing a median of 8 weeks from the first test (3.50 vs 5.09 ng/mL; $P < .0001$), as well as a greater decrease from baseline in total PSA (1.38 vs 0.44 ng/mL; $P < .0001$).

In addition, although a higher proportion of men in the intervention group were spared from biopsy (65.7% vs 7.4%), prostate cancer detection rates were actually higher in the lifestyle modification group (13.4% vs 7.4%; $P < .0001$).

In multivariable analysis adjusted for age, prostate volume, and free-to-total PSA ratio, both lifestyle modification ($P = .02$) and PSA at baseline ($P < .0001$) were independent predictors for subsequent PSA declines.

In 31 of the 67 men in the intervention group (46%), PSA levels declined to below the minimum level that would signal a biopsy was warranted, the authors reported.

"This study is interesting in the sense that if there are things that falsely elevate the PSA, you might be able to dig out the underlying mechanism behind that," commented Antti Rannikko, MD, associate professor of urology at the University of Helsinki, Finland, who was not involved in the study.

"It could be infection, inflammation, whatever. But how do you digest this information? How would you take it into your clinical practice? Are you going to start asking patients what kinds of food they eat or ask them to change their diets and come back in 2 months for another test?" he asked.

Rannikko noted, however, that the study results might possibly explain the phenomenon seen in some patients under active surveillance who have no clinical evidence of prostate cancer or inflammation but still exhibit a steady rise in PSA.

"The MRI remains the same, the biopsies remain the same, so you just don't know why the PSA rises," he said.

The study was supported by participating institutions. Zlotta and Rinniko have reported no relevant financial relationships.

European Association of Urology (EAU) 2019 Congress. Presented March 16, 2019. Abstract PT109.

https://bbc.in/2WiktSp

Psyche: Metal world mission targets 'iron volcanoes'

In 2022 NASA will visit an object believed to be mostly metal

By Paul Rincon Science editor, BBC News website, The Woodlands, Texas

Up until now, the worlds we've visited with robotic spacecraft have been composed largely of rock, ice and gas.

But a Nasa mission due to launch in 2022 will visit an object thought to be made largely of metal.

16 Psyche is part of the asteroid belt - the sprawling mass of planetary leftovers that orbits the Sun between Mars and Jupiter.

About the size of the US state of Massachusetts, Psyche is the largest metallic asteroid known to science.

But how did this 200km-wide metal world come to be?

As planetary building blocks joined together to form bigger and bigger objects in the early Solar System, some became so large and hot that they melted. This process, called differentiation, allowed heavier constituents like iron to sink to the interior.

The Psyche mission will launch towards its target in 2022 **NASA**

This resulted in some objects, like Earth, forming a rocky crust and mantle around an iron-nickel core. The core is the source of our planet's magnetic field, which protects the atmosphere from being stripped away by charged particles from space.

A widely held idea is that 16 Psyche is the exposed core of an extinct world, perhaps as large as Mars. This proto-planet must have been pounded by other objects, removing the rocky outer layers and leaving just the iron-nickel innards prone to the vacuum of space.

So, while we can't directly study the Earth's core, 16 Psyche provides an opportunity to study one in outer space.

Lindy Elkins-Tanton is principal investigator for Nasa's mission to Psyche. She said the first task for the mission after arriving in 2026 was to test the idea 16 Psyche was indeed a planetary core.

"It might be solid metal, or it might be a pile of rubble that's mostly metal," Prof Elkins-Tanton told BBC News.

"So there are a bunch of different hypotheses over what it might be and how it might have formed."

After that, "we will go on to understand what its composition is", she explained. "Would it be compositionally similar to what we think the Earth's core is, or very different from that?"

The mission will seek to understand the asteroid's surface features, or topography. It's not known whether metallic objects like 16 Psyche are covered in a superficial layer of regolith - the dust, soil or bashed-up rock that's found at the surface of the Earth, the Moon, Mars and some asteroids. In addition, says Prof Elkins-Tanton, "we don't know what impacts into metal look like - they could look very different from impacts into rock or ice".

Scientists want to understand whether the metal asteroid produced a magnetic field as it cooled. If the asteroid froze from the inside out, similar to the cores of Earth and Mercury, there will be no record of one. But if Psyche froze from the outside in, as scientists hope, its crust may retain a magnetic memory, allowing the spacecraft to measure and map the asteroid's remnant magnetic field.

Outside-in cooling would also open the door to a process never before seen before on a celestial body: sulphur-iron volcanism.

"One of the things that happens when metal freezes is that it loses about 7% of its volume. So we have a crust that's solid and the inside is continuing to solidify, but it's losing its volume as it solidifies," said Prof Elkins-Tanton, from Arizona State University (ASU) in Tempe. "The crust has to crack and settle to accommodate the loss of volume during freezing."

A 3D-printed model of Psyche. This is one imagining of how the asteroid looks, but we have no idea what its surface is like **John Carpenter**

Outside-in

Studies of iron meteorites have shown that a sulphur-rich fluid sometimes forms inside the parent body. "We think that could get squeezed out through the cracks and form a kind of sulphur-iron volcanism on the cooling Psyche," said the mission's principal investigator.

She said the team was "super-excited about this", but explained that it was "completely hypothetical". "Our very best and favourite model for Psyche is that it froze from the outside in, recording its [magnetic] field and that it would be covered in the now billions-of-years-old remnants of sulphur volcanoes," she explained.

The mission will be discussed this week at the 50th Lunar and Planetary Science Conference (LPSC), here in The Woodlands, outside Houston.

The Psyche spacecraft will also test several important technological innovations. The engine uses inert gases - energised by electric power from the solar arrays - to provide gentle, non-stop thrust.

This solar-electric propulsion (SEP) system saves on fuel mass compared with conventional chemical propulsion, allowing the spacecraft to enter orbit around 16 Psyche and freeing up space for science instruments.

During flight, controllers will also test a communications system that uses laser light, rather than conventional radio waves.

The mission was formally chosen by Nasa in March 2018, along with a separate asteroid mission called Lucy. The Lucy mission will launch in 2021 to explore the Trojans, a group of asteroids that share Jupiter's orbit around the Sun.

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Heading in the right direction: humans have an inbuilt compass

Research suggests that people – like migratory birds – can sense the magnetic pull of the poles.

Dyani Lewis reports.

The Earth’s magnetic field is faint, yet creatures from birds and bees to lobsters and bacteria have been shown to detect its dull pull. Now, after half a century of looking, scientists have reported the most convincing evidence yet to suggest humans, too, share this ability.

The mysteries surrounding magnetoreception, as it is called, abound. It makes sense for globetrotting migratory birds and turtles to have an in-built compass, but it is far less obvious why cows might need one to orient their bodies along the magnetic field lines when grazing, or dogs to point north or south when defecating.

The first inklings that humans might have an internal compass came from studies by Robin Baker at the University of Manchester in the UK. In 1980, he reported that if he blindfolded students and transported them out of town, they could almost always point towards the quadrant of their starting point, but they lost this ability if a bar magnet was strapped to their heads. Subsequent attempts to replicate the findings failed, however.

Biophysicist Joe Kirschvink, then at Princeton University in the US, is one person whose replication experiments fizzled in the 1980s. But three decades later, and now at the California Institute of Technology, he and colleagues came up with a better way of testing whether humans have an internal compass.

Instead of asking his subjects for a conscious, behavioural response to changes in magnetic field, he decided to ask their brains directly.

To do that, his team rigged up a high-tech metal cell. The dark chamber is covered in thin aluminium sheets to shield the person sitting inside from external electromagnetic signals. An array of electrical coils lining the cell exposes the person to custom magnetic fields, and a cap studded with 64 electrodes connected to an electroencephalogram (EEG) machine records brain waves.

What the team was looking for were the tell-tale signs that the brain was busy "processing" something when the magnetic fields were altered.

Away from the pings and flashes of smartphones, or even the gentle huff of a summer breeze on one's neck, the brain settles into a pattern of synchronous activity known as alpha waves.

"When the brain receives a stimulus, like sound or smell, parts of the brain will hop out of this hum and start to worry about what's going on," Kirschvink says.

"It's a response that's across a lot of different senses, so we said, 'all right, let's try that to see if the magnetic sense is being perceived'."

Sure enough, when people were subjected to a magnetic field that rotated, as though they had been swivelled in their chair by 90 degrees, the alpha waves in their brain dipped. Neurons were being recruited to "sense" the change in magnetic field.

Curiously, the effect of the rotation only occurred when the vertical magnetic field – which tells us where we are in relation to magnetic north – was directed downwards, as it is in the northern hemisphere. If the field was flipped to mimic a southern hemisphere magnetic field, the brain responses disappeared.

According to Kirschvink, that's because all 34 of the participants in the study grew up in the northern hemisphere. If the input makes no sense to what the brain knows of its surroundings, it disregards it.

The experiments also reveal how the body perceives magnetic fields. One theory suggests they spark quantum chemical reactions in crytochromes – proteins found in the retina of the eye. Another, which Kirschvink subscribes to, holds that receptor cells containing tiny molecular bar magnets – most likely made of an iron mineral called magnetite – trigger brain cells to react.

The work rules out a quantum compass.

"A quantum compass can't tell a field down to the north from up to the south. So it's not a quantum compass," he says.

But the location of the magnetite receptors – if they exist – is a mystery. Kirschvink thinks it's probably somewhere in the large trigeminal nerve that splays out around the head, but further research is needed to pin down that hunch.

“If it’s right then I think it’s really important,” says Peter Hore from the University of Oxford, UK. But, he adds, independent verification is necessary.

“My impression is [the experiments] have been done very, very carefully indeed, yet this area of research on magnetic sensing in animals has been fraught with results that no-one else has been able to repeat, so I won’t get too excited about this until someone else has independently replicated these measurements and found the same thing.”

Kirschvink and his colleagues welcome the scrutiny.

“This result is something that needs to be reproduced, it needs to be replicated by other lab groups," says co-author Isaac Hilburn from Caltech.

The team is also keen to see how people from the southern hemisphere or equatorial regions respond to the changing fields. This could help to unravel whether everyone is capable of sensing the Earth’s magnetic field, and whether anyone is able to do so on a conscious level.

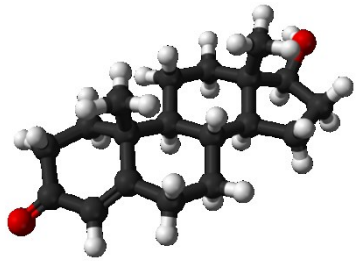
http://bit.ly/2TTRLtv

Prenatal testosterone linked to long-term effects in females who share womb with male twin

Females exposed in utero to a male twin experienced adverse educational and labor outcomes along with altered patterns of marriage and fertility as adults

Women who shared their mother's womb with a male twin are less likely to graduate from high school or college, have earned less by their early 30s, and have lower fertility and marriage rates when compared with twins who are both female, according to new Northwestern University research.

In the largest and most rigorous study of its kind, Northwestern University and Norwegian School of Econ researchers examined data on all twin birth Norway over a 12-year period to find that females exposed in utero to a male twin experienced adverse educational and labor outcomes along with altered patterns of marriage and fertility as adults.



Ball-and-stick model of the testosterone molecule, C19H28O2, as found in the crystal structure of testosterone monohydrate. Ben Mills/Wikipedia

"Nobody has been able to study how male twins impact their twin sisters at such a large scale," said study corresponding author Krzysztof Karbownik, an economist and research associate at Northwestern University's Institute for Policy Research (IPR). "This is the first study to track people for more than 30 years, from birth through schooling and adulthood, to show that being exposed in utero to a male twin influences important outcomes in their twin sister, including school graduation, wages and fertility rates."

The study, "Evidence that prenatal testosterone transfer from male twins reduces the fertility and socioeconomic success of their female co-twins," will be published the week of March 18 in the *Proceedings of the National Academy of Sciences (PNAS)*.

The researchers used data on 13,800 twin births between 1967 and 1978 to show that females exposed in utero to a male twin are less likely to graduate from high school (-15.2 percent), to complete college (-3.9 percent) or to get married (-11.7 percent). They also have lower fertility rates (-5.8 percent) and life-cycle earnings (-8.6 percent.)

The study supports the "twin testosterone-transfer hypothesis," which posits that females in male-female twin pairs are exposed to more testosterone in utero via the amniotic fluid or through the mother's bloodstream that they share with their twin brother. One

explanation for the long-term effects the researchers discovered is changes in behavior, which have previously been demonstrated in girls with male twins. Unlike the females, the researchers found that male twins do not experience long-term consequences of being exposed to a female twin in utero.

"This is a story about the biology of sex differences," said co-author David Figlio, Dean of Northwestern's School of Education and Social Policy and IPR fellow. "We are not showing that exposed females are necessarily more 'male-like,' but our findings are consistent with the idea that passive exposure to prenatal testosterone changes women's education, labor market, and fertility outcomes."

During sensitive developmental periods in utero, steroids produced by the ovaries and testes, including testosterone, help establish biological differences between males and females. Previous, smaller studies have suggested that such exposure to opposite-sex hormones can lead to lasting changes in behavior and other traits. On the other hand, it has also been noted that socialization effects—or being a female raised alongside a twin brother—could likewise explain the different behaviors and outcomes shown by past studies.

To separate the effects of fetal testosterone from postnatal socialization, the research team repeated their analyses focusing only on female twins whose twin sibling—either twin sister or twin brother—died shortly after birth, and thus they were raised as singletons. The results were unchanged in this sample, providing strong evidence that the long-term effects that the study documents are due to prenatal exposure, rather than postnatal socialization.

The near-doubling of twinning rates in many countries since 1980—a result of women conceiving later in life and increased reliance on in vitro fertilization (IVF)—means that an increasing number of females worldwide are exposed to prenatal testosterone from their male twin.

The researchers caution that they lack information on all possible outcomes, and it is possible that some positive effects from testosterone exposure also exist. Moreover, the long-term impacts of prenatal testosterone exposure, which likely involve behavioral changes, may shift as societal norms surrounding gender change.

"It is important to emphasize that our findings apply to Norwegian society during the timeframe of the study, but may not apply equally across other societies or cultural settings. For instance, if gender norms change within a society, acceptance of a wider array of behaviors could minimize later effects on outcomes like school completion or entering a marriage" said study co-author Christopher Kuzawa, professor of anthropology and an IPR fellow, whose research focuses on the roles that the intrauterine and early postnatal environments have on development and long-term health.

"Basically we find that there are some very interesting long-term biological effects of being a sister to a twin brother," Kuzawa said. "But whether we view those effects as 'positive' or 'negative' may be culturally dependent."

"While we found moderate effects at the national level, these results reflect mean differences," Karbownik said. "Not everyone will be affected in the same way, and some female twins may not be affected at all. And, these effects are highly unlikely to result from any individual fertility decision made by a woman or couple, given that twins are a small subset of births and male-female twin pairs even rarer yet."

"We certainly do not advocate against delayed reproduction or the use of IVF, which are complex decisions made by individuals balancing a range of personal factors," Karbownik said.

Caveats aside, "our results suggest that in utero testosterone transfer could present a hidden impact of practices that increase multiple zygote implantation, and provide long-term perspectives concerning

the risks and returns of these fertility decisions," the researchers wrote.

More information: *Aline Bütikofer el al., "Evidence that prenatal testosterone transfer from male twins reduces the fertility and socioeconomic success of their female co-twins," PNAS (2019). www.pnas.org/cgi/doi/10.1073/pnas.1812786116*

Journal reference: *Proceedings of the National Academy of Sciences*

https://nyti.ms/2TNQkqQ

Daily Low-Dose Aspirin No Longer Recommended by Doctors, if You're Healthy

New guidelines suggest low-dose aspirin should not be recommended to prevent heart attacks in healthy older adults.

By Laura M. Holson

For years, low-dose aspirin has been described as a panacea to ward off heart attacks, strokes and other cardiovascular disease. New guidelines, though, suggest that aspirin should not be prescribed to most adults who are in good cardiovascular health and that the risk of internal bleeding often outweighs the benefit.

The American College of Cardiology and American Heart Association released the new guidelines on Sunday. They come on the heels of studies released last year that said daily low-dose aspirin — 100 milligrams or less — did not help older adults who do not have cardiovascular disease. Those results, published in three articles in The New England Journal of Medicine, surprised physicians and patients alike who for years believed aspirin would prevent any number of heart-related ills.

The authors of the new guidelines said low-dose aspirin should not be routinely given as a preventive measure to adults 70 years and older or to any adult who has an increased risk of bleeding.

"The guidelines are for people with no clinical signs of heart disease or stroke," said one of the authors, Dr. Erin Michos, the associate director of preventive cardiology at Johns Hopkins School of Medicine, in an interview on Monday.

She emphasized, though, that people who have had heart attacks or have stents should continue with the medication. "They should still take aspirin," she added.

Patients should consult their primary care doctor or cardiovascular physician before beginning or stopping the taking of aspirin.

Dr. Michos said she had been telling her patients who do not have cardiovascular disease to stop taking aspirin. "They are receptive to that," she said.

Instead, the guidelines recommended several behavioral changes to ensure a healthy heart. These include maintaining a healthy weight, not smoking, engaging in moderate activity for at least 150 minutes a week and a diet that includes vegetables, fruits, nuts, whole grains and fish.

Last year, one study published in The New England Journal of Medicine found no benefits to taking aspirin in low-risk patients. Another found that diabetics with cardiovascular disease could benefit from low-dose aspirin, but there was a risk of major bleeding. The third study found that heavier adults would need larger doses, suggesting that how much a person takes matters. Those findings applied to people with no history of dementia, physical disability, heart attacks or strokes.

https://go.nature.com/2UHSUkJ

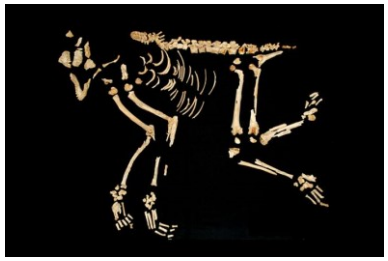
A pet monkey was buried some 4,000 years ago with same rites as humans

Rhesus macaque, perhaps an elite gift, was interred with a type of pottery also found in human graves.

Modern people aren't the first to cherish their animal companions. A monkey that died more than 4,000 years ago in the Middle East was laid to rest in a human cemetery in a type of grave used for infants, suggesting that it was a treasured pet.

The monkey was buried in the vast cemetery of Shahr-i Sokhta, an ancient city near modern-day Zabol, Iran. According to work by

Claudia Minniti at the University of Salento in Lecce, Italy, and Seyed Mansour Seyed Sajjadi at the Iranian Center for Archaeological Research in Tehran, the animal was interred in a single pit, as were the infants in the cemetery. The pit contained the same type of pottery found in the cemetery's human graves.



This young rhesus macaque was buried in 2800–2200 BC in a human cemetery near the modern-day Iran–Afghanistan border. **Claudia Minniti**

For Middle Easterners of that time, pet monkeys were status symbols. The buried primate — a rhesus macaque (*Macaca mulatta*) — might have been bestowed as a luxury gift and represents one of the earliest examples of a pet monkey.

Int. J. Osteoarchaeol. (2019)

http://bit.ly/2Hyr5bH

Discovery of a crucial immune reaction when solid food is introduced that prevents inflammatory disorders

Key immune response is generated in mice when solid food is introduced and microbiota expands

Microbes colonize all body surfaces and help to balance the immune system. In newborn infants, gut microbiota is first conditioned by breast milk components. When solid food is introduced, gut microbiota develops and bacteria proliferate. Scientists from the Institut Pasteur and Inserm have discovered that a key immune response is generated in mice when solid food is introduced and microbiota expands. But, above all, they have shown that this immune reaction is essential as it is involved in educating the immune system and leads to low susceptibility to inflammatory disorders (allergies, colitis, autoimmune diseases, cancer) in adulthood. These findings were published in the journal Immunity on March 19, 2019.

With the arrival of improved hygiene in the mid-19th century, the rate of death from diseases caused by microorganisms fell dramatically. In our current industrial societies, the hygiene hypothesis now states that reduced exposure to microbes at an early age could lead to increased susceptibility to allergic or autoimmune diseases. Previous studies have shown that disruption of microbiota, particularly through exposure to antibiotics, may result in allergic responses .

In newborn infants, the composition of the gut microbiota is determined at birth by the bacteria acquired from the mother and the composition of breast milk. It mainly features bifidobacteria and lactobacilli. When new foods are introduced, the microbiota proliferates and the number of bacteria increases 10- to 100-fold. Scientists (Ziad Al Nabhani and his colleagues) from the Microenvironment and Immunity Unit (Institut Pasteur/Inserm), led by Gérard Eberl, have discovered that this phenomenon triggers an intense immune response in mice. "We showed that this mechanism takes place within a very specific time window: between two and four weeks in mice which corresponds to three to six months in humans" explains Gérard Eberl, the lead author of the study.

"We then assumed that this specific time window means that the immune response is programmed over time and therefore has a unique role to play in the development of the immune system" continues Gérard Eberl. The scientists demonstrated that, by treating mice with antibiotics during this critical time window, mice were subsequently more likely to develop inflammatory disorders (intestinal allergies, colorectal cancer and colitis). Once the microbiota is destroyed by antibiotics, the immune reaction no longer occurs.

"This is what is known as pathogenic imprinting" explains Gérard Eberl, "that is to say, events occurring in early childhood determine future susceptibility to inflammatory disorders".

The scientists also revealed the presence of specific cells during this reaction which are necessary for balanced immune responses. These regulatory T cells (Tregs) are key modulators and without them immune responses are exacerbated, leading to inflammatory disorders.

All this data highlights the importance of early life exposure to microbiota for the development of a balanced immune system. "We would now like to confirm these findings on the impact of microbiota at weaning in the context of other pathologies, such as neurodegenerative diseases for example" concludes Gérard Eberl.

This research was funded by the Institut Pasteur and Inserm, together with Association François Aupetit, Crohn's Colitis Foundation of America, the European Crohn's and Colitis Organisation, the French Foundation for Medical Research (FRM), Janssen, and the Kenneth Rainin Foundation.

It was conducted within the framework of the "Microbiota" transversal program, introduced in 2016 as part of Inserm's strategic plan.

http://bit.ly/2TLp1nr

Healthy food prescriptions could save lives and money

Could generate substantial health gains and be highly cost-effective

Healthy food prescriptions through Medicare and Medicaid could generate substantial health gains and be highly cost-effective, according to a study published March 19 in the open-access journal PLOS Medicine by Yujin Lee and Dariush Mozaffarian of the Friedman School of Nutrition Science and Policy at Tufts University, Massachusetts, United States and colleagues. As noted by the authors, the findings support the implementation and evaluation of such programs within private and public healthcare systems.

In nearly all nations, healthcare spending continues to increase dramatically, with diet-related diseases being a major driver. Economic incentives through health insurance may promote healthier behaviors, but little is known about the health and economic impacts of incentivizing diet, a leading risk factor for diabetes and cardiovascular disease, through Medicare and Medicaid. Fruit, vegetable and other produce prescriptions have just been funded in the US through the Farm Bill with pilot programs. However, the health impacts, costs, and cost-effectiveness of the programs have not been evaluated at scale.

As a part of the Food-PRICE (Policy Review and Intervention Cost-Effectiveness) Project, Lee and colleagues estimated the health and economic impacts of healthy food prescriptions for adults in Medicare and Medicaid, the two largest US federal health insurance programs, which together cover 1 in 3 Americans.

Using nationally representative data and a validated model, they evaluated two scenarios: (1) 30% incentives for the cost of purchases of fruits and vegetables (F&V incentive), and (2) 30% incentives for the cost of purchases of several healthful foods, including fruits, vegetables, whole grains, nuts/seeds, seafood, and plant oils (healthy food incentive).

Over a lifetime, the study suggests that the F&V incentive could prevent 1.93 million cardiovascular disease events, including 0.35 million cardiovascular deaths, and save about $40 billion in healthcare costs. The healthy food incentive could prevent 3.28 million cardiovascular disease events, including 0.62 million cardiovascular deaths and 0.12 million diabetes cases, and save $100 billion in healthcare costs.

Both programs would be highly cost-effective from healthcare and societal perspectives, with lifetime incremental cost-effectiveness ratios ranging from more than $9,000 to approximately $18,000 per quality-adjusted life year. Taken together, the findings suggest that implementing healthy food prescriptions within large government healthcare programs to promote healthier eating could generate substantial health gains and be highly cost-effective.

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***Competing Interests:** I have read the journal's policy and the authors of this manuscript have the following competing interests: RM reports research funding from NIH, Bill & Melinda Gates Foundation, and Unilever and personal fees from the World Bank and Bunge. DM reports research funding from the National Institutes of Health and the Gates Foundation; personal fees from GOED, Nutrition Impact, Pollock Communications, Bunge, Indigo Agriculture, Amarin, Acasti Pharma, Cleveland Clinic Foundation, America's Test Kitchen, and Danone; scientific advisory board, Elysium Health (with stock options), Omada Health, and DayTwo; and chapter royalties from UpToDate, all outside the submitted work. TAG has also received research funds and/or consulting fees from Astra Zeneca, Novartis, United Health Group, Teva Pharmaceuticals, and Takeda in the past five years, all of which were outside the submitted work.*

***Citation:** Lee Y, Mozaffarian D, Sy S, Huang Y, Liu J, Wilde PE, et al. (2019) Cost-effectiveness of financial incentives for improving diet and health through Medicare and Medicaid: A microsimulation study.* PLoS Med *16(3): e1002761.*
https://doi.org/10.1371/journal.pmed.1002761

http://bit.ly/2CpqHIj

How hot spots of genetic variation evolved in human DNA

Study uncovers a complex story that hints at how adaptable -- yet delicate -- we are as a species

BUFFALO, N.Y. -- What makes one person different from one another, and how did these differences evolve?

A study by University at Buffalo biologists is illuminating one aspect of this complicated question. The research examines hot spots of genetic variation within the human genome, examining the sections of our DNA that are most likely to differ significantly from one person to another.

The findings uncover a complex evolutionary history, shedding light on the malleability of human DNA and pointing to just how adaptable -- yet delicate -- we are as a species.

"We have made some headway into understanding how variations in the genome occur," says Omer Gokcumen, PhD, assistant professor of biological sciences in the UB College of Arts and Sciences. "Which parts of the genome are protected and conserved through evolution? Which parts are not protected, and why?

"There is previous work showing that structural variations -- deletions, duplications, other alterations of DNA -- they're not distributed uniformly throughout the genome. There are deserts and there are hot spots. The big question is whether this clustering has biological meaning, whether it is random or driven by evolutionary forces. Our research addresses this question."

The study, published online on March 18 in the journal Genome Biology and Evolution, was conducted by Gokcumen and UB biological sciences PhD candidate Yen-Lung Lin, who has since graduated and will soon begin a new job as a postdoctoral researcher at the University of Chicago.

Exploring the architecture of thousands of genomes

The human genome is the entirety of a person's DNA. Genes -- the fragments of DNA that influence traits such as eye color and risk for disease by telling our bodies how to build important proteins -- make up about 1.5 percent of our genomes. The rest consists of noncoding DNA, whose function (or lack thereof) is a topic of debate among scientists. Every person's genome is different, and the new study compared the DNA of more than 2,500 individuals.

Scientists zeroed in on the sections of the genome that differ most between people, identifying 1,148 areas that harbor unusually high numbers of structural variants, including chunks of duplicated, deleted, inserted, inverted or repeated sections of DNA.

New insights on the malleability of human DNA

An examination of these "hot spots" revealed a complex evolutionary story.

Most are found in gene-poor regions of the genome, as expected. (Altering genes can lead to devastating health problems, so it makes sense that gene-rich areas would tend to be more heavily conserved through evolution, Gokcumen explains.)

However, a small subset of structural variant hot spots is found in parts of the genome that harbor important genes. In these hubs, genes linked to our sense of smell, blood and skin function, and immunity to disease are overrepresented, according to the study.

Balancing selection -- in which dueling evolutionary forces drive a species to preserve an array of traits -- may help to explain why these gene-heavy hot spots exist.

One example: In the study, a DNA deletion that increases a person's risk for a blood disorder called thalassemia was found in about 16 percent of genes in sub-Saharan African populations. While evolution mostly weeded this genetic variation out of human societies in other parts of the world, the variation persists in sub-Saharan Africa because it's valuable there, Gokcumen says: The deletion may confer resistance to malaria, a major disease in the region.

"There's an evolutionary reason why this mutation is lingering, despite its ill effects," he says. "It's actually beneficial too, at least for some populations. Balancing selection is important for adaptation, and we think it contributes to the development of some structural variant hot spots."

If the findings on balancing selection showcase humanity's adaptability, a second result from the study hints at just how delicate we are -- at how easily problems can arise.

The conclusion has to do with the malleability of human DNA, and the possibility that some hot spots of variation may be located in sections of the genome that are, for biochemical reasons, more susceptible to being altered.

In most people, genetic mutations in these regions are not devastating. But in some cases, large genetic deletions that begin in one hotspot and end in another may result in the erasure of entire genes in between, leading to health complications, Gokcumen says.

One example: The study found that a number of consecutive structural variant hot spots lie on either side of the short stature homeobox (SHOX) gene, whose deletion can lead to a severe bone growth disorder that causes very short stature. In some people who are missing the SHOX gene, deletions of DNA began in one hotspot, spanned the entire SHOX gene, and ended in a second hotspot.

When Gokcumen and Lin ran statistical tests, they found that the start and end points of large genetic mutations with known medical relevance were found in structural variant hot spots more often than would be expected.

The study was funded by the National Science Foundation.

http://bit.ly/2HLSp5F

New material will allow abandoning bone marrow transplantation

Able to restore the internal structure of bones damaged due to osteoporosis and osteomyelitis

Scientists from the National University of Science and Technology "MISIS" developed nanomaterial, which will be able to restore the internal structure of bones damaged due to osteoporosis and osteomyelitis.

A special bioactive coating of the material helped to increase the rate of division of bone cells by 3 times. In the future, it can allow to abandon bone marrow transplantation and patients will no longer need to wait for suitable donor material. An article about the development was published in Applied Surface Science.

Such diseases as osteoporosis and osteomyelitis cause irreversible degenerative changes in the bone structure. Such diseases require serious complex treatment and surgery and transplantation of the destroyed bone marrow in severe stages. Donor material should have a number of compatibility indicators and even close relationship with the donor cannot guarantee full compatibility.

Research group from the National University of Science and Technology "MISIS" (NUST MISIS), led by Anton Manakhov (Laboratory for Inorganic Nanomaterials) developed material that will allow to restore damaged internal bone structure without bone marrow transplantation.

It is based on nanofibers of polycaprolactone, which is biocompatible self-dissolvable material. Earlier, the same research group has already worked with this material: by adding antibiotics to the nanofibers, scientists have managed to create non-changeable healing bandages.

"If we want the implant to take, not only biocompatibility is needed, but also activation of the natural cell growth on the surface of the material. Polycaprolactone as such is a hydrophobic material, meaning, and cells feel uncomfortable on its surface. They gather on the smooth surface and divide extremely slow", Elizaveta Permyakova, one of the co-authors and researcher at NUST MISIS Laboratory for Inorganic Nanomaterials, explains.

To increase the hydrophilicity of the material, a thin layer of bioactive film consisting of titanium, calcium, phosphorus, carbon, oxygen and nitrogen (TiCaPCON) was deposited on it. The structure of nanofibers identical to the cell surface was preserved. These films, when immersed in a special salt medium, which chemical composition is identical to human blood plasma, are able to form on its surface a special layer of calcium and phosphorus, which in natural conditions forms the main part of the bone.

Due to the chemical similarity and the structure of nanofibers, new bone tissue begins to grow rapidly on this layer. Most importantly, polycaprolactone nanofibers dissolve, having fulfilled their functions. Only new "native" tissue remains in the bone.

In the experimental part of the study, the researchers compared the rate of division of osteoblastic bone cells on the surface of the modified and unmodified material. It was found that the modified material TiCaPCON has a high hydrophilicity. In contrast to the unmodified material, the cells on its surface felt clearly more comfortable, and divided three times faster.

According to scientists, such results open up great prospects for further work with modified polycaprolactone nanofibers as an alternative to bone marrow transplantation.

http://bit.ly/2HEUv7v

Gene-edited foods are safe, Japanese panel concludes

In Japan, genetically modified products have to be labeled; an advisory panel did not say whether that should apply to gene-edited food as well.

By Dennis Normile Mar. 19, 2019 , 1:15 PM

Japan will allow gene-edited foodstuffs to be sold to consumers without safety evaluations as long as the techniques involved meet certain criteria, if recommendations agreed on by an advisory panel yesterday are adopted by the Ministry of Health, Labour and Welfare. This would open the door to using CRISPR and other techniques on plants and animals intended for human consumption in the country.

“There is little difference between traditional breeding methods and gene editing in terms of safety,” Hirohito Sone, an endocrinologist at Niigata University who chaired the expert panel, told NHK, Japan’s national public broadcaster.

How to regulate gene-edited food is a hotly debated issue internationally. Scientists and regulators have recognized a difference between genetic modification, which typically involves transferring a gene from one organism to another, and gene editing, in which certain genes within an organism are disabled or altered using new techniques such as CRISPR.

That’s why a year ago, the U.S. Food and Drug Administration concluded that most gene-edited foods would not need regulation. But the European Union’s Court of Justice ruled in July 2018 that

gene-edited crops must go through the same lengthy approval process as traditional transgenic plants.

Now, Japan appears set to follow the U.S. example. The final report, approved yesterday, was not immediately available, but an earlier draft was posted on the ministry website. The report says no safety screening should be required provided the techniques used do not leave foreign genes or parts of genes in the target organism.

In light of that objective, the panel concluded it would be reasonable to require information on the editing technique, the genes targeted for modification, and other details from developers or users that would be made public while respecting proprietary information.

The recommendations leave open the possibility of requiring safety evaluations if there are insufficient details on the editing technique. The draft report does not directly tackle the issue of whether such foods should be labeled. The ministry is expected to largely follow the recommendations in finalizing a policy on gene-edited foods later this year.

Consumer groups had voiced opposition to the draft recommendations, which were released for public comment in December 2018. Using the slogan "No need for genetically modified food!" the Consumers Union of Japan joined other groups circulating a petition calling for regulating the cultivation of all gene-edited crops, and safety reviews and labeling of all gene-edited foods.

Whether consumers will embrace the new technology remains to be seen. Japan has approved the sale of genetically modified (GM) foods that have passed safety tests as long as they are labeled. But public wariness has limited consumption and has led most Japanese farmers to shun GM crops. The country does import sizable volumes of GM processed food and livestock feed, however.

Japanese researchers are reportedly working on gene-edited potatoes, tomatoes, rice, chicken, and fish. "Thorough explanations [of the new technologies] are needed to ease public concerns," Sone said.

http://bit.ly/2Ycmod0

Scientists Are Fighting Fire (Ants) With Wasabi

What's good for the sushi is not good for the Solenopsis invicta.

by Rohini Chaki

Fire ants certainly live up to their name. It can take up to a week to recover from their fierce stings, which cause large, hot welts, intense itching, and just a very unhappy outlook toward life. But relief may be close at hand, in the form of a team of Japanese and Taiwanese entomologists wielding science and wasabi.

In a paper published in the journal *Applied Entomology and Zoology*, a group of researchers led by the myrmecologist Yoshiaki Hashimoto, who teaches at the University of Hyogo in Kobe, Japan, found that lacing ant traps with a microencapsulated form of allyl isothiocyanate (AITC), an organic compound that causes the pungency in wasabi, horseradish, and mustard, kept fire ants away. Microencapsulation (read: making tiny capsules) preserves the AITC within a protective shell. Ants that came into contact with the AITC eventually died.

Global trade has accidentally exported fire ants (*Solenopsis invicta*) from their native South America in shipping containers. The ants have found their way into the United States, Australia and New Zealand, China, Taiwan, and Japan. The cost of eradicating these venomous marauders, which multiply rapidly and cause damage to agriculture, local fauna, and public health, is as high as $6 billion for the U.S. alone.

The paper reports that migrating fire ants were first discovered in Japan at a sea port in Kobe in 2017.

To keep the ants at bay, the team of entomologists from the University of Hyogo, Okinawa Institute of Science and Technology, and National Taiwan University devised a way to use AITC extracted from the wasabi plant to fend off the ants.

In microencapsulated form, the AITC compound releases slowly (a "controlled vapor release"), negating any irritation that might be caused by their excessive pungency. Microencapsulated AITC is also sensitive to moisture, and releases faster in more humid climes. "Because the regions infested heavily by S. invicta in China are located in the humid subtropical zones, the moisture sensitive property of the microencapsulated AITC could be particularly useful as S. invicta repellent," writes Hashimoto, in an email. This microencapsulated AITC can be applied to plastic packing materials to prevent fire ants from getting into packages, including perishables, as AITC is a naturally occurring, non-toxic, and colorless oil.

To test their theory, the scientists devised three scenarios in an experiment site next to a fire ant mound.

They put out 10 traps, each with a microencapsulated AITC-laced polyethylene film wrapped around the bait (a fried snack of corn grits). Then, in a control test, they put out 10 ant traps containing a regular plastic film and oily corn grits. In the final test case, they put the bait out first, caught the red ants, and then put them inside a trap with the AITC-laced film. All the ant traps were small, transparent plastic tubes with a five millimeter hole cut into the screw top to provide a point of entry.

The results proved conclusively that fire ants fear wasabi. Only the trap with the regular plastic film caught ants. The one with the AITC film repelled the ants—the researchers recorded a video of ants getting to the top of the bait tube and recoiling from the tiny hole marking the point of entry.

In the final instance, ants placed inside the small tube containing AITC film died within 40 minutes of exposure.

The use of wasabi-infused plastic film to repel invading fire ants offers a sharp new research direction for the disparate fields of food science and entomology.

https://wb.md/2UNopKf

FDA Approves Brexanolone (*Zulresso*), First Drug for Postpartum Depression

Approval marks the first time a drug has been specifically approved to treat postpartum depression

Alicia Ault

The US Food and Drug Administration (FDA) has approved brexanolone intravenous infusion (*Zulresso*, Sage Therapeutics), the first-ever drug indicated for the treatment of postpartum depression. The drug is administered under medical supervision as a continuous infusion over a total of 60 hours (2.5 days), according to the FDA.

Postpartum depression can be life-threatening, can interfere with the maternal-infant bond, and some women "may experience thoughts about harming themselves or harming their child," said Tiffany Farchione, MD, acting director of the Division of Psychiatry Products in the FDA's Center for Drug Evaluation and Research, in a statement.

"This approval marks the first time a drug has been specifically approved to treat postpartum depression, providing an important new treatment option," Farchione said

Brexanolone's mechanism of action is different from that of currently available antidepressants. It is chemically identical to endogenous allopregnanolone, a hormone that decreases after childbirth. Brexanolone acts as a positive allosteric modulator of gamma-aminobutyric acid-A (GABAA) receptors, which become dysregulated in the postpartum period.

The FDA gave brexanolone priority review and it was also designated as a breakthrough therapy. But the approval date was extended by 3 months to give the agency and Sage Therapeutics time to work out the details of the Risk Evaluation and Mitigation Strategy (REMS) that had been recommended by FDA advisers in November.

At the time, a joint panel of the FDA's Psychopharmacologic Drugs Advisory Committee and Drug Safety and Risk Management Advisory Committee voted 17-1 that brexanolone's benefits outweighed its risks, but recommended that the drug have a REMS that included elements to assure safe use.

"Because of concerns about serious risks, including excessive sedation or sudden loss of consciousness during administration, Zulresso has been approved with a Risk Evaluation and Mitigation Strategy and is only available to patients through a restricted distribution program at certified health care facilities where the health care provider can carefully monitor the patient," Farchione said.

Patients must have continuous pulse oximetry monitoring during the whole 60-hour infusion and must be accompanied during interactions by their child(ren) while receiving the infusion, the FDA said.

REMS also requires that patients be enrolled in the program before receiving Zulresso.

Brexanolone will carry a boxed warning, and patients will be counseled on the risks and told that they must be monitored at a healthcare facility for the entire infusion. The agency said that patients should not drive, operate machinery, or do other dangerous activities "until feelings of sleepiness from the treatment have completely gone away."

In two placebo-controlled studies, brexanolone demonstrated superiority to placebo in improvement of depressive symptoms at the end of the first infusion. One study included patients with severe postpartum depression (PPD) and the other enrolled patients with moderate PPD. The most common adverse reactions included sleepiness, dry mouth, loss of consciousness, and flushing.

The agency recommended that clinicians discontinue brexanolone in patients whose PPD becomes worse or who experience emergent suicidal thoughts and behaviors.

The Centers for Disease Control and Prevention estimates that 1 in 9 women — and possibly as many as 1 in 5 — experience PPD. Generally, the condition has been treated with counseling and/or antidepressants, according to the National Institute of Mental Health.

https://bbc.in/2OfqseB

Parkinson's smell test explained by science

A Scottish woman who astonished doctors with her ability to detect Parkinson's disease through smell has helped scientists find what causes the odour.

By Elizabeth Quigley BBC Scotland news

Researchers in Manchester said they had identified the molecules on the skin linked to the smell and hope it could lead to early detection.

The study was inspired by Joy Milne, a 68-year-old retired nurse from Perth.

She first noticed the "musky" smell on her husband Les, who was years later diagnosed with Parkinson's disease.

Joy, who has worked with the University of Manchester on the research for three years, has been named in a paper being published in the journal ACS Central Science.

She has also been made an honorary lecturer at the university because of her efforts to help identify the telltale smell.

The research revealed that a number of compounds, particularly hippuric acid, eicosane, and octadecanal, were found in higher than usual concentrations on the skin of Parkinson's patients.

They are contained in sebum - the oily secretion that coats everybody's skin, but which is often produced in greater quantity by people with Parkinson's, making them more likely to develop a skin complaint called seborrheic dermatitis.

Lead author Prof Perdita Barran, from the school of chemistry at the University of Manchester, told BBC Scotland: "What we found are some compounds that are more present in people who have got

Parkinson's disease and the reason we've discovered them is because Joy Milne could smell a difference.

"She could smell people who've got Parkinson's disease.

"So we designed some experiments to mimic what Joy does, to use a mass spectrometer to do what Joy can do when she smells these things on people with Parkinson's."

One in 500 people in the UK has Parkinson's and that rises to about one in 100 among the over-60s.

It can leave them struggling to walk, speak and sleep.

Currently there is no cure and no definitive test for the disease, with clinicians diagnosing patients by observing symptoms.

Prof Barran said she hoped the "volatile biomarkers" they identified could lead to a simple early detection test for the disease, such as wiping a person's neck with a swab and testing for the signature molecules.

She said: "What we might hope is if we can diagnose people earlier, before the motor symptoms come in, that there will be treatments that can prevent the disease spreading. So that's really the ultimate ambition."

Joy's husband Les, who died in 2015, was told he had Parkinson's at the age of 45 but Joy said she detected the unusual musky smell about a decade earlier.

The retired nurse only linked the odour to the disease after meeting people with the same distinctive smell at a Parkinson's UK support group.

She told BBC Scotland that not knowing Les had Parkinson's put her family in a "negative spiral".

"What if we did know?," she said

"It would have changed things dramatically.

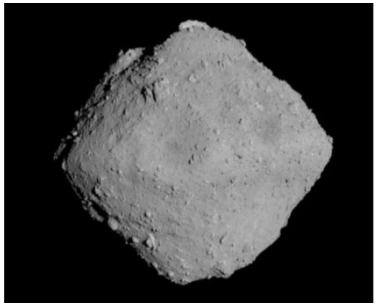
"The fact that he became withdrawn, reserved, he had bouts of depression and mood swings, if I had understood what was happening it would have changed our total outlook on life."

https://bbc.in/2HADdsK

Hayabusa-2: Asteroid mission exploring a 'rubble pile'

The asteroid being explored by the Japanese mission Hayabusa-2 is a "rubble pile" formed when rocks were blasted off a bigger asteroid and came back together again.

By Paul Rincon Science editor, BBC News website



The asteroid 162173 Ryugu consists of material blasted off another asteroid

JAXA, Uni Tokyo & collaborators

The discovery means that asteroid Ryugu has a parent body out there somewhere, and scientists already have two candidates. They have also found a chemical signature across the asteroid that can indicate the presence of water, but this needs confirmation.

Ryugu's unusual shape is also a sign that it must have been spinning much faster in the past.

Scientists from the Japanese Space Agency (Jaxa) mission and from Nasa's Osiris-Rex spacecraft, which is exploring a different asteroid called Bennu, have been presenting their latest findings at the 50th Lunar and Planetary Science Conference (LPSC) in The Woodlands, Texas.

The Hayabusa-2 team has also published its results over three papers in Science journal.

Meanwhile, the team behind the Osiris-Rex mission has made the first close-up observations of particle plumes erupting from an asteroid's surface.

These findings are published in a suite of papers in the Nature journals.

What have they learnt?

Bennu and Ryugu have many similarities. They are comparable in size, rich in carbon and shaped like spinning tops. Both missions aim to deliver samples from these objects to Earth.

Both asteroids are primitive objects, made of the same basic material that went into building rocky planets like Earth.

Studying samples in laboratories could shed light on how our own world came to be.

The identification of Ryugu as a rubble pile asteroid comes from an assessment of its density. Project scientist Sei-ichiro Watanabe said the asteroid's porosity - a measure of the voids, or spaces, present in the object - was 50%.

The large number of rough boulders on Ryugu's surface support this idea, he added. These boulders are probably fragments that joined up after the disruption of its parent body.

What's the significance of shape?

The spinning top shape, Dr Watanabe said, "was formed from a past rapid rotation". He added: "Most of the known top shapes are rapid rotators, but Ryugu is rather slow."

In fact, the scientists think that Ryugu once spun at twice its current rotation period of once every 7.6 hours. At some point in its history, the object slowed down, though what happened to cause this remains unclear.

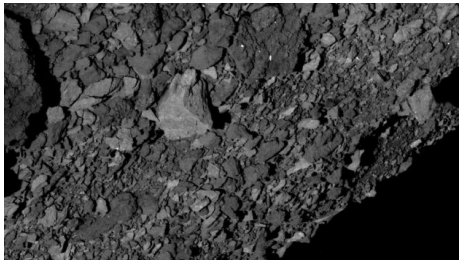
Team-member Seiji Sugita, from the University of Tokyo, said: "The size of Ryugu is very small - 800m or 900m across. It's too small to survive the entire Solar System evolution of 4.6 billion years. Ryugu must have been born from a much older and larger parent body in relatively recent times - several hundred million years."

Analysis of the reflected sunlight from Ryugu shows it is a close match to two larger asteroids, known as Polana and Eulalia. These are good potential candidates for the asteroid's parent body.

What have they discovered about water?

Ryugu is surprisingly dark, much darker than any carbonaceous chondrite meteorites, which could partly be due to exposure of the rocks to the space environment.

"The surface of Ryugu is extremely dark," said Ralph Milliken, from Brown University in Rhode Island and a co-investigator on the near-infrared spectrometer instrument (NIRS3).



The asteroid Bennu was also found to be more rugged than expected **NASA**

He held up a 3D-printed model of Ryugu, saying that he suspected the jet-black plastic used to make it was brighter than the real thing.

Data from NIRS3 has also revealed the presence of minerals with hydroxyl groups (OH), which can indicate the presence of water.

"There is evidence for water on Ryugu, but we do not have any strong evidence yet for the presence of molecular water, H2O," said Ralph Milliken.

The particular hydroxyl groups found on Ryugu appear to be associated with the element magnesium, which is often associated with clay minerals in meteorites.

What are the next steps in sample collection?

At Bennu, the team behind Osiris-Rex detected plumes of material erupting from the asteroid on 6 January this year. The immediate cause isn't clear, but it could be related to volatile gases that escape from the rocks when sunlight heats them up. This would push the dust out into space.

Bennu also appears to be a rubble pile asteroid, and, like Ryugu, was much more rugged than expected - posing a hazard for sample collection.

Hayabusa-2 has just finished a touchdown operation to collect a sample of rock and cache it for return to Earth.

Although there was no way to confirm if Hayabusa-2 had collected a sample, project manager Yuichi Tsuda said the team was confident it had, judging from the large amount of material kicked up after the spacecraft fired a 5g tantalum "bullet" into Ryugu's surface.

During the touchdown operation, Hayabusa-2's thrusters shifted 50cm-1m rocks, Yuichi Tsuda said. The thrusters also blew away the top layer of regolith, revealing darker material underneath.

Mission scientists have also set a date for Hayabusa-2's next set piece: the kinetic impact experiment. This will involve the spacecraft detonating an explosive charge near the surface of Ryugu - generating an artificial crater.

The spacecraft will move to the other side of Ryugu for safety when the charge goes off, returning later to grab a sample of rock from within the crater. The idea is for Hayabusa-2 to get at pristine samples from below the surface, samples that haven't been altered by aeons of exposure to space.

The operation will take place on 5 April, said Dr Tsuda.

http://bit.ly/2HyRVjZ

Researchers find Americans set their thermostat to match African environmental temperatures

Americans tend to set their thermostats to temperatures that mimic natural environmental conditions in parts of Africa

March 20, 2019 by Bob Yirka, Phys.org report

A team of researchers at North Carolina State University has found that people living in the United States tend to set their thermostats to temperatures that mimic natural environmental conditions in parts of Africa.

In their paper published in the journal *Royal Society Open Science*, the group describes their study, which involved installing sensors in homes across the U.S., and what they found.

In their paper, the researchers note that they did not start out looking to match indoor air indoor environments with natural environmental conditions—that came later.

Their original intent was to learn more about the creatures that exist in homes along with people—microbes, insects, rodents, etc. They wanted to know if their numbers varied depending on the indoor climate.

To find out, they asked people living in 37 homes across the U.S. to set up a sensing device in their house. The devices took temperature and humidity readings every hour for a year—at the end of the year, the sensors were sent back to the researchers who analyzed the data they recorded.

The researchers found that the lowest average temperatures came to 8 degrees C (generally at night, when people turn down thermostats) and the highest mean maximum was 36 degrees C. The researchers then split up Earth into cells half a degree longitude and latitude in size, and plugged in actual average temperatures for each cell.

They compared the averages for homes in the U.S. with their cell data and found that people in the U.S. set the environmental conditions inside their homes in a way that very nearly matches environmental conditions in western Kenya and other parts of eastern Africa.

They noted that conditions in Kenya also tend to be quite dry, similar to the U.S. They further noted that Kenya and nearby areas are believed to be the places where modern humans first appeared on the planet.

They conclude by suggesting that modern humans are setting their thermostats to give them roughly the same climate they were exposed to during the period when they had no control over the weather.

It is apparently the climate in which we are still most comfortable.

More information: *Michael G. Just et al. Human indoor climate preferences approximate specific geographies, Royal Society Open Science (2019).* *DOI: 10.1098/rsos.180695*

http://bit.ly/2HFZAxh

It's spring already? Physics explains why time flies as we age

A slowdown in image processing speeds up our perception of time passing as we age

DURHAM, N.C. -- A Duke University researcher has a new explanation for why those endless days of childhood seemed to last so much longer than they do now--physics.

According to Adrian Bejan, the J.A. Jones Professor of Mechanical Engineering at Duke, this apparent temporal discrepancy can be blamed on the ever-slowing speed at which images are obtained and processed by the human brain as the body ages.

The theory was published online on March 18 in the journal European Review.

"People are often amazed at how much they remember from days that seemed to last forever in their youth," said Bejan. "It's not that their experiences were much deeper or more meaningful, it's just that they were being processed in rapid fire."

Bejan attributes this phenomenon to physical changes in the aging human body. As tangled webs of nerves and neurons mature, they grow in size and complexity, leading to longer paths for signals to traverse. As those paths then begin to age, they also degrade, giving more resistance to the flow of electrical signals.

These phenomena cause the rate at which new mental images are acquired and processed to decrease with age. This is evidenced by how often the eyes of infants move compared to adults, noted Bejan--because infants process images faster than adults, their eyes move more often, acquiring and integrating more information.

The end result is that, because older people are viewing fewer new images in the same amount of actual time, it seems to them as though time is passing more quickly.

"The human mind senses time changing when the perceived images change," said Bejan. "The present is different from the past because the mental viewing has changed, not because somebody's clock rings. Days seemed to last longer in your youth because the young mind receives more images during one day than the same mind in old age."

"Why the Days Seem Shorter as We Get Older." Adrian Bejan. European Review, *2019. DOI: 10.1017/S1062798718000741*

http://bit.ly/2TTwLDO

New model for ICU care, developed by Rutgers, discovers causes of health emergencies

Can help identify preventable - and previously overlooked - factors that often send chronically ill patients to the ICU

A new model for intensive care, developed by Rutgers and RWJBarnabas Health System, can help identify preventable - and previously overlooked - factors that often send chronically ill patients to the intensive care unit (ICU).

The new process requires the ICU team - including physicians, nurses, pharmacists, social workers, chaplains and others - to truly listen to patients and their families to ensure their needs are being met, according to a recent study in the journal Creative Nursing.

The new model, called LOTUS (Leadership, Ownership, Transformation, Unity and Sustainability) differs significantly from the previous model in which all planning was led by the ICU physician, said lead researcher Liza Barbarello Andrews, a clinical associate professor at Rutgers' Ernest Mario School of Pharmacy and critical care pharmacy specialist at Robert Wood Johnson University Hospital.

During its first year, the new patient-focused model identified areas where the ICU was not routinely assessing the causes of the health crises that sent patients to the hospital in the first place - missing opportunities to break the cycle of admissions, Andrews said.

"Many patients present with life-threatening complications due to failure to take their diabetes or blood pressure medications," he said. "We would treat the resulting problem, but hadn't been routinely investigating what led to the issue or designed a solution to prevent it from happening again in the future. Under the LOTUS model, by focusing on the patient perspective we discovered that some patients had received confusing, mixed messages about the medicine from their health-care providers. Other patients were struggling with financial or emotional problems that made self-care difficult."

The LOTUS model empowers ICU social workers to help address those issues with patients and their families to prevent a reoccurrence.

Clinicians developed LOTUS at Robert Wood Johnson University Hospital Hamilton, following its 2016 merger with RWJBarnabas Health System. The new ICU model replaced an earlier one where patient care decisions were exclusively led by the ICU physician without routine focus on the patient's own goals or significant input from nurses, pharmacists and other members of the ICU team.

Under the old model, there was no formal structure for rounds, the practice where all members of the ICU team assess the patient at intake and through treatment. This lack of standard team structure often resulted in underutilizing individual team members' expertise.

The new illustrative logo for the ICU model is a flower with the patient at the center and the petals - the members of the health care team - overlapping and meeting at the center.

"We took a model that was fragmented and sometimes strayed from keeping the patients' own wishes central to the decision-making process - and developed one that is much more efficient, thoughtful and deliberative," Andrews said. "The ICU team members feel a real sense of engagement and collaboration and patients and families say they feel listened to.

ICU team members said the LOTUS model helped them contribute to better patient safety, decreased mortality and shorter ICU stays. Members of other teams at RWJBarnabas Health System campuses are exploring how the LOTUS concept can be adopted for their ICU teams.

http://bit.ly/2TR5H8q

New treatment of acute myeloid leukemia achieves remarkable results in a disease formerly with little hope

New Australian drug trial has achieved a remarkable result, clearing the bone marrow of leukaemia in almost 60% of patients

The prognosis for older patients with acute myeloid leukemia (AML) is poor: very few achieve remission and for those that don't the option is largely palliative.

Every year almost 1000 Australians die of the disease and clinical trials into new therapies for older patients have largely failed.

A new Australian drug trial has achieved a remarkable result, clearing the bone marrow of leukaemia in almost 60% of patients.

The trial was considered so effective that the US Food and Drug Administration approved its use last November for the treatment of AML.

Kaye Oliver, 74, was the first patient in the world enrolled on this trial at the Alfred Hospital in 2015 - the results of which are published today in the Journal of Clinical Oncology.

Given little hope of survival beyond a few months at diagnosis, Kaye remains well and without evidence of the cancer four years later.

Associate Professor Andrew Wei, from the Alfred Hospital and Monash University Clinical School, commenced research in this area almost two decades ago at the Walter and Eliza Hall Institute of Medical Research. He is now the lead clinician/researcher on the international trial of the cancer drug, currently combined with cytarabine to treat older adults with AML.

Taken separately these drugs achieve little, according to Associate Professor Wei. Venetoclax alone led to a 19% response rate in a US trial and cytarabine had a similar result, he said.

"But combining LDAC with venetoclax in older patients led to a 54% response rate, with half the study population surviving longer than 10 months," he added.

The trial tested 82 patients with a median age of 74 years and was conducted in Australia, Europe and the USA.

The current research is supported by another trial in older AML patients, which combined venetoclax with another drug, azacytidine and led to a 71% remission rate with an average life expectancy of almost 17 months.

Based on the early results of these two studies, the Food and Drug Administration in the US approved the use of these combination drug therapies in older people with AML on November 21 last year.

The drug combination acts on a protein prevalent in leukaemia cells called BCL-2 which controls the survival of the cells. Venetoclax acts by effectively switching off the protein and activating a self-destruct program in the cell.

Associate Professor Wei said that a randomised trial of the therapy, where patients on the therapy are compared to those who are not, has recently been completed and the results are awaited to support a submission to the Therapeutic Goods Association in Australia.

The findings are important not just because of the success of the treatment in a disease that, previously, was fatal, but because with an aging population AML is likely to become more prevalent in the future.

"AML arises due to mutations accumulating in the bone marrow over time. It also arises in patients who have previously had chemotherapy. With an expected doubling in the number of people over 65 in the next 30 years, the need to find more effective treatments for this disease is paramount," Associate Professor Wei said.

"AML research used to be likened to a 'clinical trial graveyard' because trials of new drugs into AML were rarely successful," Associate Professor Wei said.

"It was widely seen as an untreatable and inevitably fatal condition for older patients by most doctors. These two new trials have given real hope to patients who previously had little."

http://bit.ly/2UPbNT4

Laser-targeted removal of prostate tumors works as well complete removal of prostate

Laser treatment, however, preserves erectile and urinary functions

GALVESTON, Texas - Researchers from The University of Texas Medical Branch at Galveston, led by prostate cancer treatment pioneer Dr. Eric Walser, have shown that selectively destroying cancerous prostate tissue is as effective as complete prostate removal or radiation therapy while preserving more sexual and urinary function than the other treatments. This study is currently available in Journal of Vascular and Interventional *Radiology*.

Prostate cancer the second most common form of cancer in men. In fact, 1 in 9 men will be diagnosed during his lifetime. The American Cancer Society estimates 174,650 new cases and 31,620 deaths from prostate cancer in 2019.

With current screening techniques, prostate cancers are now often detected early enough so that with treatment, they stay within the prostate gland and don't spread or cause harm to the patient. However, aggressive treatments such as removing the prostate or radiation therapy can result in difficulty with urinary and sexual functions.

Walser, lead author, UTMB professor and chair of the department of radiology, helped to establish a less invasive method of targeting and removing only the cancerous prostate tissue called focal laser ablation or FLA. This outpatient procedure has very little recovery or pain and preserves erectile and urinary functions.

"FLA offers men more peace of mind than active surveillance or 'watchful waiting', the traditional alternative to radical treatment," said Walser. "FLA pairs MRI imaging to identify cancer-suspicious

areas in the prostate and advanced laser technology to remove it completely, with virtually no risk of impotence or incontinence."

In 120 men with low- to intermediate-risk prostate cancer treated with FLA, 17 percent needed additional cancer treatment after one year with no noticeable change in quality of life or urinary function. In a small group of men who underwent a more aggressive FLA, only 6 percent had evidence of cancer one year later. However, these men all noticed a significant drop in sperm count.

"Other studies have shown that after completely removing the prostate, 15 to 30 percent of patients have a cancer recurrence within 5 to 10 years of surgery," Walser said. "Although FLA doesn't yet have such long-term data, this technique may ultimately provide similar cancer control while better preserving quality of life."

Other authors include UTMB's Anne Nance, Leslie Ynalvez, Shan Yong, Jacqueline Aoughsten, Eduardo Eyzaguirre and Stephen Williams.

http://bit.ly/2umeAr9

Active substance from plant slows down aggressive eye cancer

Researchers at the Universities of Magdeburg and Bonn are testing a substance from the leaves of the coralberry (マンリョウ)

An active substance that has been known for 30 years could unexpectedly turn into a ray of hope against eye tumors. This is shown by a study conducted by researchers from the Universities of Bonn and Magdeburg together with US colleagues. The results are published in the renowned journal "Science Signaling".

The plant leaves of which contain the tested substance is anything but rare: At Christmas time you can find it in every well-assorted garden center.

***Ardisia crenata* - KENPEI's photo**

The coralberry decorates many German living rooms during the winter months. At this time it forms bright red fruits, which make it a popular ornamental plant. The plant, originally from Korea, is surprisingly resistant to insect attack: Its leaves contain bacteria that produce a natural insecticide - a toxin with the cryptic name FR900359, abbreviated FR.

This toxin could soon become a star in a completely different field: as a potential drug against uveal melanoma, the most common and aggressive variant of eye cancer. FR has been the focus of pharmaceutical research for some time now: "The substance inhibits an important group of molecules in the cells, the Gq proteins," explains Prof. Dr. Evi Kostenis from the Institute of Pharmaceutical Biology at the University of Bonn.

Gq proteins have a similar function in the cell as a city's emergency control center: When the control center receives a call, it informs the police, ambulance and fire brigade as required. Gq proteins, on the other hand, can be activated by certain control signals. In their activated form, they switch different metabolic pathways on or off. However, the cell should not permanently change its behavior. The Gq proteins therefore inactivate themselves after a short time.

In uveal melanoma, however, a tiny mutation prevents two important Gq proteins from returning to their inactive state. They thus remain permanently active - this is as if the control center were constantly sending emergency vehicles to the source of the fire, even though the fire has been extinguished for days. Due to this malfunction, cells harboring this mutation begin to divide uncontrollably.

"FR can stop this division activity," says Kostenis. "That's something no one would have expected." It has been known for some time that FR can prevent the activation of Gq proteins. The substance "clings" to the proteins and ensures that they remain in their inactive form. Common understanding was that FR ignores any Gq proteins that have already been activated. "Therefore, it seemed impossible for the

substance to be effective in mutated and thus permanently active Gq proteins," emphasizes Dr. Evelyn Gaffal.

A firm grip on the cancer causing protein

Gaffal recently moved from Bonn to the University of Magdeburg. Her research there includes strategies for combating skin cancer. "We also used FR in our experiments and were surprised to find that it suppresses the proliferation of cancer cells," she explains. Scientists now also know why this is so: The mutated Gq proteins also seem to occasionally revert into their inactive form. As soon as this happens, FR900359 intervenes and gets a firm grip on the molecule. As a result, over time, more and more Gq proteins are successively withdrawn from their activated state for good.

FR has already proven its effectiveness in cell cultures and in experiments with mice suffering from cancer. But there are still a few hurdles to overcome before application in humans becomes feasible. Above all, the substance must reach the tumor cells precisely, without hitting other tissues. "Gq proteins assume vital functions practically everywhere in the body," explains Prof. Kostenis. "If we want FR to kill only the tumor cells, we have to get the drug right there. However, this is a challenge that many other chemotherapies also have to deal with."

FR was isolated for the first time 30 years ago by Japanese researchers. Another 25 years would pass before its biological mode of action was described - by none other than the research groups led by Professor Gabriele M. König and Professor Evi Kostenis at the Institute of Pharmaceutical Biology of the University of Bonn. This work now forms the basis for a research group of the German Research Foundation (DFG) on the group of G proteins and the possibility of their pharmacological manipulation.

Publication: Suvi Annala, Xiaodong Feng, Naveen Shridhar, Funda Eryilmaz, Julian Patt, JuHee Yang, Eva M. Pfeil, Rodolfo Daniel Cervantes-Villagrana, Asuka Inoue, Felix Häberlein, Tanja Slodczyk, Raphael Reher, Stefan Kehraus, Stefania Monteleone, Ramona Schrage, Nina Heycke, Ulrike Rick, Sandra Engel, Alexander Pfeifer, Peter Kolb, Gabriele König, Moritz Bünemann, Thomas Tüting, José Vázquez-Prado, J. Silvio Gutkind, Evelyn Gaffal & Evi Kostenis: Direct targeting of Gaq and Ga11 oncoproteins in cancer cells; Science Signaling*; DOI: 10.1126/scisignal.aau5948*

http://bit.ly/2YfEzyc

Magnetic stir bars carry 'memory' from previous flasks and tubes

Surprisingly high level of surface contaminations of magnetic stir bars escapes regular cleaning and brings highly reactive traces of metal species from previous experiments to the next ones

With electron microscopy experiments and DFT calculations it was shown that plastic surface of magnetic stir bars can form reactive centers which absorb metal atoms from solution followed by growth of metal nanoparticles. The process readily takes place on the surface of PTFE-coated magnetic stir bars, ubiquitously used in modern chemistry and biology labs.

The regular in-use magnetic stir bars carry bunches of metal nanoparticles on their surface. It was demonstrated that the presence of a previously used magnetic stir bar in reaction medium is sufficient for initiating a full-scale catalytic reaction (promoted by leaching of metal species from the PTFE surface).

Magnetic stir bars are commonly regarded as reusable consumables, and in many labs they last for months and years. This study shows that in a regular catalysis lab almost all magnetic stir bars become permanently contaminated with metal nanoparticles after about a week of use. Regular routine cleaning procedures do not remove such contamination completely. Indeed, subsequent release of metal traces in the next reactions is unacceptable even in small quantitates, as it may add critical bias to many experimental settings.

In this study the authors examined stir bars from different laboratories, and only 1 bar out of 60 was found uncontaminated. They further investigated the origins of contamination, performed

on-line ESI-MS monitoring of the contamination process and demonstrated its impact on catalysis.

Metal contamination is a critical issue, which has paramount importance for the development of high-performance catalytic and synthetic systems. Although several issues dealing with metal contamination have been already discussed in literature, the chemical reactivity of PTFE remains underexplored, as it was believed to be an inert material.

It is difficult to imagine an article, which will intrigue every chemist or biochemist to read. But this one is. Magnetic stirrers are indispensable for treatment of solutions. Easy contamination and chemical activity of stir bars is like a bombshell for the research community.

http://bit.ly/2WfJ61L

Did judgmental gods help societies grow?

Powerful moralizing 'big gods' and prosocial supernatural punishment tend to appear only after the emergence of 'megasocieties' with populations of more than one million people

By Lizzie Wade Mar. 20, 2019 , 2:00 PM

Today's most popular religions have one thing in common: gods or supernatural laws (such as karma) that dictate moral behavior and punish transgressions. Act morally and these supernatural forces will reward you; break the rules and you'll be punished.

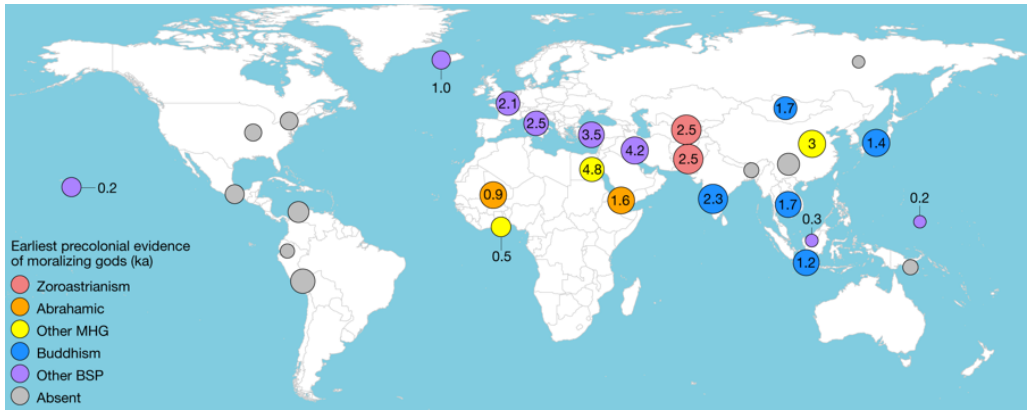
Sistine Chapel (Cappella Sistina) by Michelangelo Buonarroti, 16th century, fresco (post restoration), Buonarroti, Michelangelo (1475-1564) **Musei e Gallerie Pontificie, Musei Vaticani, Vatican City/Mondadori Portfolio/Bridgeman Images**

But moralizing gods seem to be quite rare in human history. Researchers know from ethnographies that the gods of hunter-gatherer societies, for example, don't much concern themselves with humans, much less their moral behavior. (Many of them focus on nature instead.) Now, a new study tests a popular hypothesis about why moralizing gods eventually took over.

Many scholars argue that moralizing gods were needed to build large-scale societies, an idea sometimes known as the "big gods" hypothesis, although it applies to impersonal supernatural moral laws like karma as well. Hunter-gatherers live in small bands in which everybody knows everybody else, so immoral behavior is virtually guaranteed to be discovered and punished. But in larger, more anonymous societies—from networks of interconnected villages to the first cities—people can break the rules without anyone noticing. If everyone did that, society would fall apart, so moralizing gods were needed to keep an eye on everyone and encourage cooperation instead of cheating. The more people cooperate, the more the society can grow.

To test this idea, a team of researchers used a new historical database called Seshat (named for the ancient Egyptian goddess of wisdom). Seshat contains information about the sizes, governments, militaries, religions, economies, and more of hundreds of societies spanning the past 10,000 years, making it possible for researchers to quantitatively compare them.

The scientists analyzed 414 societies from 30 regions around the world, from the deep past until the Industrial Revolution. They classified each society according to 51 measures of social complexity, such as how many people belonged to it and whether its government had hierarchical leadership. They also attempted to determine whether each society believed in a moralizing god (or gods) or a supernatural law that enforced values such as fairness and loyalty. It's "very ambitious," says Carol Ember, a cross-cultural anthropologist at Yale University, who wasn't involved in the new research.



***The area of each circle is proportional to social complexity of the earliest polity with moralizing gods to occupy the region or the latest precolonial polity for regions without precolonial moralizing gods. For regions with precolonial moralizing gods, the date of earliest evidence of such beliefs is displayed in thousands of years ago (ka), coloured by type of moralizing gods. The three transnational religious systems that represent the first appearance of moralizing gods in more than one region—Zoroastrianism, Abrahamic religions (Judaism, Islam and Christianity) and Buddhism—are coloured red, orange and blue, respectively, whereas other local religious systems with beliefs in MHG or BSP are coloured yellow and purple, respectively.* (c) the authors of the paper**

Large-scale societies did tend to have moralizing gods, whereas small-scale societies didn't, the team reports today in *Nature*. But when the researchers zeroed in on the 12 regions for which they could examine societies before and after the emergence of moralizing gods, they found that moralizing gods consistently appeared *after* a society had already grown large and complex.

That means these deities couldn't have helped a society with its initial growth spurt, says Patrick Savage, an anthropologist and ethnomusicologist at Keio University in Fujisawa, Japan, and an author of the new study. He suggests participating in religious rituals—which do tend to appear as social complexity is increasing—may be more important than belief in moralizing gods for first promoting cooperation. Once societies reach 1 million members or so, he says, moralizing gods seem to come in to stabilize cooperation between people who may have different languages, ethnicities, or cultural backgrounds.

That's "an interesting alternative hypothesis" that deserves to be investigated, says Edward Slingerland, a historian at the University of British Columbia in Vancouver, Canada, who helped develop the "big gods" hypothesis. But he worries about the reliability of Seshat's data, because the majority of them were collected and classified by research assistants and not expert historians.

"People are really going to be scrutinizing the data," and rightfully so, adds Quentin Atkinson, an evolutionary psychologist at the University of Auckland in New Zealand who wasn't involved in the new research. He points out, for example, that written or archaeological evidence for moralizing gods likely appeared well after belief in them begins, a lag that can skew the timing of their emergence in a database such as Seshat. "A lot rests on the quality of that information."

http://bit.ly/2Fw9H5b

Immunotherapy of precancerous skin lesions may prevent squamous cell carcinoma

Risk of skin cancer development cut almost 75 percent in clinical trial participants who received immunotherapy treatment

A treatment previously shown to clear the precancerous skin lesions called actinic keratosis now appears to reduce the chance that the treated skin will develop squamous cell carcinomas (SCCs), the second most common form of skin cancer.

In their paper being published online in JCI Insight, a team led by a Massachusetts General Hospital (MGH) investigator reports that treatment with the combination of two FDA-approved drugs - a topical chemotherapy and an immune-system-activating compound -

reduced the risk of SCC development on the face and scalp by almost 75 percent.

"This finding provides the first clinical proof-of-concept that an immunotherapy directed against premalignant tumors can prevent cancer," says Shawn Demehri, MD, PhD, of the MGH Center for Cancer Immunology and the Cutaneous Biology Research Center (http://www.massgeneral.org/cbrc/), senior author of the report. "We hope our findings will establish that the use of premalignant lesions as personalized therapeutic targets can train the immune system against the progression to cancer."

A common lesion that develops in sun-damaged skin, actinic keratosis is the third most common reason for U.S. patients to consult a dermatologist. While the chance of an individual lesion progressing to cancer is only 1 percent, the majority of SCCs develop from existing actinic keratosis lesions.

In a study) published in the January 2017 issue of the *Journal of Clinical Investigation*, Demehri and his team reported that twice-daily treatment for four days with a combination of calcipotriol, an FDA-approved treatment to treat psoriasis, and 5-fluorouracil (5-FU) cream, a standard treatment for actinic keratosis, significantly reduced the number and size of actinic keratosis lesions.

The current study follows up on the participants of the 2017 trial to determine whether or not the combined treatment reduced the risk of their developing SCCs.

Of the 130 participants in original trial - 64 who received calcipotriol plus 5-FU and 66 who received a control treatment of 5-FU in petroleum jelly - three-year outcome results were available for 84 individuals, 39 who received the combination treatment and 45, the control treatment. Results for treatment on the face and scalp were available for 72 participants (32 combination treatment and 40 controls).

Overall, a greater proportion of participants who received the combination treatment for lesions on their face and scalp remained free of SCC development for more than three years after treatment, with only 7 percent developing SCC compared with 28 percent in the control group.

Samples of treated face and scalp tissues of 22 participants showed higher levels of tissue-resident memory T cells - both CD4+ and CD8+ T cells - in normal skin treated with the combination treatment, compared with the control group.

While treatment did not reduce SCC development on the arms, the investigators believe that may result from greater immune system activation on the face and scalp along with better penetration of topical treatments on those areas. They hypothesize that longer treatment with calcipotriol plus 5-FU may be required to reduce SCC risk on the arms and other parts of the body.

"Our previous findings that calcipotriol plus 5-FU is highly effective for actinic keratosis clearance has led to its being increasingly used in clinics around the world, although further clinical studies are required for formal FDA approval," says Demehri, an assistant professor of Dermatology at Harvard Medical School. "The treatment of SCC can be costly and has significant side effects, and it can be deadly, particularly for patients with suppressed immune systems.

"The primary reason for treating actinic keratosis is to prevent SCC development, and our findings suggest this immunotherapy may be an effective way of achieving that goal," he adds. "Finding that targeting precancerous lesions with a robust T-cell-directed immunotherapy can yield effective cancer prevention may be applicable to other organs than the skin, something we hope to investigate for malignancies such as breast cancer, for which immunoprevention is an urgent, unmet need."

The lead author of the JCI Insight report is Abby Rosenberg of the Division of Dermatology at Washington University School of Medicine in St. Louis. Additional co-authors are Mary Tabacchi, Michael Wallendorf, MD, Ilana Rosman, MD, and Lynn Cornelius, MD, Washington University School of Medicine; and Kenneth Ngo, MGH Center for Cancer Immunology and the Cutaneous Biology Research Center. The study was supported by National Institutes of Health grants K08 AR068619 and DP5 OD0213530 and grants from the Burroughs Wellcome Fund, the Sidney Kimmel Foundation and the Cancer Research Institute. Cornelius and Demehri are co-inventors on a filed patent for calcipotriol plus 5-FU to treat precancerous skin lesions.

http://bit.ly/2HAsfDC

Do hopes and prayers work? Looks like that's a no

Three double-blind studies in 20 years find little evidence that praying improves outcomes for heart patients.

Andrew Masterson reports.

Praying might be a favourite response to the misfortune of others, but there's precious little evidence that it works. **Jean-Philippe Tournut/Getty Images**

It happens with such regularity that, in the US at least, it has become a cliché. Every time there is a mass shooting, or a tornado hits a town, or an epidemic surges, people in positions of power offer up hopes and prayers for the victims.

This, of course, begs the question: do prayers have any effect?

It's an important consideration, given that in modern American politics prayers are generally deployed instead of other interventions, such as, for instance, gun control laws, climate policy or affordable healthcare.

So, have the healing effects of prayer ever been put to the test by scientists? Yes, a few times, and the results are, at best, uncertain and, at worst, counter-productive.

Most tests have focussed on medical conditions and treatment, which are naturally easier to monitor and quantify than, say, the mental health of mass shooting victims and witnesses. Cardiac surgery has been a particular favourite.

In 1999, a team led by William Harris from the Sanford School of Medicine at the University of South Dakota set up a double-blind trial to test the efficacy of prayer on 990 patients admitted to a coronary care unit (CCU).

On admission, the patients were randomly assigned into two groups. The names of members of the first groups were given to groups of religious believers, who prayed for them daily for four weeks. The second group received no prayers.

The results showed that the patients in receipt of prayer had 11% fewer setbacks than those that did not. There was no difference in length of hospital stay between the two groups.

Writing in the journal *JAMA Internal Medicine*, Harris and his colleagues noted there was "no known way to ascribe a clinical significance" to the result, but added that further studies should be conducted.

One such was done in 2006 and reported in the *American Heart Journal*. This had a more complex set-up. It involved patients admitted to six US hospitals, and randomly assigned to three groups. The first had people praying for them, but were told such a thing "may or may not" happen. The second received no prayers, but were told the same thing. The third group received prayer and was told that it was definitely happening. All up, 1800 patients were involved.

The results were curious. The two groups who did not know whether or not they were receiving prayers had almost identical levels of complications – 51% and 52%. The group which knew for sure people were putting in a good word for them with God fared significantly worse, with a 59% rate of complications.

In 2009, the Cochrane Library – an organisation that specialises in systematically reviewing other research – took a close look at the

matter, poring over the methods and results of 10 studies that investigated the clinical power of prayer.

Lead author Leanne Roberts actually came from a religious background, holding a position at the Southwark Diocesan Office at Trinity House in London, UK. Despite that, she and her colleagues came away unimpressed by the data.

"These findings are equivocal and, although some of the results of individual studies suggest a positive effect of intercessory prayer, the majority do not and the evidence does not support a recommendation either in favour or against the use of intercessory prayer," they wrote. They added that they were not convinced enough even by a couple of apparently positive outcomes in a few of the studies to feel it was worth recommending further trials.

They concluded that they "would prefer to see any resources available for such a trial used to investigate other questions in health care".

And that, perhaps, is an outcome we can all hope for.

https://go.nature.com/2WlSKjo

Baby monkey is first primate created using sperm from tissue transplanted into dad

The technique could help boys made infertile by cancer treatment to become fathers later in life.

Heidi Ledford

A one-of-a-kind rhesus macaque named Grady is growing up under intense scrutiny at the Oregon National Primate Research Center in Beaverton. That's because she has an unusual pedigree: researchers created her using sperm from tissue harvested from her father's testicles when he was young, and then grafted onto his body as an adult. If all goes well with Grady, the technique might one day be used to restore fertility in boys who have received damaging cancer treatments.

Grady's birth, reported on 21 March in *Science*[1], marks a crucial success in the long-running effort to provide the possibility of fatherhood to boys who are treated for cancer before they are old enough to make sperm that could be frozen and stored for future use. The reproductive biologists who developed the method are now watching the nearly year-old macaque (*Macaca mulatta*) closely to see whether she develops normally.

Researchers have previously used the technique to produce babies in mice and pigs, says lead study author and reproductive biologist Kyle Orwig at the University of Pittsburgh School of Medicine in Pennsylvania. If Grady grows up without any issues, then the method could be ready for testing in people, he adds.

Transplanting for the future

Orwig's team harvested tissue from the testicles of five monkeys — including Grady's father — when they were too young to produce sperm. They froze the tissue samples until just before the monkeys reached puberty, then thawed the samples and sewed the tissue under the skin on the back and scrotum of the animals.

Less than a year later, the patches of tissue were producing testosterone, and all of the tissue recovered from both graft sites were making sperm. Orwig's team then took sperm from Grady's father and used *in vitro* fertilization to produce an embryo.

Other research teams are working to apply similar methods to farm animals by transplanting sperm-producing stem cells from 'elite' livestock into less-elite individuals. The hope is that sufficient numbers of sperm from the elite fathers would be produced in the ejaculate of lower-value males. This could speed up breeding efforts by generating many males that are capable of producing high-value offspring.

In 2012, Orwig's team reported early success using a similar stem-cell transplant technique in monkeys[2]. But the researchers didn't produce babies using the sperm at that time, because they couldn't

determine whether any baby monkeys created with this method would have come from sperm made by the transplanted cells, or by cells in the male monkeys that had recovered some function after being damaged.

Still, the success was enough to convince Orwig that a human treatment might be only a decade or two away, and so he launched an effort to collect testicular tissue from boys undergoing fertility-destroying medical treatments. Orwig's team, along with collaborators at other medical centres, have collected such tissue from more than 200 boys. That tissue could be used for either of Orwig's approaches — the stem-cell transplants or the tissue grafts described in the latest report — if he can get them to work in people.

One giant leap

For reproductive biologist Stefan Schlatt of the University of Münster in Germany, Orwig's success with grafting should be enough to pave the way for clinical trials. "I think with that paper, ethics committees throughout the world will be granting clinical studies," he says.

But Ellen Goossens, a reproductive biologist at Vrije Universiteit Brussel, cautions that tissue transplants from people with cancer could carry malignant cells that are capable of seeding fresh tumours. Researchers will need to develop ways to ensure the grafts are cancer-free, she says.

Nevertheless, the success in monkeys is important for the field, Goossens says. Previous efforts had succeeded in generating sperm when tissue was grafted into rodents, she notes, but sperm production is different between rodents and primates such as monkeys and humans. "It's a huge step that this can be performed in primates," she says.

doi: 10.1038/d41586-019-00938-9

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http://bit.ly/2U27eYv

Why Is There More Matter Than Antimatter?

A new experiment at the world's most powerful particle collider sheds light on an enduring cosmic mystery

By Marco Gersabeck, The Conversation

Why do we exist? This is arguably the most profound question there is and one that may seem completely outside the scope of particle physics. But our new experiment at CERN's Large Hadron Collider has taken us a step closer to figuring it out.

To understand why, let's go back in time some 13.8 billion years to the Big Bang. This event produced equal amounts of the matter you are made of and something called antimatter. It is believed that every particle has an antimatter companion that is virtually identical to itself, but with the opposite charge. When a particle and its antiparticle meet, they annihilate each other—disappearing in a burst of light.

Why the universe we see today is made entirely out of matter is one of the greatest mysteries of modern physics. Had there ever been an equal amount of antimatter, everything in the universe would have been annihilated. Our research has unveiled a new source of this asymmetry between matter and antimatter.

Antimatter was first postulated by Arthur Schuster in 1896, given a theoretical footing by Paul Dirac in 1928, and discovered in the form of anti-electrons, dubbed positrons, by Carl Anderson in 1932. The positrons occur in natural radioactive processes, such as in the decay of Potassium-40. This means your average banana (which contains Potassium) emits a positron every 75 minutes. These then annihilate with matter electrons to produce light. Medical applications like PET scanners produce antimatter in the same process.

The fundamental building blocks of matter that make up atoms are elementary particles called quarks and leptons. There are six kinds of quarks: up, down, strange, charm, bottom and top. Similarly, there

are six leptons: the electron, muon, tau and the three neutrinos. There are also antimatter copies of these twelve particles that differ only in their charge.

Antimatter particles should in principle be perfect mirror images of their normal companions. But experiments show this isn't always the case. Take for instance particles known as mesons, which are made of one quark and one anti-quark. Neutral mesons have a fascinating feature: they can spontaneously turn into their anti-meson and vice versa. In this process, the quark turns into an anti-quark or the anti-quark turns into a quark. But experiments have shown that this can happen more in one direction than the opposite one—creating more matter than antimatter over time.

Third time's a charm

Among particles containing quarks, only those including strange and bottom quarks have been found to exhibit such asymmetries—and these were hugely important discoveries. The very first observation of asymmetry involving strange particles in 1964 allowed theorists to predict the existence of six quarks—at a time when only three were known to exist. The discovery of asymmetry in bottom particles in 2001 was the final confirmation of the mechanism that led to the six-quark picture. Both discoveries led to Nobel Prizes.

Both the strange and bottom quark carry a negative electric charge. The only positively charged quark that in theory should be able to form particles that can exhibit matter-antimatter asymmetry is charm. Theory suggests that if it does, then the effect should be tiny and difficult to detect.

But the LHCb experiment has now managed to observe such an asymmetry in particles called D-meson—which are comprised of charm quarks—for the first time. This is made possible by the unprecedented amount of charm particles produced directly in the LHC collisions, which I pioneered a decade ago. The result indicates that the chance of this being a statistical fluctuation is about 50 in a billion.

If this asymmetry is not coming from the same mechanism causing the strange and bottom quark asymmetries, this leaves room for new sources of matter-antimatter asymmetry that can add to the total such asymmetry in the early universe. And that's important as the few known cases of asymmetry can't explain why the universe contains so much matter. The charm discovery alone will not be sufficient to fill this gap, but it is an essential puzzle piece in the understanding of the interactions of fundamental particles.

Next steps

The discovery will be followed by an increased number of theoretical works, which help to interpret the result. But more importantly, it will outline further tests to deepen the understanding following our finding—with a number of such tests already ongoing.

Over the coming decade, the upgraded LHCb experiment will boost the sensitivity for these kinds of measurements. This will be complemented by the Japan-based Belle II experiment, which is just starting to operate. These are exciting prospects for research into matter-antimatter asymmetry.

Antimatter is also at the heart of a number of other experiments. Whole anti-atoms are being produced at CERN's Antiproton Decelerator, which feeds a number of experiments conducting high precision measurements. The AMS-2 experiment aboard the International Space Station is on the lookout for antimatter of cosmic origin. And a number of current and future experiments will tackle the question of whether there is antimatter-matter asymmetry among neutrinos.

While we still cannot completely solve the mystery of the universe's matter-antimatter asymmetry, our latest discovery has opened the door to an era of precision measurements that have the potential to uncover yet unknown phenomena. There's every reason to be

optimistic that physics will one day be able to explain why we are here at all.

This article was originally published on The Conversation. Read the original article.

http://bit.ly/2CyTScc

Prenatal allergies prompt sexual changes in offspring

Female rats born to exposed moms act like males, study finds

COLUMBUS, Ohio - A single allergic reaction during pregnancy prompts sexual-development changes in the brains of offspring that last a lifetime, new research suggests.

Female rats born to mothers exposed to an allergen during pregnancy acted more characteristically "male" - mounting other female rodents, for instance - and had brains and nervous systems that looked more like those seen in typical male animals.

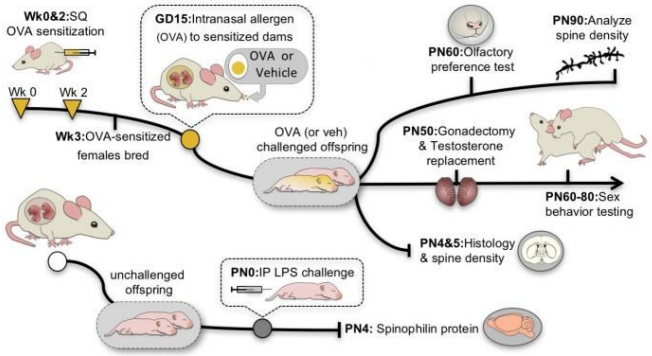
The male offspring also showed a tendency toward more female characteristics and behaviors, though the changes were not as significant.

"The study shows for the first time that an allergic reaction in a mother could alter the sexual development of its offspring," said Kathryn Lenz, the study's lead author and an assistant professor of psychology at The Ohio State University. The research appears online in the journal Scientific *Reports*.

"This allergic response is enough to make the female brain look like a male's brain, and that's something that endures throughout its entire life."

Previous research has shown that insults to the immune system, including stress, infection and malnutrition, can change brain development. This new research highlights the important role allergies could play, Lenz said.

She compared the allergic reaction in the study to an asthma attack - something that prompts a more-robust immune response than low-grade seasonal allergies but less severe than an allergic attack that would require a person to use an EpiPen or go to the emergency department.



Researchers at The Ohio State University found that rats born to moms who had an allergic reaction during pregnancy exhibited unexpected sexual behaviors and experienced brain changes that made them look more like animals of the other gender. **Credit: The Ohio State University**

Sexual development occurs on a spectrum and, in and of themselves, these shifts in sexual behavior after allergy exposure are not particularly troubling, Lenz said. They do help researchers understand the interplay between allergens and brain development, however, and highlight that early life immune activation could be a source of normal variations in female behavior, which haven't been as well-studied.

And these types of brain changes as a response to an allergen could mean changes in other areas of concern, such as cognitive development.

"It's possible these changes could also contribute to things like impaired decision-making, attention and hyperactivity," she said.

The study builds on Lenz's previous work, which found changes in immune cells called microglia and mast cells in an area of the brain called the preoptic area, a region of the hypothalamus involved in sexual behavior.

"We wanted to see if an allergic exposure that activated these cells would also change typical development," said Lenz.

Mother animals in the study were either exposed once to an allergen derived from eggs or unexposed.

Then, the research team studied their pups into adulthood. Females born to mothers that had an allergic reaction during pregnancy exhibited higher levels of behavior normally attributed to males. They mounted other females more often and were as quick to mount another female as typical male rats. They also were drawn to bedding that smelled like other females.

Furthermore, they had increases in brain cells called mast cells and microglia and evidence of more synapses in the brain - changes that looked more like what the researchers would expect in a male rat.

Males born to the allergy-exposed mothers behaved less like typical male rats. They had less interest in mounting and less interest in female bedding. The researchers also saw less activation of microglia and fewer synapses - both of which point to a change in the rats as a result of the allergen exposure that made them more like females, Lenz said.

"Most of the scientific literature on immune activation during pregnancy and outcomes in offspring has focused on autism and schizophrenia. This is the first time we're seeing this kind of connection with altered sexual development," Lenz said.

"Interestingly, there's some research out there to show an increase in gender variance and gender-identity differences in people with autism. It suggests that something about sexual development is different in people with autism."

Lenz said she was especially interested in the profound changes seen in female brain development, because that's an area that hasn't been as well-studied in neuroscience.

"Oftentimes, we are focused on male animals because they appear to be more sensitive to environment changes and also have a higher incidence of conditions such as ADHD and autism. We often frame what we understand about the female brain and female behavior in relation to males. We need to move past that," Lenz said.

"Study of female sexual development has just really been neglected. Even though we know there's wide variety in girls' and women's behavior, we don't really understand what contributes to those variations."

Though it's too soon to draw connections between what has been seen in the rats and human development, it may be worthwhile to explore further how medications and other factors during pregnancy may contribute to developmental changes in the fetus, Lenz said.

Other researchers who worked on the study were Anabel Galan of Ohio State and Margaret McCarthy, Lindsay Pickett and Christopher Wright of the University of Maryland School of Medicine.

http://bit.ly/2TSJpmy

Bonanza of Bizarre Cambrian Fossils Reveals Some of the Earliest Animals on Earth

A newfound fossil site in China is teeming with bizarre, primitive species that have never before been found any place on Earth.

By Mindy Weisberger, Senior Writer

The bounty of creatures includes a spiny, segmented animal known as a mud dragon, and several jellyfish with preserved tentacles.

Paleontologists discovered this treasure trove of fossils, which are incredibly well-preserved, along the banks of the Danshui River in southern China. The dozens upon dozens of creatures date to the Cambrian Period (490 million to 530 million years ago), when Earth's animal diversity was booming at an unprecedented pace.

Artist's rendering of the Qingjiang biota showing characteristic early Cambrian life from the well-preserved fossil site. **Dongjing Fu**

Scientists collected hundreds of specimens and identified fossils of 101 animals. Of those, more than half are new species that have yet to be described, the researchers reported in a new study.

"It is a huge surprise to find a new deposit of such incredible richness and with such a large proportion of species that are completely new to science," study co-author Robert Gaines, a professor in the Geology Department at Pomona College in California, told Live Science in an email.

Researchers in China discovered the site while exploring early Cambrian rocks nearby. During their lunch break by the river, the scientists noticed "a striking pattern of alternating gray and black stripes" in the rocks of the river bank. This type of sediment pattern indicates areas where ancient mudflows once surged — flows that may have buried and preserved ancient organisms, Gaines explained.

The scientists started chipping away at the rock, and sure enough, they soon detected the first of the site's exceptional fossil remains, now known collectively as the Qingjiang biota, they wrote in the study.

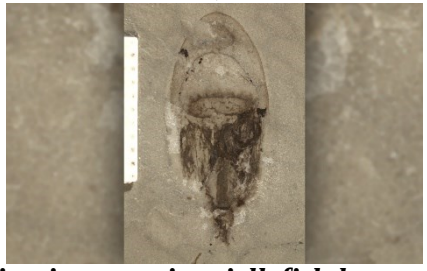
An unidentified species of Cambrian arthropod from the Leanchoilia genus has armlike appendages and long feelers. **Xingliang Zhang**

All told, the team uncovered fossils of more than 50 species unknown to science. Many of the fossils — bell-shaped jellyfish, spiky worms, armored arthropods and more — retain an astonishing level of detail in their preserved soft tissues, such as gills, digestive systems and even eyes. "Qingjiang is a new window on a different type of early Cambrian ecosystem," Gaines said.

As in other rich fossil deposits of well-preserved Cambrian life — the Burgess Shale deposits in Canada and the Chengjiang deposits in China's Yunnan Province — the Qingjiang animals had been quickly swallowed by mudflows and then buried in fine-grain soils, Gaines said. As sediment "cemented" around the tiny bodies, it locked out microbes and halted the process of decay.

This preserved "exquisite primary organic remains of creatures like jellyfish and worms that usually leave no fossil record," he said.

In fact, jellyfish and sea anemones, which are among the earliest known animals, are far more numerous in the Qingjiang biota than in the Burgess Shale or Chengjiang sites, the researchers reported.



One of the still-undescribed species from China is an ancient jellyfish known as a cnidarian; visible here are two layers of its "umbrella" and an array of tentacles. **Xingliang Zhang**

What's more, the Qingjiang fossils' condition is substantially better than that of fossils at the other Cambrian sites. At Burgess Shale, the formation of the Rocky Mountains heated and compressed the fossils; though anatomical details remained, the fossils were reshaped from their original forms, according to Gaines. And in Chengjiang, groundwater that flowed over the fossil deposits over millions of years also carried away some of the detail of their original shapes.

"The Qingjiang fossils, however, are pristine, and appear much as they would have after they were fossilized in the Cambrian period," Gaines said. The findings were published online today (March 21) in the journal Science.

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Researchers point to a common cause in sudden death syndromes

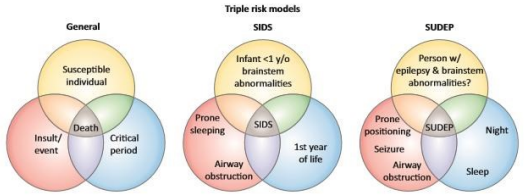
Inability for an individual to wake up when their CO2 blood levels rise may be a shared cause for incidences of death

Sudden Infant Death Syndrome (SIDS) and Sudden Unexpected Death in Epilepsy (SUDEP) are syndromes that share many medical

similarities but whose physiological causes are poorly understood. An opinion article publishing March 21 in the journal Trends in Neurosciences suggests that the inability for an individual to wake up when their CO2 blood levels rise, likely due to a faulty neural reflex, may be a shared cause for incidences of death in both disorders.

"If someone's airway is blocked with a blanket, for example, they are unable to expel CO2, which causes their CO2 blood levels to rise. Normally, this triggers a series of reactions that cause the individual to wake up and either re-position themselves so that they can breathe again, or cry out for help, like in the case of a baby," says author Gordon Buchanan, an associate professor of neurology at the University of Iowa. "However, in instances of SIDS and SUDEP, evidence is beginning to suggest that elevated CO2 doesn't trigger this wake-up response like it should, which can ultimately result in death."

Why a person would fail to wake up from increased CO2 is not fully understood, but a potential explanation is that a malfunctioning serotonin receptor in the midbrain may be responsible.



This graphical abstract shows risk models for a susceptible individual (left), for SIDS (middle),and for SUDEP (right). **Buchanan et al./Trends in Neurosciences**

"Serotonin neurons in the medulla are involved in regulation of breathing, and we think the ones in the midbrain are involved in regulating a person's ability to wake up," says Buchanan. "In instances of SIDS and SUDEP, autopsies frequently reveal that there are abnormalities in the individual's serotonin system in the brain.

"It is very possible that there is a direct path by which CO2 is sensed by serotonin receptors in the midbrain, and when there is too much CO2 present, the brain reacts by waking up the individual," he says. "The existence of this direct pathway is important because it could drive future treatments."

However, applying this information to create preventative therapies for these syndromes is still in the works. In addition to validating that SIDS and SUDEP are caused by an inability to wake up because of a defective CO2 system, a safe and reliable way to test if a person has dysfunctional serotonin receptors needs to be developed as well. Currently, such determinations are possible only through autopsies.

In the meantime, parents or caregivers for infants or people with epilepsy should employ the same preventative measures that have been recommended, and largely successful, for decades. "For infants six months and younger, which is the population most susceptible to SIDS, parents should put babies on their backs to sleep. At that age, they can't really roll, so they should stay put through the night," Buchanan says. Further, not putting plush toys or blankets in the crib and dressing the baby in tight-fitting clothing are other guidelines to follow.

"As for people with epilepsy who may be prone to SUDEP, which tends to be people who have nighttime seizures, they can also try to sleep on their backs, although it's less likely that they'll stay like that throughout the night since they can roll," says Buchanan. "And in both cases, using a baby monitor to keep an eye on the individual can be helpful."

Buchanan is supported by the NIH/NINDS; the Pappajohn Biomedical Institute and Iowa Neuroscience Institute at the University of Iowa; and the Beth Levitt Tross Professorship in Epilepsy Research.

Trends in Neurosciences, Buchanan, G.: "Impaired CO2-induced arousal in SIDS and SUDEP" https://www.cell.com/trends/neurosciences/fulltext/S0166-2236(19)30018-9

http://bit.ly/2HPCtQ0

Jupiter's unknown journey revealed

Giant planet formed four times further from the sun and then migrated to its current orbit

It is known that gas giants around other stars are often located very near their sun. According to accepted theory, these gas planets were formed far away and subsequently migrated to an orbit closer to the star.

Now researchers from Lund University and other institutions have used advanced computer simulations to learn more about Jupiter's journey through our own solar system approximately 4.5 billion years ago.

At that time, Jupiter was quite recently formed, as were the other planets in the solar system. The planets were gradually built up by cosmic dust, which circled around our young sun in a disk of gas and particles. Jupiter was no larger than our own planet.

The results show that Jupiter was formed four times further from the sun than its current position would indicate.

"This is the first time we have proof that Jupiter was formed a long way from the sun and then migrated to its current orbit. We found evidence of the migration in the Trojan asteroids orbiting close to Jupiter", explains Simona Pirani, doctoral student in astronomy at Lund University, and the lead author of the study.

These Trojan asteroids consist of two groups of thousands of asteroids that reside at the same distance from the Sun as Jupiter, but orbiting in front of and behind Jupiter, respectively. There are approximately 50 per cent more Trojans in front of Jupiter than behind it. It is this asymmetry that became the key to the researchers' understanding of Jupiter's migration.

"The asymmetry has always been a mystery in the solar system", says Anders Johansen, professor of astronomy at Lund University.

Indeed, the research community had previously been unable to explain why the two asteroid groups do not contain the same number of asteroids.

However, Simona Pirani and Anders Johansen, together with other colleagues, have now identified the reason by recreating the course of events of Jupiter's formation and how the planet gradually drew in its Trojan asteroids.

Thanks to extensive computer simulations, the researchers have calculated that the current asymmetry could only have occurred if Jupiter was formed four times further out in the solar system and subsequently migrated to its current position. During its journey towards the sun, Jupiter's own gravity then drew in more Trojans in front of it than behind it.

According to the calculations, Jupiter's migration went on for around 700 000 years, in a period approximately 2-3 million years after the celestial body started its life as an ice asteroid far from the sun.

The journey inwards in the solar system followed a spiralling course in which Jupiter continued to circle around the sun, albeit in an increasingly tight path. The reason behind the actual migration relates to gravitational forces from the surrounding gases in the solar system.

The simulations show that the Trojan asteroids were drawn in when Jupiter was a young planet with no gas atmosphere, which means that these asteroids most probably consist of building blocks similar to those that formed Jupiter's core.

In 2021, NASA's space probe Lucy will be launched into orbit around six of Jupiter's Trojan asteroids to study them.

"We can learn a lot about Jupiter's core and formation from studying the Trojans", says Anders Johansen.

The authors of the study also suggest that the gas giant Saturn and the ice giants Uranus and Neptune could have migrated in a similar way.

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Teens who seek solitude may know what's best for them, research suggests

Despite stigma, solitude doesn't have to be problematic for adolescents and young adults

Teens who choose to spend time alone may know what's best for them, according to new research that suggests solitude isn't a red flag for isolation or depression.

The key factor is choice, say researchers at the University of California, Santa Cruz, and Wilmington College: When solitude is imposed on adolescents and young adults, whether as punishment or as a result of social anxiety, it can be problematic. But chosen solitude contributes to personal growth and self-acceptance, they found.

"Solitude has gotten a lot of bad press, especially for adolescents who get labeled as social misfits or lonely," said Margarita Azmitia, professor of psychology at UC Santa Cruz and coauthor of a new paper in the Journal of Adolescence. "Sometimes, solitude is good. Developmentally, learning to be alone is a skill, and it can be refreshing and restorative."

Most previous studies confounded solitude with loneliness or shyness, said Azmitia. "There's a stigma for kids who spend time alone. They're considered lacking in social skills, or they get labeled 'loners,' " she said. "It's beneficial to know when you need to be alone and when you need to be with others. This study quantifies the benefits of solitude and distinguishes it from the costs of loneliness or isolation."

Virginia Thomas (PhD, '17, psychology), assistant professor of psychology at Wilmington College, spearheaded the research as a graduate student in Azmitia's lab, where she developed a specialization in the role of solitude in identity development and emotional wellbeing.

When adolescents and young adults choose to spend time alone, solitude can provide an opportunity for self-reflection, creative expression, or spiritual renewal. But it can be challenging when it is imposed on them--when they opt out of social engagement because they lack friends, feel awkward, experience social anxiety, or are being punished, said Thomas.

To distinguish between these motivations, Thomas and Azmitia developed a 14-item survey that asked respondents to rate their motivations for solitude on a four-point scale, posing questions like, "I feel energized when I spend time by myself," and "I enjoy the quiet," versus "I feel uncomfortable when I'm with others," and "I regret things I say or do when I'm with others."

"We got clear results that are pretty reliable indicators of adaptive versus maladaptive solitude," said Thomas. Those who seek solitude because they feel rejected or want to retreat into isolation are at greater risk of social anxiety, loneliness, and depression, and they tend to have lower levels of identity development, autonomy, and positive relationships with others. In contrast, those who seek solitude for positive reasons, such as self-reflection or a desire for peace and quiet, face none of these risks.

Today's fast-paced, device-driven culture emphasizes being connected to friends and associates 24/7, and young people have little practice learning to manage their time alone productively. Imposed solitude is more problematic for adolescents, who often worry about being rejected by their peers or friends or fear that being alone means they are unpopular. However, the capacity for solitude blossoms in young adults, the researchers found.

"These results increase our awareness that being alone can be restorative and a positive thing," said Thomas. "The question is how to be alone without feeling like we're missing out. For many people, solitude is like exercising a muscle they've never used. You have to develop it, flex it, and learn to use time alone to your benefit."

Solitude serves the same positive functions in introverts and extroverts. "Introverts just need more of it," noted Thomas.

"Our culture is pretty biased toward extroversion," she said. "When we see any sign of shyness or introversion in children, we worry they won't be popular. But we overlook plenty of well-adjusted teens and young adults who are perfectly happy when alone, and who benefit from their solitude."

Both researchers encouraged parents to appreciate the benefits of solitude for their children. "Parents can help their children understand that being alone isn't bad. It doesn't mean nobody likes you," said Azmitia. "Solitude can improve the wellbeing of kids who are overstimulated. They can learn to regulate their behavior, on their own, without being told to."

"We need to build our cultural understanding that we don't have to be social all the time," said Azmitia. "Sometimes alone time is good time."

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Missed something the doctor said? Recording your appointments gives you a chance to go back

It's often hard to comprehend complicated medical information from your doctor – particularly if you've just received bad news.

Amelia Hyatt * **Ruby Lipson-Smith** **

You're in a consultation with your doctor and you've just been told you have cancer. You're in shock, and find it difficult to take in anything else the doctor says during the remainder of the appointment.

Research shows receiving bad news can impact people's ability to understand and absorb information. Specifically, it affects the processing of information and memory formation.

People who are unwell and managing difficult health situations will often find it hard to remember important and complex medical information. This might include their diagnosis, prognosis, treatment plans, appointments, and when to take their medication.

Since the 1970s, researchers have been experimenting with audio recording medical consultations to combat this problem.

Many studies and reviews since then have found patients who are given personalised recordings of their medical consultations feel their recall and understanding is improved.

We don't yet have evidence that directly links the recording of medical consultations with improved health outcomes. But we know people who understand and remember important medical information are better placed to remember to attend scheduled appointments, to decide on the best treatment options, and to take their medication correctly.

This is commonly referred to as health literacy, and people with higher health literacy are known to have improved health outcomes. So we have good reason to believe recording medical appointments might positively impact people's long-term health.

Could recording your medical appointments benefit you?

While most research around medical consultation recordings has been done with people diagnosed with cancer, the process could help any person in any medical situation.

People who speak English as a second language find recordings of medical consultations particularly useful.

And consultation recordings are not just useful for patients. Family members and friends often play a significant part in the care of a loved one who is unwell. Recordings give them the opportunity to be involved and informed – even if they cannot attend the appointment in person – as recordings are easily shared.

Patients in a recent study described using the recording to replay important sections to their family, to remind themselves of words to look up, and to prompt questions to ask their doctor.

patient trust and satisfaction with their doctor.

Health professionals including doctors and nurses believe consultation recordings benefit patients, and improve the care they are able to provide.

Patients have described which appointments they feel are most useful to record. These include appointments at diagnosis of a health condition, appointments where important information is discussed, or appointments where treatment plans are made. Others think recording every appointment would be useful for them.

The great thing about recordings is they are under the control of the patient, so they can be made and used in the way that suits the person best.

Ethical considerations

People are already using their mobile phones to record their doctors' appointments. One study from the UK found 69% of people were interested in recording consultations on their phones.

Although this is usually done with the doctor's permission, it's sometimes done covertly. This may diminish the trust and openness that should characterise any doctor-patient relationship, and may even be unlawful in some states. So you should always seek your doctor's permission before recording.

Importantly, if a health service endorses and provides a means for you to record your medical consultations, the recording is seen as forming part of your medical record.

By law in Australia, hospitals have a responsibility to safely store all parts of your medical record, including copies of consultation recordings made in this context.

Our team at the Peter MacCallum Cancer Centre has developed a smartphone app called SecondEars as part of a research project. This app will enable patients to record their consultations and share the recordings with family and friends.

Importantly, because this app has been designed to be integrated and supported by hospitals and other health services, once it's implemented in a health service, recordings will be able to be uploaded and saved in the patient's medical record.

Patients will have full control over which appointments they seek to record. It is hoped this service will be made available to health services around Australia in the future.

Disclosure statement

**Senior Researcher, Peter MacCallum Cancer Centre Amelia Hyatt is the principal investigator on the project developing the SecondEars app.*

***Research officer, Peter MacCallum Cancer Centre Ruby Lipson-Smith is the project manager on the project developing the SecondEars app.*

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Reel-y? New Beer Can Double as Motion Picture Film Developer

Kodak says a new beer hitting the market can be used to develop its Super 8 movie film.

Associated Press

ROCHESTER, N.Y. (AP) — Dogfish Head Craft Brewery in Delaware created its SuperEIGHT beer after a conversation with people at Kodak, the upstate New York technology company most famous for its photographic roots.

Image via AP

Dogfish learned from Kodak that heightened levels of acidity and vitamin C in certain beers could make them a processing agent for film. That inspired the brewery to design such a beer. Kodak helped by testing it.

Dogfish founder Sam Calagione says he'll document his summer travels on Super 8 film that will be developed in SuperEIGHT beer and turned into a short film.

The beer, made with pear, mango, berries, kiwi, quinoa and salt, is set for national distribution next month.