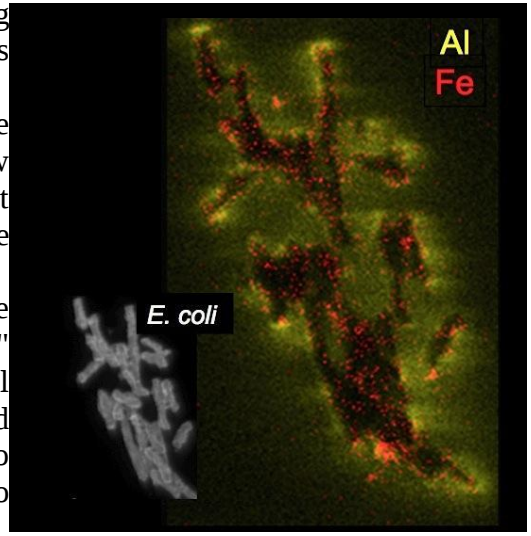
http://www.eurekalert.org/pub_releases/2016-01/asu-asd010816.php

ASU scientists discover how blue and green clays kill bacteria

Since prehistoric times, clays have been used by people for medicinal purposes.

Whether by eating it, soaking in a mud bath, or using it to stop bleeding from wounds, clay has long been part of keeping humans healthy. Certain clays have also been found with germ-killing abilities, but how these work has remained unclear.



Working in tandem, chemically reduced iron (Fe2+) and aluminum (Al3+) in blue clays can kill pathogenic bacteria, such as these E. coli cells. **ASU**

A new discovery by Arizona State University scientists shows exactly how two specific metallic elements in the right kinds of clay can kill troublesome bacteria that infect humans and animals.

"We think of this mechanism like the Trojan horse attack in ancient Greece," said Lynda Williams, a clay-mineral scientist at ASU's School of Earth and Space Exploration (SESE). "Two elements in the clay work in tandem to kill bacteria."

She explained, "One metallic element -- chemically reduced iron, which in small amounts is required by a bacterial cell for nutrition -- tricks the cell into opening its wall. Then another element -- aluminum -- props the cell wall open, allowing a flood of iron to enter the cell. This overabundance of iron then poisons the cell, killing it as the reduced iron becomes oxidized."

"It's like putting a nail in the coffin of the dead bacteria," said Keith Morrison, Williams' former doctoral student, who is now at Lawrence Livermore National Laboratory.

Morrison is the lead author of the paper reporting the discovery, which was published Jan. 8 in Nature *Scientific Reports*. Rajeev Misra, a microbiology professor in ASU's School of Life Sciences (SOLS) is the third author of the paper.

Morrison's work in Misra's laboratory gave insights into the mechanism by which clays work to kill bacteria. Both SESE and SOLS are units in the university's College of Liberal Arts and Sciences.

A critical part of the investigation involved the use of ASU's NanoSIMS, which is part of the National Science Foundation-supported Secondary Ion Mass Spectrometry Facility. The study also benefited from a variety of electron microscopes and X-ray equipment in the LeRoy Eyring Center for Solid State Science.

French green clay leads to Oregon blue clay

A chance discovery of a medicinal clay from Europe caught Williams' attention and put her on the track.

A French philanthropist with clinical experience in Africa told her about a particular green-hued clay found near the philanthropist's childhood home in France.

The philanthropist, Line Brunet de Courssou, had taken samples of the clay to Africa, where she documented its cure for Buruli ulcer, a flesh-eating skin disease, in patients in the African country of Cote d'Ivoire (Ivory Coast).

Williams attempted to locate the site of the green clay deposit, which was in the French Massif Central region. When the search proved unsuccessful, she began systematically testing clays sold online as "healing clays."

After testing dozens of samples, Williams and her team identified a blue-colored clay from the Oregon Cascades that proved to be highly antibacterial.

The research reported in the paper shows that it works against a broad spectrum of human pathogens, including antibiotic-resistant strains such as methicillin-resistant Staphylococcus aureus (MRSA).

The colors of the clays reflect their origins, Williams said. The greens and blues of antibacterial clays come from having a high content of chemically reduced iron (Fe2+), as opposed to oxidized iron (Fe3+), which gives the familiar red color of rust (Fe-oxide), often associated with many clays.

Reduced clays are common in many parts of the world, typically forming in volcanic ash layers as rocks become altered by water that is oxygen-deprived and hydrogen-rich.

"The novelty of this research is two-fold: identifying the natural environment of the formation of clays toxic to bacteria, and how the chemistry of these clays attacks and destroys the bacteria," said Enriqueta Barrera, a program director in the National Science Foundation's Division of Earth Sciences, which funded the research.

Because blue and green clays are found abundantly in nature, Williams said, this discovery of how their antibacterial action works should lead to alternative ways of treating infections and diseases that are persistent and hard to heal with antibiotics.

Williams said, "Discovery of how natural clays kill human pathogens may lead to a new economic use of such clays and also to new drug designs."

http://www.eurekalert.org/pub_releases/2016-01/qumc-nac011016.php

New analyses confirms biennial mammography starting at age 50 is optimal for average women

Unanimous finding of six research teams on breast cancer screening provided to USPSTF

WASHINGTON - New and comprehensive analyses from six independent research teams examining breast cancer screening intervals have produced a unanimous finding -- that mammography screening every two years for average risk women ages 50 to 74 offers a favorable balance of benefits to harm.

The conclusion is consistent with the same groups' analyses published in 2009, even with newly added data from digital mammography, advanced treatments and molecular tumor subtypes.

The findings, presented to the U.S. Preventive Services Task Force as part of its evidence review for breast cancer screening recommendations, are published in the Jan. 12 issue of *Annals of Internal Medicine*.

The analyses were conducted by modeling research teams that are part of the Cancer Intervention and Surveillance Modeling Network (CISNET), funded by the National Cancer Institute. Researchers from the Breast Cancer Surveillance Consortium (BCSC) also contributed to the research.

"CISNET's charge is to create models that can test a large number of screening and treatment scenarios, and provide evidence that can be considered for public health recommendations for average risk women. But it's important to remember that none of us is the 'average' woman," says the paper's lead author, Jeanne S. Mandelblatt, MD, MPH, of Georgetown Lombardi Comprehensive Cancer Center, and a principal investigator with CISNET.

As first reported in the groups' technical report published online in April 2015, the CISNET/BCSC analyses used the six independent simulation models to analyze 10 different digital breast cancer screening strategies for the average risk U.S. female population.

The researchers examined screening strategies with different starting ages (40, 45 or 50), and one- or two-year intervals between screening exams. The modeling uses national data on breast cancer incidence, risks for breast cancer, mammography characteristics, treatment effects, and risk of dying from other diseases. Then, the lifetime impact including benefits and harms of breast cancer screening mammography is calculated.

"These new analyses include information not in our 2009 report," Mandelblatt says. "We added digital mammography outcomes and the most modern treatments including therapy based on tumor molecular subtypes such as HER2 and ER status. We also included additional results for risk levels, breast density, and women's other illnesses to help guide clinical practice considerations." (Studies have suggested that women with dense breasts are more prone to cancer development.)

With the new updated data, the CISNET results still demonstrate the same finding as in 2009 -- that screening average-risk women biennially from ages 50 to 74 provides a reasonable balance of avoiding deaths from breast cancer and potential screening harms, including over-diagnosis, false-positives, and benign biopsies.

The researchers found that for average risk populations, starting screening earlier or screening more often prevented a small number of additional deaths, but also caused a larger number of false positive mammograms and benign biopsies, and led to more over-diagnosis and over-treatment.

"Still, the bottom line is that mammography saves lives. When to start screening and how often to undergo mammography is a personal decision. No model can provide those answers," Mandelblatt says.

Other CISNET modeling findings include:

- In an unscreened population, the models predict a median 12.9 percent ***cumulative probability of having a breast cancer diagnosis from ages 40 to 100. Without screening, the median probability of dying of breast cancer is 2.5 percent. Thus, if a particular screening strategy leads to a 30 percent reduction in breast cancer mortality, the probability of breast cancer mortality was reduced from 2.5 percent to 1.75 percent.***
- ***Screening biennially (every two years) from ages 50-74 achieves a median 25.8 percent breast cancer mortality reduction -- averting 7 breast cancer deaths per 1000 women screened -- and leads to 953 false positives and 19 over-diagnosed cases, or 12% of all screen detected cases. (Over-diagnosis occurs when the cancer is small and was never destined to become life threatening or because a woman can die of other illnesses before her breast cancer surfaces.)***
- ***In general, biennial strategies maintain an average of 81.2 percent of annual screening benefits with almost half the false positives and fewer over-diagnosed cases.***
- ***Compared with biennial screening from ages 50-74, starting biennial screening at age 40 averts one more death per 1000 from breast cancer and generates 576 more false positive tests and two additional over-diagnosed cancers for every 1000 women screened.***
- ***Annual screening from ages 50-74 averted 2 more deaths per 1000 compared to biennial screening, but had more substantially more harms, (845 more false positive tests and 6 more over-diagnosed cases) compared to biennial screening.***
- ***For women with a two- to four-fold increase in breast cancer risk compared with the average population, annual screening starting at age 40 or 45 would have a similar or more favorable harm to benefit ratio as biennial screening of average risk women from 50-74. (A two-fold increase in risk is seen in groups of women with a mother, sister or daughter with breast cancer.)***

- ***For women with even a 1.3-fold increase in risk (the level seen with high vs. average breast density, for example), biennial screening starting at age 40 would have similar ratios of harms to benefits as biennial screening of average risk groups from ages 50-74.***
- ***For healthy older women with an average remaining life expectancy of 17 years, screening would be reasonable through age 78 or 80 and would have a minimal increase in over-diagnosis compared with stopping at age 74. However, for women with moderate to severe illnesses, screening cessation at about age 68 offers a similar balance of harms and benefits as stopping at age 74 for women with average comorbidity.***

http://annals.org/article.aspx?doi=10.7326/M15-1536

The study was supported by the National Institutes of Health (National Cancer Institute grant U01 CA152958 and National Cancer Institute-funded BCSC grant P01 CA154292, contract HSN261201100031C and grant U54CA163303). The investigators worked with members of the USPSTF and AHRQ staff to develop the scope and key questions for this research. The USPSTF, AHRQ and the funding sources had no role in study conduct.

In addition to Mandelblatt, authors include Kathleen A. Cronin, PhD, MPH, and Harry J. de Koning, MD, PhD, who served as dual senior authors. Eric Feuer, PhD, was responsible for overall CISNET project direction. Additional authors include Natasha K. Stout, PhD and Clyde B. Schechter, MA, MD on the writing committee; and Jeroen J. van den Broek, MS; Diana L. Miglioretti, PhD; Martin Krapcho, BS; Amy Trentham-Dietz, PhD, MS; Diego Munoz, PhD, MS; Sandra J. Lee, ScD; Donald A. Berry, PhD; Nicolien T. van Ravesteyn, PhD; Oguzhan Alagoz, PhD; Karla Kerlikowske, MD; Anna N.A. Tosteson, ScD; Aimee M. Near, MPH; Amanda Hoeffken, MPH; Yaojen Chang, DrPH, MS, MPH; Eveline A. Heijnsdijk, PhD; Gary Chisholm, MS; Xuelin Huang, PhD; Hui Huang, MS; Mehmet Ali Ergun, MSc; Ronald Gangnon, PhD; Brian L. Sprague, PhD; and Sylvia Plevritis, PhD.

http://www.eurekalert.org/pub_releases/2016-01/wuso-aia011116.php

Atherosclerosis is Alzheimer's disease of blood vessels, study suggests

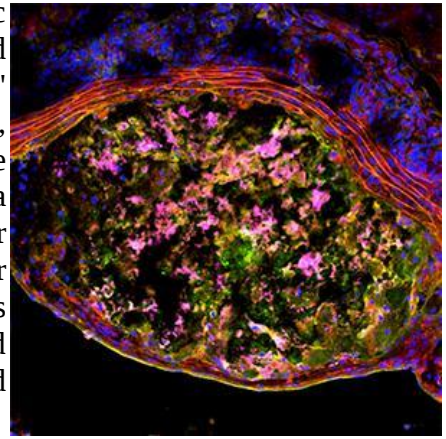
Suggestion that atherosclerosis is driven by processes similar to the plaque formation implicated in brain diseases such as Alzheimer's and Parkinson's

In atherosclerosis, plaque builds up on the inner walls of arteries that deliver blood to the body. Studying mice and tissue samples from the arteries of patients, researchers at Washington University School of Medicine in St. Louis suggest this accumulation is driven, at least in part, by processes similar to the plaque formation implicated in brain diseases such as Alzheimer's and Parkinson's.

The study is published in the journal *Science Signaling*.

A look behind the scenes in the process of plaque accumulating in arteries, the new study is the first to show that another buildup is taking place. Immune cells attempting to counteract plaque formation begin to accumulate misshapen proteins. This buildup of protein junk inside the cells interferes with their ability to do their jobs.

Protein buildup is widely studied in the brain -- accumulation of proteins such as amyloid beta and tau are hallmarks of Alzheimer's, Parkinson's and other degenerative neurological disorders. But until now, the process of misshapen protein buildup within cells has not been implicated in atherosclerosis.



"In an attempt to fix the damage characteristic of atherosclerosis, immune cells called macrophages go into the lining of the arteries," said senior author Babak Razani, MD, PhD, assistant professor of medicine. "The macrophage is like a firefighter going into a burning building. But in this case, the firefighter is overcome by the conditions. So another firefighter goes in to save the first and is likewise overcome. And another goes in, and the process continues to build on itself and worsen."

In atherosclerosis, plaque builds up on the inner walls of arteries that deliver blood to the body. Studying mice and tissue samples from the arteries of patients, researchers at Washington University School of Medicine in St. Louis suggest this accumulation is driven, at least in part, by processes similar to the plaque formation implicated in brain diseases such as Alzheimer's and Parkinson's. The image shows a cross section of a mouse aorta, the main artery in the body, with a large plaque. Red lines near the top are the wall of the aorta. The plaque contains a dysfunctional buildup of immune cells called macrophages (pink) and protein waste (green). **I. Sergin**

The researchers showed that this protein buildup inside macrophages results from problems with the waste-disposal functions of the cell. They identified a protein called p62 that is responsible for sequestering waste and delivering it to cellular incinerators called lysosomes. To mimic atherosclerosis, the researchers exposed the cells to types of fats known to lead to the condition. The researchers noted that during atherosclerosis, the macrophages' incinerators become dysfunctional. And when cells stop being able to dispose of waste, p62 builds up. In a surprise finding, when p62 is missing and no longer gathers the waste in one place, atherosclerosis in mice becomes even worse.

Razani and his colleagues, including the study's first author, Ismail Sergin, PhD, a research assistant, also found these protein aggregates and high amounts of p62 in atherosclerotic plaque samples taken from patients, suggesting these processes are at work in people with plaque building up in the arteries.

"That p62 sequesters waste in brain cells was known, and its buildup is a marker for a dysfunctional waste-disposal system," Razani said. "But this is the first evidence that its function in macrophages is playing a role in atherosclerosis."

The study demonstrates that p62's role in gathering up the misfolded proteins is protective against atherosclerosis, even if the cell can't actually dispose of the waste it gathers.

"If p62 is missing, the proteins don't aggregate," Razani said. "It's tempting to think this might be good for the cell, but we showed this is actually worse. It causes more damage than if the waste were corralled into a large 'trash bin.' You can imagine a situation where lots of trash is being generated and see that it would be better to keep it all in one place, rather than have it strewn across the floor. You might have difficulty removing the trash to the dumpster, but at least it's contained."

In atherosclerosis, and perhaps in the brain disorders characterized by protein accumulation, such evidence suggests it would be better to focus on ways to fix the cells' waste-disposal system for getting rid of the large protein aggregates, rather than on ways to stop the aggregates from forming.

This work was supported by the National Institutes of Health (NIH), grant numbers 5K08HL098559, 1R01HL125838 and 1R01AG037120; the Foundation for Barnes-Jewish Hospital; and the Washington University Diabetic Cardiovascular Disease Center.

Sergin I, Bhattacharya S, Emanuel R, Esen E, Stokes CJ, Evans TD, Arif B, Curci JA, Razani B. Inclusion bodies enriched for p62 and polyubiquitinated proteins in macrophages protect against atherosclerosis. Science Signaling. *Jan. 5, 2016.*

http://www.eurekalert.org/pub_releases/2016-01/yu-lhb010716.php

Life-extending hormone bolsters the body's immune function

Hormone that extends lifespan in mice by 40% is produced by specialized cells in the thymus gland

A hormone that extends lifespan in mice by 40% is produced by specialized cells in the thymus gland, according to a new study by Yale School of Medicine researchers. The team also found that increasing the levels of this hormone, called FGF21, protects against the loss of immune function that comes with age.

Published online in the Proceedings of the National Academy of Sciences on Jan. 11, the study's findings have future implications for improving immune function in the elderly, for obesity, and for illnesses such as cancer and type-2 diabetes.

When functioning normally, the thymus produces new T cells for the immune system, but with age, the thymus becomes fatty and loses its ability to produce new T cells. This loss of new T cells in the body is one cause of increased risk of infections and certain cancers in the elderly.

Led by Vishwa Deep Dixit, professor of comparative medicine and immunobiology at Yale School of Medicine, the researchers studied transgenic mice with elevated levels of FGF21. The team knocked out the gene's function and studied the impact of decreasing levels of FGF21 on the immune system. They found that increasing the levels of FGF21 in old mice protected the thymus from age-related fatty degeneration and increased the ability of the thymus to produce new T cells, while FGF21 deficiency accelerated the degeneration of the thymus in old mice.

"We found that FGF21 levels in thymic epithelial cells is several fold higher than in the liver -- therefore FGF21 acts within the thymus to promote T cell production," said Dixit.

"Elevating the levels of FGF21 in the elderly or in cancer patients who undergo bone marrow transplantation may be an additional strategy to increase T cell production, and thus bolster immune function," said Dixit.

Dixit added that FGF21 is produced in the liver as an endocrine hormone. Its levels increase when calories are restricted to allow fats to be burned when glucose levels are low. FGF21 is a metabolic hormone that improves insulin sensitivity and also induces weight loss; therefore it is being studied for its therapeutic effects in type-2 diabetes and obesity.

Dixit said further studies will focus on understanding how FGF21 protects the thymus from aging, and whether elevating FGF21 pharmacologically can extend the human healthspan and lower the incidence of disease caused by age-related loss of immune function.

"We will also look to developing a way to mimic calorie restriction to enhance immune function without actually reducing caloric intake."

Other authors on the study include Yun-Hee Youm, Tamas Horvath, David Mangelsdorf, and Steven Kliewer.

The study was funded by The National Institutes of Health, The Robert Welch Foundation, and the Howard Hughes Medical Institute.

Citation: http://www.pnas.org/cgi/doi/10.1073/pnas.1514511113.

http://www.eurekalert.org/pub_releases/2016-01/aha-esr010716.php

Even small reductions in kidney function may damage heart, blood vessels

American Heart Association rapid access journal report

DALLAS - Even small reductions in kidney function are associated with heart and blood vessel damage, according to new research in the American Heart Association's journal *Hypertension*.

"Even in very healthy people, a small reduction in kidney function from normal to just a bit below normal was associated with an increase in the mass of the left

ventricle, a change that makes the heart stiffer and impairs its ability to contract," said Jonathan Townend, M.D., senior author of the paper and professor of cardiology at the Queen Elizabeth Hospital Birmingham in Edgbaston, United Kingdom. For years, it has been known that people with long-standing kidney disease are at increased risk of heart disease.

"Mild chronic kidney disease is common, affecting over 10 percent of the U.S. population, so if kidney disease really is a cause of heart disease it may be a major public health problem," Townend said. However, since kidney disease patients commonly have other risk factors, such as high blood pressure and diabetes, the direct effect of diminishing kidney function on the heart has been uncertain.

To look for a direct link, the researchers tracked an extremely healthy group of people - living kidney donors - to see whether the decreases in kidney function that occur after donation were associated with heart and blood vessel changes.

Researchers compared 68 kidney donors (average age 47) with 56 controls (average age 44) through the first year after surgery. Compared with controls, the researchers found that kidney donors had:

- ***An expected decline in kidney function (as measured by the glomerular filtration rate and the appearance of the protein albumin in the urine).***
- ***An increase in the mass of the left ventricle, a strong predictor of heart disease risk.***
- ***An increase in measures of heart damage apparent in blood tests, such as troponin.***
- ***No difference in blood pressure.***

"This is evidence that reduction in kidney function itself leads directly to measurable adverse effects on the heart and blood vessels, even without other risk factors. More research is needed to know just what aspects of reduced kidney function are responsible for the effects," Townend said. As for kidney donors, the researchers urge them not to worry about the new findings.

"Kidney donors are already highly selected as healthy individuals. Our paper has shown that kidney donation causes very small adverse effects on the heart and blood vessels that took careful and accurate measurements to detect. We do not yet know if these effects are maintained over the long term. Even if there is a small increase in your long-term risk of heart disease after donation, it is still likely that you will be at lower than average risk, Townend said.

Researchers suggest that all people discuss heart disease risk, and ways to lower it, with their physicians if medical tests indicate reduced kidney function.

Co-authors are William E. Moody, B.Med.Sc.; Charles J. Ferro, M.D.; Nicola C. Edwards, Ph.D.; Colin D. Chue, Ph.D., M.R.C.P.; Erica Lai Sze Lin, B.Med.Sc., M.B.Ch.B.; Robin J. Taylor, M.R.C.P.; Paul Cockwell, Ph.D.; and Richard P. Steeds, M.D., M.A. Author disclosures are on the manuscript.

The British Heart Foundation, the National Institute for Health Research/Wellcome Trust, and the Queen Elizabeth Hospital Birmingham charities supported the study.

http://www.medscape.com/viewarticle/856859

Can Coffee KO Cancer's Return?

Hypothesis that coffee drinkers would be at less risk of recurrence than those who don't drink coffee

David J. Kerr, CBE, MD, DSc, FRCP, FMedSci

Hello. I'm David Kerr, professor of cancer medicine at the University of Oxford. I'd like to discuss a very interesting study that has been produced by Charlie Fuchs and colleagues,[1] which looked at the impact of coffee on reducing recurrence rates of colon cancer.

We know that the recurrence of colon cancer is related to relative hyperinsulinemia. Patients who have a sedentary lifestyle, who sit on their bottoms, who have an increased glycemic load, and who eat too much carbohydrates tend to have higher rates of recurrence. We know that caffeine can increase insulin sensitivity and reduce glycemic load.

Therefore, they proposed a hypothesis that coffee drinkers would be at less risk of recurrence than those who don't drink coffee.

It was a large study of initially about 1600 patients. Throughout adjuvant therapy and for 6 months afterwards, they did a detailed prospective study in which they collected a compendium of dietary input, exercise, etc.

In this particular study, they looked at intake of caffeinated coffee, decaffeinated coffee, and herbal tea.

What they showed was that patients with colon cancer who took more than four cups of caffeinated coffee/day had a very significant reduction in mortality and recurrence rates. This was not seen in those poor souls, like myself, who drink decaffeinated coffee or in those of us who like the odd cup of herbal tea.

So, there you are. Should we now be recommending, as the thoughtful physicians that we are, that our patients who have undergone a resection of primary tumor and who have completed adjuvant therapy be regularly gulping a minimum of four cups of coffee per day?

Clearly, it's a bit early to be able to say that, but it is a very interesting observation. The hazard ratios look fantastic, and they are just about 0.5 in the heavy coffee drinkers.

It's an interesting observation from a good group. Herbal tea was, sadly, just not on the radar screen at all. So get out there and drink coffee like crazy. Thanks for listening. Please make any comments that you wish to. For the time being, Medscapers, over and out.

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http://bit.ly/1n3NVtq

Microbe Cells Don't Outnumber Your Own

For years people have cited the ten-to-one ratio, with microbes dominating human cells, but that number is probably wrong, according to recent research

By Marissa Fessenden

Good news for the germaphobes. A frequently cited statistic—that the microbes living in and on your body outnumber human cells ten-to-one—is most likely entirely made up, reports Ed Yong for *The Atlantic*. Instead, you probably have equal numbers microbial cells and cells you can truly call your own. Doesn't that make you feel better?

Sure, that still sounds like an incredible number of teeming creepy crawlies to which you play host. But the microbial cells are vital parts of a functioning body. They make up the microbiome and without them, the truly harmful bacteria could take over.

In recent years, scientists have increasingly realized that the human microbiome is remarkably responsible for maintaining human health as well as responsive to the things people do—microbes can get jet lagged and change if we travel to space. These minuscule creatures are even responsible for making humans stink.

Scientists and writers alike, in communicating all this new research, like to throw around the ten-to-one ratio to impress exactly how important the microbiome is.

But, Yong reports, that number was really just a "a back-of-the-envelope calculation that became enshrined as hard fact based on little more than its catchy nature and its sounds-about-right-ness."

In 1970, microbiologist Thomas D. Luckey estimated that there are 100 billion microbes in a gram of intestinal fluid or feces and that every adult had about 1000 grams of these substances. So humans, on average, must play host to 100 trillion microbes, write Elio Schaechter and Stanley Maloy in a 2010 blog post for *Small Things Considered*. Another microbiologist, Dwayne Savage, compared that number to the 10 trillion human cells our bodies carry in a 1977 paper. Thus the ratio was born.

The problem was that Luckey didn't really have much basis for his numbers. In a 2014 letter to *Microbe Magazine*, Judah L. Rosner of the National Institutes of Health, points out that more recent estimates for the number of human cells in the average body range from 15 to 724 trillion. That very wide range called into question the ten-to-one citation.

More recently, a team of researchers led by Ron Milo of the Weizmann Institute of Science decided to come up with a better, more accurate ratio. Along with Ron Sender and Shai Fuchs, Milo's team scoured the literature for actual measurements of the microbes contained in feces samples and the measure of human cells in different types of tissue.

Their estimate, published online in the preprint server *bioRxiv*, puts those numbers at about 39 trillion microbes to 30 trillion human cells. That ratio, 1.3-to-1, is pretty close to equal—though the researchers caution that their numbers are still very rough estimates.

However, our microbes' genes still easily outnumber our human genes, Yong writes. So humans' dominance over their own bodies is still up for debate (if it matters at all—the microbes aren't coordinating to overthrow us).

The new ratio comes with the added comfort that it's close enough to influence easily, all you need to do is visit the toilet. The microbes lost in each "defecation event" could be enough to flip the ratio in favor of human cells, the researchers write.

Or as Yong puts it: "You gain temporary dominance over your own body with every flush."

http://www.medscape.com/viewarticle/856942

A Child's Right to Be Vaccinated

Is it your right to catch and transmit a potentially fatal infection?

Paul A. Offit, MD

Hi. My name is Paul Offit. I'm talking to you today from the Vaccine Education Center here at the Children's Hospital of Philadelphia.

Most of you know that the state of California eliminated its philosophical exemption to vaccines. Therefore, the only exemptions in California are medical exemptions. Why did they do that? The reason is that southern California, specifically Disneyland, served as the epicenter for a massive measles epidemic—one that spread across the United States, involving about 25 states and affecting about 158 people, mostly children. The epidemic also extended northward into two Canadian provinces, where it affected hundreds more people. What happened in California was, they asked the question, "Is it your right to catch and transmit a potentially fatal infection?"

They decided in California that the answer was no. This is the third state that now has only medical exemptions to vaccines. The other two states are Mississippi and West Virginia. The roots of this are in Mississippi, in a case that occurred in the late 1970s called *Brown v. Stone*. The question that came up in Mississippi was, "Is it your right not to be vaccinated?" and the decision was made that only medical exemptions made sense. It was a 14th Amendment argument—specifically, the second clause of the 14th Amendment—which states that all citizens of the United States should have equal protection under the law. Even if

your parents have ill-founded beliefs about vaccine safety, that doesn't mean that children shouldn't be protected. Essentially it became a civil rights issue.

If you go to these rallies in California or Vermont or Michigan, you often hear parents say, "It's about my rights. It's my parental right to raise my child as I see fit." But what about children's rights? Who represents them? In this country, for example, if you are an African American and you feel that you are being treated badly, there are places you can go and people who will represent you. If you are Jewish and you feel that you are being defamed, there are groups you can go to who will defend you. But if you are a child, it's assumed that your parents represent your best interests, and that's not always true. When it's not true, as in this case where parents have a false belief that vaccines cause autism and they don't want to vaccinate their children, who do those children go to?

The answer is, they go to the state. That's what happened, frankly, in California, which basically used a child's rights issue as the central focus of how they made that change. A little boy who had leukemia would go out to those meetings and say, "What about me? Don't I have rights, too? I can't be vaccinated. I depend on those around me to be vaccinated." In the end, in many ways, this is a child's rights issue. It is a civil rights issue with a child, and it's a right that is protected by the 14th Amendment.

Thank you for your attention.

http://www.medscape.com/viewarticle/856858

From Aedes to Zika: Mosquito-borne Viruses a Growing Concern

Mosquitoes proving to be more than just a nuisance

Paul G. Auwaerter, MD

Hello. This is Paul Auwaerter with Medscape Infectious Diseases and the Johns Hopkins Division of Infectious Diseases, talking about travel-related infections. This winter season, many people think of traveling to warmer climates. Mosquitoes are often in these environments and are thought of as nothing more than a pedestrian, nuisance problem.

However, in the past couple of years, three viruses have grabbed a lot of attention, posing problems not only for travelers but for people living in Central and South America and the Caribbean. Chikungunya first swept in about 2 years ago, causing hundreds of thousands of cases. In 2014, cases began to be identified among returning travelers.[1] Chikungunya is a virus that can cause rather severe musculoskeletal pain and, uncommonly, neurologic and longer-term arthritic sequelae. Local transmission has even been documented in Florida, Puerto Rico, and the Virgin Islands.

Beyond chikungunya is the more serious virus, dengue, which has been on the radar of many public health officials for years. Dengue also causes fever, headache, and muscle and joint pain, and it is often hard to distinguish between the two viruses. Retro-orbital pain, if present, might be a distinguishing feature of dengue. Bleeding is more common with dengue, which can cause a petechial rash or the most feared complication of dengue, hemorrhagic fever.

The dengue virus is known to be endemic in the Virgin Islands and Puerto Rico, but cases have been seen in Texas and South Florida. Of interest, Hawaii is currently experiencing a small outbreak on the Big Island (probably from an imported case), where more than 181 cases have been reported since September of 2015.[2]

For travelers, these viruses could be a cause for concern. However, Brazil is currently experiencing a dramatic outbreak of dengue, where more than 1.5 million cases have been reported to date. This large number prompted public health officials in Brazil to approve the Sanofi Pasteur dengue vaccine, which has undergone clinical trials.[3] The vaccine appears to protect against four serotypes of dengue, with about a 60% reduction of disease in children. It may be more protective against severe dengue and the need for hospitalization, although by the third year after immunization there was an uptick in younger children needing hospitalization that is not quite understood yet. However, the vaccine has impressed public health officials, not only in Brazil but in two other countries that have approved the vaccine—the Philippines and Mexico—as one of the few tools other than routine mosquito avoidance measures to help combat the dengue epidemic.

Now a third virus, the Zika virus, has been a cause for concern. This virus, first described in Africa and Southeast Asia, appears to now be epidemic in Brazil. The Zika virus has also been reported in Mexico and no doubt is probably elsewhere in the same distribution in both the Northern and Southern Hemispheres, or certainly will be in short order.[4] It's a flavivirus, much like dengue or yellow fever. It can cause fever, rash, joint pain, and conjunctivitis, but generally has not resulted in death or severe illness.

However, it can be confusing because Zika represents a third virus that must be considered and which can be hard to distinguish on a clinical basis from the other two viruses. There has also been concern about an increased rate of birth defects in Brazil, specifically microcephaly, which might be caused by the Zika virus. The link isn't clear, but the possibility has created a lot of concern among pregnant women in that country.

For US travelers, unfortunately, the dengue vaccine is not yet available. Therefore, mosquito avoidance is the only practical measure to prevent dengue. This nice handout from the Centers for Disease Control and Prevention (CDC)[5] describes recommended mosquito avoidance maneuvers that should be followed as

carefully as possible by anyone who is planning to travel to areas where they could acquire a mosquito-borne illness.

The Zika virus is new diagnostically, with no easy tests.[6] You have to contact your local health authorities to ship a sample to the CDC for polymerase chain reaction or antibody testing. But keep in mind that if you are evaluating a patient who has recently returned from Central or South America with a febrile illness, rash, and joint pains, maintain a suspicion for Zika virus, along with chikungunya and dengue. Thanks very much for listening.

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http://www.eurekalert.org/pub_releases/2016-01/b-pcb011116.php

Potato consumption before pregnancy linked to diabetes risk during pregnancy

Swapping potatoes for other vegetables or whole grains might lower the risk

Higher consumption of potatoes before pregnancy is associated with greater risk of developing diabetes while pregnant (known as gestational diabetes mellitus or GDM), concludes a study published by The BMJ today. The US-based researchers suggest that substituting potatoes with other vegetables, legumes (such as peas, beans and lentils), or whole grain foods might lower the risk.

Potatoes are one of the world's most commonly consumed foods. US dietary guidelines continue to include potatoes in the vegetable food group and encourage consumption, though previous studies suggest that potatoes can have a detrimental effect on blood sugar levels due to their high starch content.

Gestational diabetes is a common pregnancy complication that has long term health risks for both mothers and babies, but the association between potato consumption and risk of gestational diabetes remains unknown. So researchers from Eunice Kennedy Shriver National Institute of Child Health and Human Development and Harvard University tracked 15,632 women who were part of the Nurses' Health Study II and who became pregnant over a 10-year period (1991-2001).

They had no previous gestational diabetes or chronic disease before pregnancy.

Consumption of potatoes and other foods was assessed every four years and cases of gestational diabetes were ascertained from self reports of a physician diagnosis of GDM, which was validated by medical records.

Over the 10 year follow-up period, the team identified 21,693 singleton pregnancies of which 854 were affected by gestational diabetes.

After taking account of other risk factors for gestational diabetes such as age, family history of diabetes, physical activity, overall diet quality, and BMI, they found that higher total potato consumption was significantly associated with an increased risk of gestational diabetes.

However, substituting two servings of potatoes a week with other vegetables, legumes, or whole grain foods was significantly associated with a 9-12% lower risk.

The authors point out that potatoes have a high glycaemic index compared with other vegetables, so can trigger a sharp rise in blood sugar levels, and this could be one explanation for the findings.

They also acknowledge several study limitations and say because of the observational nature of their study, no definitive conclusions can be drawn about cause and effect.

However, they conclude: "Higher levels of potato consumption before pregnancy are associated with greater risk of GDM, and substitution of potatoes with other vegetables, legumes, or whole grain foods might lower the risk."

http://www.eurekalert.org/pub_releases/2016-01/cu-cpd011216.php

Cancer-killing proteins destroy tumor cells in bloodstream

Cornell researchers have discovered potent cancer-killing proteins that can travel by white blood cells to kill tumors in the bloodstream of mice with metastatic prostate cancer.

ITHACA, N.Y. - The breakthrough study will be published Feb. 10 as the cover article in the Journal of Controlled Release.

"The therapy is remarkably effective in vivo and shows several advantages, such as no toxicity and getting good results with very low dosages," said senior author Michael King, the Daljit S. and Elaine Sarkaria Professor in Cornell's Meinig School of Biomedical Engineering. "It was our wildest dream to completely prevent the spread of prostate cancer. And that's what happened in this system."

Moving from the lab to mouse models, this therapy seeks, attacks and destroys cancer cells circulating in the bloodstream, concurrently preventing the

spontaneous formation and growth of metastatic tumors. While surgery and radiation treat primary tumors, it remains difficult to detect and reach metastatic cancer cells - which makes the treatment of spreading cancer more treacherous and problematic, King explains.

King's laboratory created nano-sized liposomes with a protein called TRAIL (Tumor Necrosis Factor Related Apoptosis-Inducing Ligand) that attach to leukocytes (white blood cells). The liposomes are about one-one hundredth the size of the white blood cells. As the white blood cells travel throughout the bloodstream, the hitchhiking TRAIL protein kills the tumor cells - leaving the bloodstream free of cancer.

In the study prostate cancer cells were implanted into the prostate of male mice to let the tumors grow. The researchers found that secondary tumors were prevented by the treatment and that the primary tumor shrunk in size.

While treated mice showed no metastases, the circulating tumor cell count remained greatly reduced but not completely zero, which leads scientists to believe "you don't have to be perfect in completely eliminating circulating tumor cells to observe a very good outcome," said King.

Further, the King group found that a single dose of the therapy - even delivered very late in the course of the disease - can substantially reduce the number of tumor cells. King said: "This suggests that it may never be too late to help."

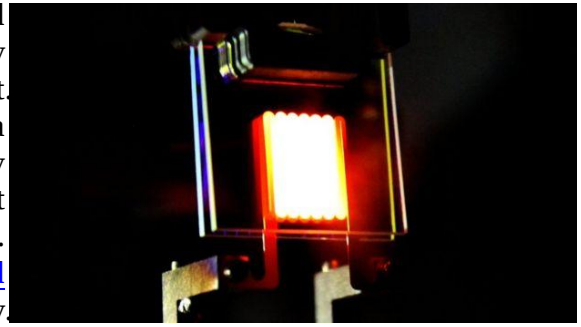
The National Cancer Institute (Physical Sciences-Oncology program) of the National Institutes of Health funded the research.

http://bbc.in/236ofwQ

New development could lead to more effective light bulbs

US researchers say they have developed a technique that can significantly improve the efficiency of the traditional incandescent light bulb.

By Matt McGrath Environment correspondent



This is the proof of concept, higher efficiency incandescent light bulb developed at MIT

Little has changed in the technology of the incandescent light bulb since they were commercially developed by Thomas Edison in the US in the 1880s.

These older bulbs have been phased out in many countries because they waste huge amounts of energy as heat. But scientists at MIT have found a way of recycling the waste energy and focusing it back on the filament where it is re-emitted as visible light. The development has been reported in the journal Nature Nanotechnology.

They create light by using electricity to heat a thin tungsten wire filament to temperatures of around 2,700C. This causes the filament to glow and produce a broad-spectrum warm white light.

However light bulbs of this type are hugely inefficient - they only convert around 2-3% of the energy they use into light - the rest is wasted as heat. They have long been a target for green campaigners, concerned about climate change.

Phased out

This has seen the bulbs banned in the European Union, Canada and their manufacture and importation has been phased out in the US. They've been replaced by more expensive compact fluorescent (CFL) and LED bulbs which are significantly more efficient at around 13%.

Now researchers at MIT believe they have developed a technique that could turn the weakness of the traditional incandescent bulb into a strength.

Using nanotechnology, they've built a structure that surrounds the filament of the bulb and captures the leaking infrared radiation, reflecting it back to the filament where it is re-absorbed and then re-emitted as visible light. The structure is made from thin layers of a type of light-controlling crystal. A key aspect though is the way that these layers are stacked, with visible wavelengths allowed to pass through while infrared get reflected back to the filament as if in a mirror.

"It is not so much the material you make the surrounding structure from, it is how you arrange the material to create the optical filtering property that will recycle infra red light and let the visible light through," Ognjen Illic, the paper's lead author told BBC News.

In theory, the crystal structures could boost the efficiency of incandescent bulbs to 40%, making them three times more efficient than the best LED or CFL bulbs on the market. The researchers have built their first proof-of-concept units which reach an efficiency of 6.6%, but even that is almost three times the level of a standard incandescent bulb.

So do the researchers think that they can build a better light bulb?

"I would not exclude the possibility," said Prof Marin Soljacic, another author on the paper.

"Thomas Edison was not the first one to work on the design of the light bulb, but what he did was figure out how to mass produce it cheaply and keep it stable longer than 10 hours, these are still the the two critical criteria. These are the questions we are trying to answer now," he said.

The scientists point out that improving light bulbs is but one of the options that could spring from this development. The authors say it could have "dramatic implications" for the performance of other energy conversion technologies.

"We have this huge challenge that the world is facing right now, global warming and energy efficiency and this gives you one more tool in the toolbox to meet that huge challenge," said Prof Soljacic.

"We are very excited about the potential though."

http://bbc.in/236ofwQ

New rumours that gravitational waves have finally been detected

A rumour that the world's largest gravitational-wave observatory has caught the first whiff of its quarry is heating up.

Gravitational waves are ripples in space-time produced by massive bodies accelerating through space, such as pairs of neutron stars orbiting each other or the merging of two black holes.

They were predicted as part of Einstein's general relativity a century ago, but have yet to be seen directly.

Finding them would confirm the final piece of his theory, and also give us a new way to view the universe, allowing us to probe distant objects that might otherwise be dark or obscured by interstellar dust.

The Laser Interferometer Gravitational-Wave Observatory (LIGO) searched for such signals from 2002 to 2010 with no luck. Its more sensitive successor, Advanced LIGO or aLIGO, started collecting data on 18 September.

Fresh sighting

Barely a week later, cosmologist Lawrence Krauss at Arizona State University tweeted a rumour that the detector had already picked up a signal.

Now Krauss claims that the original rumour has been confirmed by an independent source.

"Stay tuned!" he tweeted. "Gravitational waves may have been discovered!! Exciting."

Off Twitter, however, Krauss was more cautious. The signal could have been a false one deliberately injected into the data to test the detection team. "I'm told this isn't that," Krauss told *New Scientist*.

His source says that the LIGO collaboration is writing up a paper on the possible find. "That suggests it's not a false signal – but who knows for sure?"

The official word from the LIGO team is that they are still analysing the data from the first run, which should finish on 12 January.

"It takes time to analyse, interpret and review results," says spokesperson Gabriela González at Louisiana State University. "We expect to have news on the run results in the next few months."

"We'll use something other than the rumour mill when we have a contribution to the discussion!" adds David Shoemaker at the Massachusetts Institute of Technology.

http://bit.ly/1OotdqM

String Theory Meets Loop Quantum Gravity

Two leading candidates for a "theory of everything," long thought incompatible, may be two sides of the same coin.

Eight decades have passed since physicists realized that the theories of quantum mechanics and gravity don't fit together, and the puzzle of how to combine the two remains unsolved. In the last few decades, researchers have pursued the problem in two separate programs — string theory and loop quantum gravity — that are widely considered incompatible by their practitioners. But now some scientists argue that joining forces is the way forward.

Among the attempts to unify quantum theory and gravity, string theory has attracted the most attention. Its premise is simple: Everything is made of tiny strings. The strings may be closed unto themselves or have loose ends; they can vibrate, stretch, join or split. And in these manifold appearances lie the explanations for all phenomena we observe, both matter and space-time included.

Loop quantum gravity, by contrast, is concerned less with the matter that inhabits space-time than with the quantum properties of space-time itself. In loop quantum gravity, or LQG, space-time is a network. The smooth background of Einstein's theory of gravity is replaced by nodes and links to which quantum properties are assigned. In this way, space is built up of discrete chunks. LQG is in large part a study of these chunks.

This approach has long been thought incompatible with string theory. Indeed, the conceptual differences are obvious and profound. For starters, LQG studies bits of space-time, whereas string theory investigates the behavior of objects within space-time. Specific technical problems separate the fields. String theory requires that space-time have 10 dimensions; LQG doesn't work in higher dimensions. String theory also implies the existence of supersymmetry, in which all known particles have yet-undiscovered partners. Supersymmetry isn't a feature of LQG.

These and other differences have split the theoretical physics community into deeply divergent camps. "Conferences have segregated," said Jorge Pullin, a physicist at Louisiana State University and co-author of an LQG textbook. "Loopy people go to loopy conferences. Stringy people go to stringy conferences. They don't even go to 'physics' conferences anymore. I think it's unfortunate that it developed this way."

But a number of factors may be pushing the camps closer together. New theoretical findings have revealed potential similarities between LQG and string theory. A young generation of string theorists has begun to look outside string theory for methods and tools that might be useful in the quest to understand how

to create a "theory of everything." And a still-raw paradox involving black holes and information loss has given everyone a fresh dose of humility.

Moreover, in the absence of experimental evidence for either string theory or LQG, mathematical proof that the two are in fact opposite sides of the same coin would bolster the argument that physicists are progressing toward the correct theory of everything. Combining LQG and string theory would truly make it the only game in town.

An Unexpected Link

An effort to solve some of LQG's own internal problems has led to the first surprising link with string theory. Physicists who study LQG lack a clear understanding of how to zoom out from their network of space-time chunks and arrive at a large-scale description of space-time that dovetails with Einstein's general theory of relativity — our best theory of gravity. More worrying still, their theory can't reconcile the special case in which gravity can be neglected. It's a malaise that befalls any approach reliant on chunking-up space-time: In Einstein's theory of special relativity, an object will appear to contract depending on how fast an observer is moving relative to it. This contraction also affects the size of space-time chunks, which are then perceived differently by observers with different velocities. The discrepancy leads to problems with the central tenet of Einstein's theory — that the laws of physics should be the same no matter what the observer's velocity.

"It's difficult to introduce discrete structures without running into difficulties with special relativity," said Pullin. In a brief paper he wrote in 2014 with frequent collaborator Rodolfo Gambini, a physicist at the University of the Republic in Montevideo, Uruguay, Pullin argued that making LQG compatible with special relativity necessitates interactions that are similar to those found in string theory.

That the two approaches have something in common seemed likely to Pullin since a seminal discovery in the late 1990s by Juan Maldacena, a physicist at the Institute for Advanced Study in Princeton, N.J. Maldacena matched up a gravitational theory in a so-called anti-de Sitter (AdS) space-time with a field theory (CFT — the "C" is for "conformal") on the boundary of the space-time. By using this AdS/CFT identification, the gravitational theory can be described by the better-understood field theory.

The full version of the duality is a conjecture, but it has a well-understood limiting case that string theory plays no role in. Because strings don't matter in this limiting case, it should be shared by any theory of quantum gravity. Pullin sees this as a contact point.

Herman Verlinde, a theoretical physicist at Princeton University who frequently works on string theory, finds it plausible that methods from LQG can help illuminate the gravity side of the duality. In a recent paper, Verlinde looked at AdS/CFT in a simplified model with only two dimensions of space and one of time, or "2+1" as physicists say. He found that the AdS space can be described by a network like those used in LQG. Even though the construction presently only works in 2+1, it offers a new way to think about gravity. Verlinde hopes to generalize the model to higher dimensions. "Loop quantum gravity has been seen too narrowly. My approach is to be inclusive. It's much more intellectually forward-looking," he said.

But even having successfully combined LQG methods with string theory to make headway in anti-de Sitter space, the question remains: How useful is that combination? Anti-de Sitter space-times have a negative cosmological constant (a number that describes the large-scale geometry of the universe); our universe has a positive one. We just don't inhabit the mathematical construct that is AdS space.

Verlinde is pragmatic. "One idea is that [for a positive cosmological constant] one needs a totally new theory," he said. "Then the question is how different that theory is going to look. AdS is at the moment the best hint for the structure we are looking for, and then we have to find the twist to get a positive cosmological constant." He thinks it's time well spent: "Though [AdS] doesn't describe our world, it will teach us some lessons that will guide us where to go."

Coming Together in a Black Hole

Verlinde and Pullin both point to another chance for the string theory and loop quantum gravity communities to come together: the mysterious fate of information that falls into a black hole. In 2012, four researchers based at the University of California, Santa Barbara, highlighted an internal contradiction in the prevailing theory. They argued that requiring a black hole to let information escape would destroy the delicate structure of empty space around the black hole's horizon, thereby creating a highly energetic barrier — a black hole "firewall." This firewall, however, is incompatible with the equivalence principle that underlies general relativity, which holds that observers can't tell whether they've crossed the horizon. The incompatibility roiled string theorists, who thought they understood black hole information and now must revisit their notebooks.

But this isn't a conundrum only for string theorists. "This whole discussion about the black hole firewalls took place mostly within the string theory community, which I don't understand," Verlinde said. "These questions about quantum information, and entanglement, and how to construct a [mathematical] Hilbert space – that's exactly what people in loop quantum gravity have been working on for a long time."

Meanwhile, in a development that went unnoted by much of the string community, the barrier once posed by supersymmetry and extra dimensions has fallen as well. A group around Thomas Thiemann at Friedrich-Alexander University in Erlangen, Germany, has extended LQG to higher dimensions and included supersymmetry, both of which were formerly the territory of string theory.

More recently, Norbert Bodendorfer, a former student of Thiemann's who is now at the University of Warsaw, has applied methods of LQG's loop quantization to anti-de Sitter space. He argues that LQG can be useful for the AdS/CFT duality in situations where string theorists don't know how to perform gravitational computations. Bodendorfer feels that the former chasm between string theory and LQG is fading away. "On some occasions I've had the impression that string theorists knew very little about LQG and didn't want to talk about it," he said. "But [the] younger people in string theory, they are very open-minded. They are very interested what is going on at the interface."

"The biggest difference is in how we define our questions," said Verlinde. "It's more sociological than scientific, unfortunately." He doesn't think the two approaches are in conflict: "I've always viewed [string theory and loop quantum gravity] as parts of the same description. LQG is a method, it's not a theory. It's a method to think of quantum mechanics and geometry. It's a method that string theorists can use and are actually using. These things are not incompatible."

Not everyone is so convinced. Moshe Rozali, a string theorist at the University of British Columbia, remains skeptical of LQG: "The reason why I personally don't work on LQG is the issue with special relativity," he said. "If your approach does not respect the symmetries of special relativity from the outset, then you basically need a miracle to happen at one of your intermediate steps." Still, Rozali said, some of the mathematical tools developed in LQG might come in handy. "I don't think that there is any likelihood that string theory and LQG are going to converge to some middle ground," he said. "But the methods are what people normally care about, and these are similar enough; the mathematical methods could have some overlap."

Not everyone on the LQG side expects the two will merge either. Carlo Rovelli, a physicist at the University of Marseille and a founding father of LQG, believes his field ascendant. "The string planet is infinitely less arrogant than ten years ago, especially after the bitter disappointment of the non-appearance of supersymmetric particles," he said. "It is possible that the two theories could be parts of a common solution … but I myself think it is unlikely. String theory seems to me to have failed to deliver what it had promised in the '80s, and is one of the many 'nice-idea-but-nature-is-not-like-that' that dot the history of science. I do not really understand how can people still have hope in it."

For Pullin, declaring victory seems premature: "There are LQG people now saying, 'We are the only game in town.' I don't subscribe to this way of arguing. I think both theories are vastly incomplete."

http://www.medscape.com/viewarticle/857100

In Cancer Screening, Why Not Tell the Truth?

An unpleasant emotion caused by the belief that something is dangerous. This is fear. This is cancer.

John M Mandrola, MD

The motivation to screen for cancer, therefore, is easy to understand.

The problem: cancer screening has not worked. Recent reviews of the evidence show that current-day screening techniques do not save lives. Worse, in many cases, these good-intentioned searches bring harm to previously healthy people.

I realize this sounds shocking. It did to me, too. Millions of women and men have had their breasts squished, veins poked, lungs irradiated, and bowels invaded in the name of "health" maintenance. I've been scolded for forgoing PSA tests and colonoscopy - "you should know better, John."

I know what you may be thinking. We have all heard the anecdotes - cases that are often celebrated in local news reports and hospital marketing material. People saved by early detection, and the opposite: the unscreened felled by late-stage disease.

Anecdotes, however compelling, are not evidence. When you pull up a chair, open your computer, take a breath, suspend past beliefs, and look for the evidence that screening saves lives, it simply isn't there.

One reason that this many people (doctors and patients alike) have been misled about screening has been our collective attachment to the belief that if screening lowers disease-specific death rates, that would translate to lower overall mortality. That is: breast, lung, and colon cancer are bad diseases, so it makes sense that lowering death from those three types of cancer would extend life.

It is not so.

Facts, Not Fear

In a comprehensive review of the literature[1] published in the *BMJ*, Drs Vinay Prasad (Oregon Health Sciences University, Portland) and David Newman (School of Medicine at Mount Sinai, New York), along with journalist Jeanne Lenzer, find that disease-specific mortality is a lousy surrogate for overall mortality. They report that when a screening technique does lower disease-specific death rates, which is both uncommon and of modest degree, there are no differences in overall mortality.

The authors cite three reasons why cancer screening might not reduce overall mortality:

- ***Screening trials were underpowered to detect differences. I'm no statistician, but doesn't the fact that a trial requires millions of subjects to show a difference, mean there is little, if any, difference?***
- ***"Downstream effects of screening may negate any disease-specific gains." My translation: harm. Dr Peter Gøtzsche (Nordic Cochrane Center, Copenhagen) wrote in a commentary[2] that "screening always causes harm. Sometimes it also leads to benefits, and sometimes these benefits outweigh the harms." To understand harm resulting from screening, one need only to consider that a prostate biopsy entails sticking a needle through the rectum, or that some drugs used to treat breast cancer damage the heart.***
- ***Screening might not reduce overall mortality because of "off-target deaths." An illustration of this point is provided by a cohort study[3] that found a possible increased risk of suicide and cardiovascular death in men in the year after being diagnosed with prostate cancer. People die — of all sorts of causes, not just cancer.***

Let's also be clear that this one paper is not an outlier. A group of Stanford researchers performed a systematic review and meta-analyses[4] of randomized trials of screening tests for 19 diseases (39 tests) where mortality is a common outcome. They found reductions in disease-specific mortality were uncommon and reductions in overall mortality were rare or nonexistent.

Drs Archie Bleyer and H Gilbert Welch (St Charles Health System, Central Oregon, Portland) reviewed Surveillance, Epidemiology, and End Results (SEER) data from 1976 through 2008 and concluded that "screening mammography has only marginally reduced the rate at which women present with advanced cancer and that overdiagnosis may account for nearly a third of all new breast cancer cases."[5] Likewise, a Cochrane Database Systematic review[6] of eight trials and 600,000 women did not find an effect of screening on either breast cancer mortality or all-cause mortality. This evidence caused the Swiss medical board to abolish screening mammography.[7]

These are the data. It's now clear to me that mass cancer screening does not save lives. But I'm still trying to understand how this practice became entrenched as public-health gospel. It has to be more than fear.

How We Say It Matters

Dr Gerd Gigerenzer (Max Planck Institute, Berlin, Germany) offered a clue in his editorial[8] accompanying the recently published literature review and analysis by Prasad and colleagues. He pointed to language and the ability of words to persuade. Instead of saying "early detection," advocates might use the term "prevention." This, Dr Gigerenzer says, wrongly suggests screening reduces the odds of getting cancer. Doesn't looking for cancer increase the odds of getting the diagnosis of cancer? Gigerenzer noted two other ways language is used to emphasize screening benefits over harms:

- ***The reporting of benefits in relative, not absolute terms.***
- ***The equating of increases in 5-year survival rates with decreases in mortality.***

I would add to this list of word misuse, the practice of referring to women sent to mammography screening as patients. They are not patients; they are well people.

Dr Gigerenzer agreed with the commonsense notion that overall mortality should be reported along with cancer-specific mortality. His editorial included a fact box on breast cancer early detection using mammography provided by the Harding Center for Risk Literacy. I challenge you to tell me why such text boxes should not be shown to people before they undergo screening,

Fixing a Public-Health Problem

Given these revelations, I conclude that we have a massive public-health problem. Any expert in problem solving will tell you the first step of getting out of hole is to stop digging. I see three obvious next steps:

The first action healthcare experts should take is to spread the word that there is nothing about the mass screening of healthy people for cancer that equates to health maintenance. Embrace clear language. Saying or implying that screening saves lives when there are no data to support it and lots to refute it undermines trust in the medical profession.

The second action healthcare experts should take is to stop wasting money on screening. If the evidence shows no difference in overall mortality, why pay for it? I'm not naive to the fact that use of clear language will decrease the number of billable procedures. I am not saying this will be easy. One first move that would be less painful would be to get rid of quality measures or incentives that promote screening.

I want to be clear; I'm not saying all cancer screening is worthless. People at higher baseline risk for cancer, such as those with a family history of cancer or environmental exposures, might derive more benefit than harm from screening. Prasad, Lenzer, and Newman say this group of patients would be a good place to spend future research dollars. That sounds reasonable. I also acknowledge that some people, even when presented with the evidence, will want to proceed with screening. We can argue about who should pay for non–evidence-based medical procedures.

The most important action that all of us (patients, nurses, doctors, and healthcare writers) should take is to learn from this revelation. There's nothing bad about the fact that current-day screening tests don't save lives. Cancer is a tough disease, and in some ways, it may be the natural order of cell biology. What's bad about this medical reversal has been our blindness to the evidence.

We let what we believe become what we know. In clinical medicine, that should be a never event.

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Do we need more than two genders?

A growing number of people refuse to be put into male or female categories, either because they do not identify as male or female, or because they are going through transition to the opposite gender.

Germany, Australia, Nepal and Pakistan now offer a third gender option on official forms with other countries set to follow suit. And scientists are finding more evidence to suggest that even biological sex is a spectrum.

Do we need to re-imagine our binary world and rethink one of the most basic parts of our identity?

Four experts talk to the BBC World Service Inquiry programme.

Brin Bixby: Gender is a cultural construction

Brin Bixby was brought up as a boy, and went on to get married and father children before coming out as bigender. She set up Bigender.net, which reflects the view that gender is a spectrum.

"In college I wore a dress on Halloween, and it was supposed to be a joke, and the people helping me thought it was going to be hyper-real, exaggerated. [But] I didn't want to be a drag queen, I wanted to be a woman, and I think it took people by surprise.

"It was the first time I looked in the mirror and saw myself. People interacted with me as a woman: they saw me the way I wanted them to.

"I would be most comfortable if I didn't have to think about my gender, but unfortunately that's not how it works for me and a lot of other non-binary people.

"We have a cultural understanding of what gender is and looks like, and in the west we have a very binary view of it. My sense of gender as a part of my identity shifts.

"I present as a woman everywhere I go, except for at work and at my children's school, because it gets very exhausting to have to explain gender fluidity to everyone I meet.

"Ideally we would not make gender such a huge focus of our culture, which would give people the freedom to inhabit their gender in ways that feels most comfortable to them.

"What we're seeing now is a relaxation of the sense of binary amongst younger people and internet-savvy people who are inhabiting much more fluid spaces."

Mark Gevisser: Accept the gender continuum

Writer Mark Gevisser explores gender identities across different cultures.

"We know there's a gender continuum, because there have always been effeminate boys and masculine girls. Transgender is certainly not a western phenomenon. In many cultures all over the world there are traditionally third gender or gender-fluid identities.

"There are the Hijras in India, what are known as two-spirited people in Native American culture, Muxe in Mexico, and the Bakla in the Philippines. The space these people have occupied has receded with the spread of the Judeo-Christian ethic and western culture, but they're still very much there.

"There's a tendency in the west to idealise these. But the truth is that if you're Bakla or two-spirited, there are only certain things in your culture you can do. In India, the Hijras are basically cast out of society, only good for begging and sex work. So it's not necessarily a great life.

"I was talking to a remarkable gender therapist named Diane [Erinsaft] and I suddenly started worrying that if she'd been around when I was a little boy, I might have been turned into a little girl. She laughed and said 'No, you're definitely a guy'.

"But we started talking about the potential risk of the transgender movement establishing new binaries where, if you have a girly boy, and you're worried about how effeminate this child is, you could very easily solve the problem by taking the child to the doctor and the doctor can wave a wand and say 'Your girly boy is now a princess'.

"Wouldn't it be better if we had a society that just raised children so that it was okay to be a tomboyish girl, or a girly boy, and to explore that?

"Diane speaks about 'gender smoothies'; she got this from one of her patients who said 'I'm not a girl or a boy, I'm a gender smoothie, I mix it all up together'."

Dr Imran Mushtaq: Doctors increasingly recognise complexity of defining sex

Dr Imran Mushtaq is a consultant paediatric urologist who works with children with differences in sex development (DDS) at Great Ormond Street Hospital in London. Around 1 in 1500 babies are born with DDS but up to 1 in 100 people have less obvious differences.

"Absolutely sex is a spectrum. It's not binary in any way and we are slowly coming to understand this.

"As a specialist working in this area for the last 12 years, I've seen us transitioning so much in the way we think about sex and the way we treat children in whom the sex is not clear, and we are increasingly becoming aware how complex the issue is.

"How do you define what sex a child is? Is it the physical characteristics, the genitalia - do they have testicles, do they have ovaries or do they have both? Is it their chromosomes, is it their hormones?

"You can have a child whose chromosomes are XX, typical of what you'd associate with being female, yet their genitalia looks like a boy.

"Ten or 20 years ago when children were born with these kind of problems, there was very little discussion about not doing surgery. It was almost a given that the child would need surgery to make it a boy or a girl.

"As a doctor and surgeon, I'm increasingly uncomfortable about undertaking what is irreversible surgery.

"We know that the outcomes of surgeries that were undertaken 10, 20 years ago are not necessarily as good as we would like them to be. Now is the next stage: in 10 or 20 years' time we will find out the outcome of not doing the surgery or maintaining these children in a certain sex, whereas previously they would have been changed to a different sex.

"I don't think we should have gender categories. I don't think that sex should be on birth certificates, I don't think sex should be on driving licences and I don't think sex should be on passports.

"We are just what we are. We have a name, we have a date of birth, give us a number."

Tamara Adrian: We must work towards a more gender fluid world

Tamara Adrian is Venezuela's first transgender congresswoman although since it has not been possible legally to change your gender in Venezuela since 1998, she was sworn in under her old name, as a man.

"I've been saying for more than 15 years that gender as a legal category must be suppressed, because it is a way to deny rights or grant rights to male or female. Gender has the same effect that race or religion had in the past: there were two groups, one that was privileged and had rights, another that was underprivileged and didn't have rights.

"It is exactly the same with gender. If you are male, you have rights that females don't have, and this legal category of male and female is still being used to prevent equal rights: for instance, when you advertise a job and ask for someone you say female or male.

"I think [the idea of a legal third gender] will be the first test for this future solution in which gender will be suppressed in the legal document.

"It could be a solution because initially some of the [gender fluid] people in Nepal or India or Pakistan were not able to legally exist. They were not able to vote or go to school, and in general they were deprived of any basic rights. So it is an alternative in these countries.

"In other countries such as Australia which do not categorise a person within the male or female boxes, it's the first step in order to have a much more gender fluid world. But in Australia, for instance, they are allowing people to choose not to be considered legally male or female. But in those cases, you are deprived of the right of marriage.

"We see a little of the possibility [of a less binary future] when you talk about a metrosexual man, or you see women that allow themselves a suit one day and the following day to use a dress with high heels.

"That's part of this gender fluid world in which you are not prevented to use the clothes that you want or to express your gender in the way you want."

http://www.eurekalert.org/pub_releases/2016-01/uota-sdh011316.php

Scientists discover how we play memories in fast forward

Discovery of a mechanism that may explain how the brain can recall nearly all of what happened in a fraction of the time it takes to live out the experience

Scientists at The University of Texas at Austin have discovered a mechanism that may explain how the brain can recall nearly all of what happened on a recent afternoon -- or make a thorough plan for how to spend an upcoming afternoon -- in a fraction of the time it takes to live out the experience.

The breakthrough in understanding a previously unknown function in the brain has implications for research into schizophrenia, autism spectrum disorders, Alzheimer's disease and other disorders where real experiences and ones that exist only in the mind can become distorted.

The newly discovered mechanism, which compresses information needed for memory retrieval, imagination or planning and encodes it on a brain wave frequency that's separate from the one used for recording real-time experiences, is described in a cover article in the Jan. 20 print edition of the journal Neuron.

Brain cells share different kinds of information with one another using a variety of different brain waves, analogous to the way radio stations broadcast on different frequencies.

Laura Colgin, an assistant professor of neuroscience, Chenguang Zheng, a postdoctoral researcher, and their colleagues found that one of these frequencies allows us to play back memories -- or envision future activities -- in fast forward.

"The reason we're excited about it is that we think this mechanism can help explain how you can imagine a sequence of events you're about to do in a time-compressed manner," says Colgin.

"You can plan out those events and think about the sequences of actions you'll do. And all of that happens on a faster time scale when you're imagining it than when you actually go and do those things."

In the brain, fast gamma rhythms encode memories about things that are happening right now; these waves come rapidly one after another as the brain processes high-resolution information in real time.

The scientists learned that slow gamma rhythms -- used to retrieve memories of the past, as well as imagine and plan for the future -- store more information on their longer waves, contributing to the fast-forward effect as the mind processes many data points with each wave.

Mental compression turns out to be similar to what happens in a computer when you compress a file. Just like digital compression, when you replay a mental memory or imagine an upcoming sequence of events, these thoughts will have less of the rich detail found in the source material.

The finding has implications for medicine as well as for criminal justice and other areas where memory reliability can be at issue.

Colgin notes that the research could also explain why people with schizophrenia who are experiencing disrupted gamma rhythms have a hard time distinguishing between imagined and real experiences.

"Maybe they are transmitting their own imagined thoughts on the wrong frequency, the one usually reserved for things that are really happening," says Colgin. "That could have terrible consequences."

Next, the researchers plan to use animals with neurological disorders similar to autism spectrum disorders and Alzheimer's disease in humans to better understand what role this mechanism plays and explore ways to counteract it.

This research was supported by the Esther A. and Joseph Klingenstein Fund, the Alfred P. Sloan Foundation, the National Institute of Mental Health and the Office of Naval Research.

http://www.eurekalert.org/pub_releases/2016-01/uoe-mva011216.php

Migrant values adapt over just 1 generation

Migrants' thinking styles and social values rapidly shift over a single generation to become more similar to those of the wider society they have moved into, new research has indicated

Migrants' thinking styles and social values rapidly shift over a single generation to become more similar to those of the wider society they have moved into, new research has indicated.

A study led by the University of Exeter has concluded that the children of people who migrated to the UK tend to think and reason in a way that is more typical of the wider UK population. The research allays fears that migrating communities will fail to integrate due to psychological differences, according to the team.

The study, funded by the Economic and Social Research Council (ESRC) and published on Wednesday January 13 in the journal PLOS ONE, involved collaborators from the universities of Durham and Edinburgh. They assessed members of the British Bangladeshi community in East London's Tower Hamlets borough, where British Bangladeshis make up 32 per cent of the total population.

The team wanted to establish whether previously observed cultural differences in psychological characteristics changed over a single generation. They carried out an assessment of 108 first generation migrants - people who were born and raised in Bangladesh and had moved to the UK after the age of 14. They also assessed 79 second generation migrants - people born and raised in the UK to two first generation British Bangladeshi migrants.

In line with previous research, they found differences in the psychological characteristics of first generation migrants, compared to non-migrants whose parents were born and raised in the UK. One example was that first generation British Bangladeshis tended towards collectivism, meaning they were more family-orientated and community-centred, and motivated by teamwork, much like people from other non-Western societies. Non-migrants living in the same area of East London tended to be less collectivistic, on average. Another example concerned how people explain other people's actions. Non-migrants, like people from other Western countries, tended to explain other people's actions in terms of that person's own intrinsic dispositions. For example, they might say that a student who failed an exam did so because the student is unintelligent or lazy. Those who had migrated from Bangladesh explained the outcome in a way similar to people from other non-Western countries, and tended to explain the same events in terms of situations rather than dispositions. For example, they might say that a student who failed an exam did so because of a lack of support, or overbearing pressure to succeed academically.

In just one generation, these differences had significantly reduced. On average, second generation British Bangladeshis showed less collectivism than their parents' group, and were more likely to blame individual dispositions rather than situations for others' actions.

This shift occurred despite them retaining many cultural similarities with their parents. For example, nearly all were Muslim and were fluent Bengali speakers.

Lead author Dr Alex Mesoudi, Associate Professor of Cultural Evolution at the University of Exeter, said the findings suggested that communities could integrate over a single generation much more effectively than commonly assumed. He said: "This study should allay fears that migrants will fail to integrate because of unalterable social and cultural differences. Surveys have shown that half of the British public believe you can't be 'truly British' unless you have British ancestry, but our study shows a rapid shift over a single generation towards the same values and thinking styles, even while the second generation British Bangladeshis retained their sense of heritage identity through language and religion.

"While on the one hand the shift seen in the second generation can be seen as good in the sense that it may encourage greater integration of migrant groups with the wider UK society, on the other hand it's a shame that values less typical of modern-day British society, such as close family ties and community support, are being lost."

The research project originated when Dr Mesoudi was lecturing psychology at Queen Mary University of London in East London, and his students, many of whom were second generation British Bangladeshis themselves, took an interest in research about cultural integration. They began to survey their peers, prompting a successful application for the ESRC funding.

Dr Nasima Akhter, who was involved in data collection for this study and has also conducted focus groups with East London British Bangladeshis as part of another project examining migration and its impact on wellbeing among Bangladeshi migrants, said: "Members of the British Bangladeshi community often say that it is not always clear what 'integration' means or entails, and that negative mainstream perceptions of immigrants can be a barrier to successful integration. A better understanding of the psychological changes that occur in migrant communities, and factors that influence integration, can help to clarify these issues and counter false perceptions."

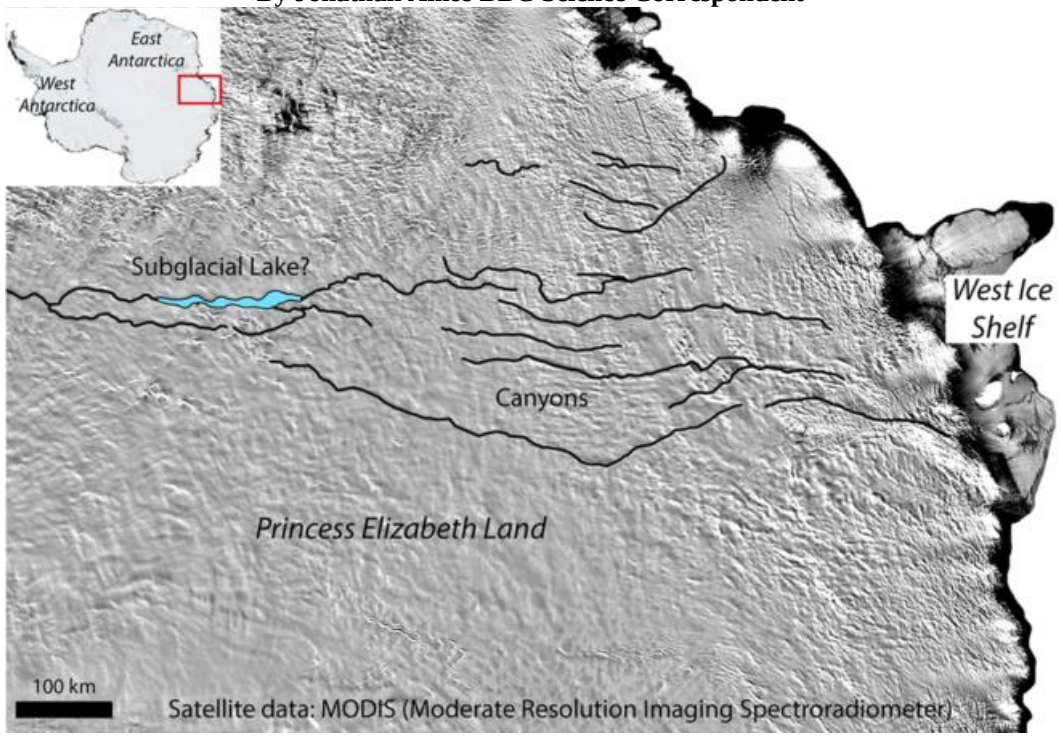
The paper, entitled "How Do People Become W.E.I.R.D.? Migration Reveals the Cultural Transmission Mechanisms Underlying Variation in Psychological Processes", is published today, Wednesday January 13, in PlOS ONE.

http://bit.ly/1npAR1V

'Gigantic chasm under Antarctic ice'

A vast, previously unrecognised canyon system could be hidden under the Antarctic ice sheet.

By Jonathan Amos BBC Science Correspondent



Faint lineations in the ice surface have been traced by satellites (For comparison, the Grand Canyon is about 450km long)

Hints of its presence are seen in the shape of the white continent's surface, in a largely unexplored region called Princess Elizabeth Land.

If confirmed by a proper geophysical survey - now under way - the winding canyon network would be over 1,000km long and in places as much as 1km deep.

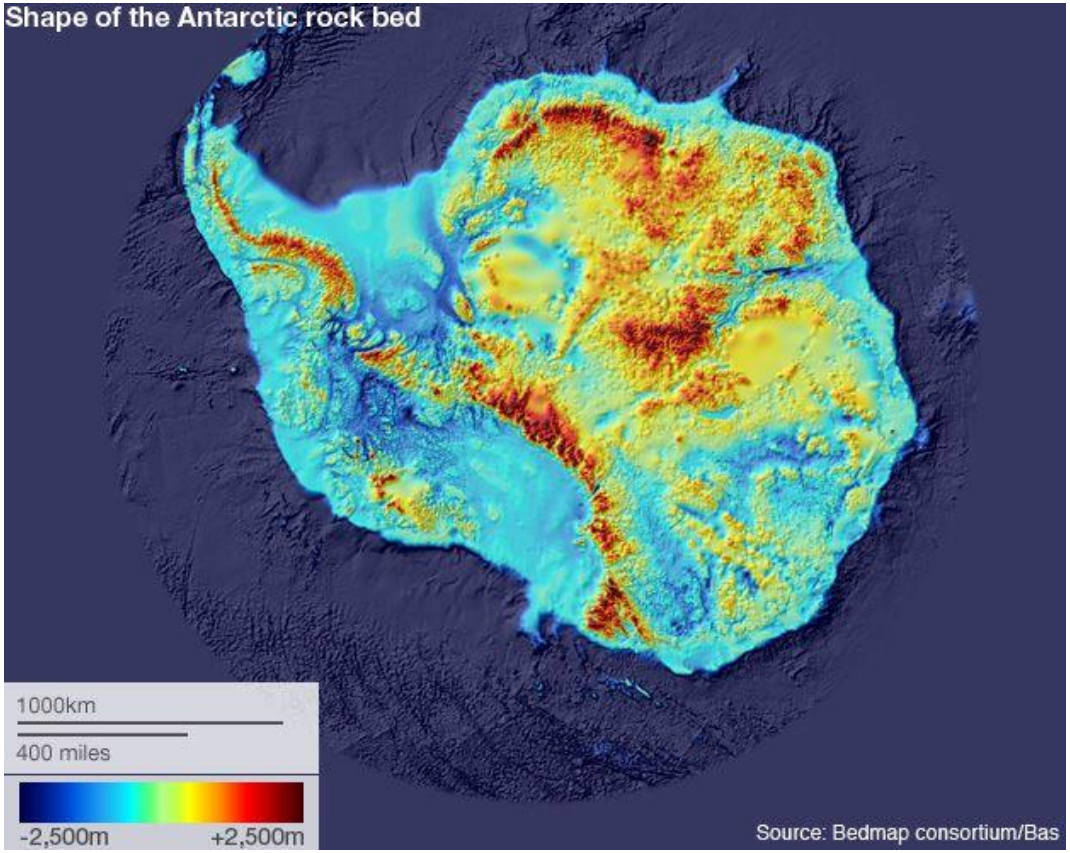
These dimensions would make it bigger than the famous Grand Canyon in the US.

"We know from other areas of Antarctica that the shape of the ice surface is obviously dependent on the shape of the landscape underneath - because the ice is flowing over that landscape," explained Dr Stewart Jamieson, from Durham University, UK.

"When we look in Princess Elizabeth Land with satellite data, there seem to be some linear features in the surface ice that to us look very reminiscent of a canyon.

"We have traced these faint lineations from the centre of Princess Elizabeth Land all the way to the coast, off to the north. It's a pretty substantial system," he told BBC News.

There are suggestions also that the canyon network is connected to a previously undiscovered subglacial lake. If confirmed, this lake would likely cover up to 1,250 square km, which is about 80 times as big as Windermere, England's largest lake.



Getting an accurate visualisation of the hidden rock under the ice has taken more than five decades

The initial interpretation of a canyon system is supported by radar data that has been gathered in a couple of locations. Radar sees through the ice layers to the hard rockbed below.

The story is consistent, says team-member Prof Martin Siegert, from Imperial College London, UK, said. "Discovering a gigantic new chasm that dwarfs the Grand Canyon is a tantalising prospect.

"Geoscientists on Antarctica are carrying out experiments to confirm what we think we are seeing from the initial data, and we hope to announce our findings at a meeting of the ICECAP2 collaboration, at Imperial, later in 2016."

Most of Antarctica has now been covered by full geophysical surveys that have imaged the continent's underlying topography.

But there remain two "Poles of Ignorance" that need to be filled in. One of these is Princess Elizabeth Land; the other is the Recovery Basin.

Both are in East Antarctica, and both are now the targets of intense study.

International teams - comprising scientists from the US, the UK, Australia, China and other nations - are flying sensors back and forth across thousands of square kilometres of ice surface.

When complete, Antarctic researchers will have a comprehensive view of what the landscape really looks like beneath all its accumulated ice. This is fundamental knowledge in trying to understand how the continent might react in a warming world. "If we don't know the shape of the rockbed, we cannot confidently build models that will produce sensible behaviours in the ice," asserted Dr Jamieson. The latest research is published in Geology journal.

http://bit.ly/1P5XUeo

What Will It Take for Humans to Colonize the Milky Way?

It's a common theme in science fiction, but migrating to planets beyond our solar system will be a lot more complicated and difficult than you might imagine

The idea that humans will eventually travel to and inhabit other parts of our galaxy was well expressed by the early Russian rocket scientist Konstantin Tsiolkovsky, who wrote, “Earth is humanity’s cradle, but you’re not meant to stay in your cradle forever.” Since then the idea has been a staple of science fiction, and thus become part of a consensus image of humanity’s future. Going to the stars is often regarded as humanity’s destiny, even a measure of its success as a species. But in the century since this vision was proposed, things we have learned about the universe and ourselves combine to suggest that moving out into the galaxy may not be humanity’s destiny after all.

The problem that tends to underlie all the other problems with the idea is the sheer size of the universe, which was not known when people first imagined we would go to the stars. Tau Ceti, one of the closest stars to us at around 12 light-years away, is 100 billion times farther from Earth than our moon. A quantitative difference that large turns into a qualitative difference; we can’t simply send people over such immense distances in a spaceship, because a spaceship is too impoverished an environment to support humans for the time it would take, which is on the order of centuries. Instead of a spaceship, we would have to create some

kind of space-traveling ark, big enough to support a community of humans and other plants and animals in a fully recycling ecological system.

On the other hand it would have to be small enough to accelerate to a fairly high speed, to shorten the voyagers' time of exposure to cosmic radiation, and to breakdowns in the ark. Regarded from some angles bigger is better, but the bigger the ark is, the proportionally more fuel it would have to carry along to slow itself down on reaching its destination; this is a vicious circle that can't be squared. For that reason and others, smaller is better, but smallness creates problems for resource metabolic flow and ecologic balance. Island biogeography suggests the kinds of problems that would result from this miniaturization, but a space ark's isolation would be far more complete than that of any island on Earth. The design imperatives for bigness and smallness may cross each other, leaving any viable craft in a non-existent middle.

The biological problems that could result from the radical miniaturization, simplification and isolation of an ark, no matter what size it is, now must include possible impacts on our microbiomes. We are not autonomous units; about eighty percent of the DNA in our bodies is not human DNA, but the DNA of a vast array of smaller creatures. That array of living beings has to function in a dynamic balance for us to be healthy, and the entire complex system co-evolved on this planet's surface in a particular set of physical influences, including Earth's gravity, magnetic field, chemical make-up, atmosphere, insolation, and bacterial load. Traveling to the stars means leaving all these influences, and trying to replace them artificially. What the viable parameters are on the replacements would be impossible to be sure of in advance, as the situation is too complex to model. Any starfaring ark would therefore be an experiment, its inhabitants lab animals. The first generation of the humans aboard might have volunteered to be experimental subjects, but their descendants would not have. These generations of descendants would be born into a set of rooms a trillion times smaller than Earth, with no chance of escape.

In this radically diminished enviroment, rules would have to be enforced to keep all aspects of the experiment functioning. Reproduction would not be a matter of free choice, as the population in the ark would have to maintain minimum and maximum numbers. Many jobs would be mandatory to keep the ark functioning, so work too would not be a matter of choices freely made. In the end, sharp constraints would force the social structure in the ark to enforce various norms and behaviors. The situation itself would require the establishment of something like a totalitarian state.

Of course sociology and psychology are harder fields to make predictions in, as humans are highly adaptable. But history has shown that people tend to react poorly in rigid states and social systems. Add to these social constraints permanent enclosure, exile from the planetary surface we evolved on, and the probability of health problems, and the possibility for psychological difficulties and mental illnesses seems quite high. Over several generations, it's hard to imagine any such society staying stable.

Still, humans are adaptable, and ingenious. It's conceivable that all the problems outlined so far might be solved, and that people enclosed in an ark might cross space successfully to a nearby planetary system. But if so, their problems will have just begun.

Any planetary body the voyagers try to inhabit will be either alive or dead. If there is indigenous life, the problems of living in contact with an alien biology could range from innocuous to fatal, but will surely require careful investigation. On the other hand, if the planetary body is inert, then the newcomers will have to terraform it using only local resources and the power they have brought with them. This means the process will have a slow start, and take on the order of centuries, during which time the ark, or its equivalent on the alien planet, would have to continue to function without failures.

It's also quite possible the newcomers won't be able to tell whether the planet is alive or dead, as is true for us now with Mars. They would still face one problem or the other, but would not know which one it was, a complication that could slow any choices or actions.

So, to conclude: an interstellar voyage would present one set of extremely difficult problems, and the arrival in another system, a different set of problems. All the problems together create not an outright impossibility, but a project of extreme difficulty, with very poor chances of success. The unavoidable uncertainties suggest that an ethical pursuit of the project would require many preconditions before it was undertaken. Among them are these: first, a demonstrably sustainable human civilization on Earth itself, the achievement of which would teach us many of the things we would need to know to construct a viable mesocosm in an ark; second, a great deal of practice in an ark obiting our sun, where we could make repairs and study practices in an ongoing feedback loop, until we had in effect built a successful proof of concept; third, extensive robotic explorations of nearby planetary systems, to see if any are suitable candidates for inhabitation.

Unless all these steps are taken, humans cannot successfully travel to and inhabit other star systems. The preparation itself is a multi-century project, and one that relies crucially on its first step succeeding, which is the creation of a sustainable long-term civilization on Earth. This achievement is the necessary, although not

sufficient, precondition for any success in interstellar voyaging. If we don't create sustainability on our own world, there is no Planet B.

http://bit.ly/1n2ClP5

Tool find hints Java Man and hobbit had early human neighbour

The infamous hobbit may not have been the only ancient human species to travel deep into Indonesia.

A collection of stone tools found on the island of Sulawesi hints that other early humans might have lived there too.

The strip of ocean that separates Borneo from Sulawesi, and Bali from Lombok, is just 35 kilometres wide in places. But for the mammals of the northern hemisphere it has historically marked a virtually impenetrable barrier called the Wallace line.

These stone tools were found scattered on the gravelly shore of the Walanae river near Talepu, Sulawesi **Image: Erick Setiabudi**

This line marks a deep ocean channel that remained water-filled even during past ice ages, when sea levels saw channels between other islands in the region dry out.

So mammals coming from the north were able to reach the islands to the north and west of the line. But the islands to the south and east – known as Wallacea – remained out of reach.

Our species, Homo sapiens, is one of the few that managed to cross. We rafted across about 50,000 years ago. The diminutive hobbit, Homo floresiensis, also made it across. It was living on the island of Flores at least 38,000 years ago.

Stone tools have also been found on Flores, at different sites, and these date back at least 1 million years. It is possible they were made by the hobbit's ancestors, or by a different species of hominin that also crossed the Wallace line.

Now a collection of some 300 stone tools have been found at a site called Talepu on the island of Sulawesi, also in Wallacea. They date back at least 118,000 years – some might even be 194,000 years old – and include an array of choppers and sharp flakes.

They are clearly the work of hominin hands, and they were found in sediments containing the fragmentary fossils of water buffalo and pigs. But the identity of the toolmaker is a mystery: the tools are so simple that almost any human could have made them, although their age makes it less likely that they were fashioned by Homo sapiens.

Whose tools?

Gerrit van den Bergh at the University of Wollongong in New South Wales, Australia, and his colleagues, who found the tools, say there are at least three possibilities. It could have been the hobbit's handiwork – the only early hominin we know definitely crossed the Wallace line.

Yet Flores lies to the south of Sulawesi – and strong ocean currents in the area flow predominantly from north to south. "It would be very difficult, if not impossible, to cross [from Flores to Sulawesi] without any means of boat or raft technology," says van den Bergh – the kind of technology the hobbit is not thought to have mastered.

The tools could also indicate that other species made the crossing, perhaps Java Man (Homo erectus): who lived on Java, just a few hundred kilometres west of the line until some 500,000 years ago.

Enigmatic Denisovans

Or they could have been made by an enigmatic group called the Denisovans.

The Denisovans have at some point interbred with our species. Curiously, Denisovan DNA is only common in people today who live to the south-east of the Wallace line – which suggests that our species met and interbred with Denisovans only after crossing the line.

More clues to the toolmaker's identity might come from even further north, given the way the currents flow through the region. "We think that the ancestors of the Talepu toolmakers came from either Borneo or the Philippines," says van den Bergh. There have been very few archaeological searches of Borneo, so at the moment we know practically nothing about its fossil record.

Philippine secrets

But the Philippines is beginning to reveal its riches. In 2007, researchers found a 67,000-year-old human foot bone on the island of Luzon. It was provisionally suggested that it belonged to an unusually early Homo sapiens to the east of the Wallace line.

But there are also unpublished reports that more human fossils were found on Luzon in 2014 – and that these additional finds suggest that the Luzon hominin may have been a more primitive species.

The ancient human colonisation of the islands to the south-east of the Wallace line is certainly a complex story, says archaeologist Roy Larick.

But he says we can look forward to finding out more in the next few months to few years. "In totality, the coming papers should indicate that tool-using early hominins occupied a number of Wallacean islands," he says.

Journal reference: Nature, DOI: 10.1038/nature16448

http://www.eurekalert.org/pub_releases/2016-01/si-apl011416.php

Autism-linked protein lays groundwork for healthy brain

A gene linked to mental disorders helps lays the foundation for a crucial brain structure during prenatal development, according to Salk Institute research published January 14, 2016 in Cell Reports.

LA JOLLA - The findings reveal new mechanistic insights into the gene, known as MDGA1, which may bring a better understanding of neurodevelopmental disorders in people, says Carlos Perez-Garcia, the study's lead author and a staff researcher in the laboratory of Professor Dennis O'Leary, holder of the Vincent J. Coates Chair in Molecular Neurobiology.

Signs of autism, schizophrenia and bipolar disorder often take years to manifest. Studying suspect disease genes in the brain early in life could prove valuable in the development of new treatments or interventions.

More than a decade ago, O'Leary's group discovered MDGA1, which codes for a protein that influences neuron migration in the developing brain. Coating the outer surfaces of neurons, MDGA1 is particularly abundant in the cerebral cortex, a six-layered area of the brain needed to process information from the five senses and coordinate movement, as well as to be self-aware and plan ahead.

As the lab was investigating the role of MDGA1 in brain development, other research groups published large population-based studies implicating the gene in autism, schizophrenia and bipolar disorder. "The human data brought a whole new level of meaning to our work," says Perez-Garcia. "It allowed us to consider our findings in the context of human disease."

The team decided to look at the protein's role in early brain development, when the foundation of a proper, six-layer cortex is being laid. When Perez-Garcia disabled the gene in mice a little more than halfway through pregnancy, to his surprise, the neuron precursors in the cerebral cortex migrated to the wrong places in the brain. These cells die off before they can become neurons and, overall, without MDGA1, the cerebral cortex loses about half its neurons.

These new results suggest that mutations in MDGA1 while the cortex is developing (during the first half of pregnancy in humans) could produce snowball effects leading to the development of brain disorders. The severe depletion of neurons in the cortex strongly compromises its ability to communicate with other brain areas, says Perez-Garcia. More experiments by the group revealed what happens when MDGA1 is mutated: It prevents neuron precursors from sticking to one another, which is critical for those cells to divide and generate neurons.

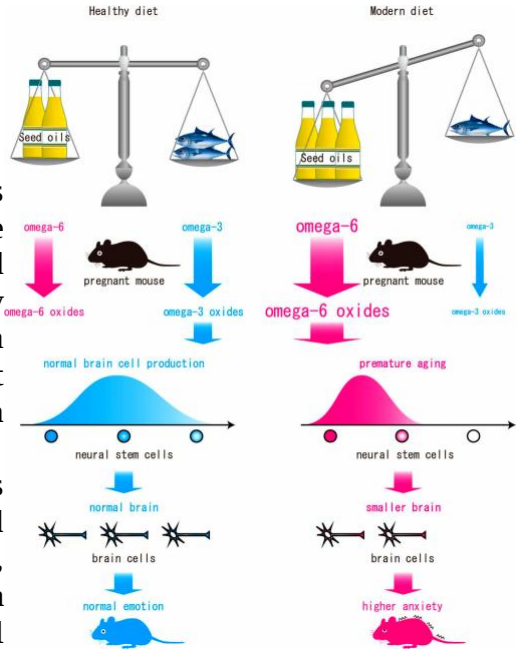
The lab plans to continue to examine the role of MDGA1 earlier in development and also during adulthood, as well as assess behaviors of mice lacking the gene.

The research was supported by the National Institutes of Health.

http://www.eurekalert.org/pub_releases/2016-01/tu-wfi011416.php

Why fish intake by pregnant women improves the growth of a child's brain

Explanation for correlation between eating fish during pregnancy and health of the baby's brain



Researchers at Tohoku University's School of Medicine have found an explanation for the correlation between eating fish during pregnancy, and the health of the baby's brain.

Dietary lipid contains fatty acids such as omega-6 and omega-3, which are essential nutrients for many animals and humans. The research group, led by Professor Noriko Osumi, found that a balanced intake of lipids by pregnant women is necessary for the normal brain formation of the unborn child.

In an animal study, the researchers noticed that when female mice were fed an omega-6-rich/omega-3-poor diet, their offsprings were born with a smaller brain and showed abnormal emotional behavior in adulthood.

Dietary lipid contains fatty acids such as omega-6 and omega-3, which are essential nutrients for many animals and humans. We found from an animal study the underlying mechanism of how an imbalance of omega-6 and omega-3 affects brain development and causes anxiety in the offspring. This may imply that a balanced intake of lipids (such as the regular intake of fish) during pregnancy is good for the healthy development of the brain of the unborn child. **Noriko Osumi**

This is significant because people in many countries these days have similarly poor dietary patterns and tend to consume more seed oils that are rich in omega-6 fatty acids and less fish rich in omega-3 fatty acids.

According to Professor Osumi, the brain abnormality found in the offsprings of mice used in the study, was caused by a premature aging of fetal neural stem cells that produce brain cells. The premature aging was promoted by an imbalance of oxides of omega-6 and omega-3 fatty acids. The offsprings also showed higher anxiety levels, even though they were raised on nutritionally optimized diets from an early lactation period.

A diet that contains a good balance of omega-6 and omega-3 fatty acids is known to improve the development of brain functions; this is based on earlier researches that evaluated the effects of maternal intake of an omega-3-poor diet on brain function in children.

The new study took this premise further and focused on the effects of dietary lipids on the brain formation. The results reveal why omega-6 and omega-3 balance is important for future brain function, and reinforces earlier suggestions that more fish intake by women during pregnancy can advantageously affect the child's health.

Publication Details:

Authors: Nobuyuki Sakayori, Takako Kikkawa, Hisanori Tokuda, Emiko Kiryu, Kaichi Yoshizaki, Hiroshi Kawashima, Tetsuya Yamada, Hiroyuki Arai, Jing X Kang, Hideki Katagiri, Hiroshi Shibata, Sheila M Innis, Makoto Arita and Noriko Osumi

Title: Maternal dietary imbalance between omega-6 and omega-3 polyunsaturated fatty acids impairs neocortical development via epoxy metabolites

http://www.eurekalert.org/pub_releases/2016-01/mgh-sfh011416.php

Study finds how diabetes drug metformin inhibits progression of pancreatic cancer

Metformin-induced suppression of metastasis-promoting tumor microenvironment may be most prevalent in overweight, obese patients

Massachusetts General Hospital (MGH) investigators may have uncovered a novel mechanism behind the ability of the diabetes drug metformin to inhibit the progression of pancreatic cancer. In their report that has been published in the open access journal PLOS One, the research team describes finding that metformin decreases the inflammation and fibrosis characteristic of the most common form of pancreatic cancer. Their findings in cellular and animal models and in patient tumor samples also indicate that this beneficial effect may be most prevalent in overweight and obese patients.

"We found that metformin alleviates desmoplasia - an accumulation of dense connective tissue and tumor-associated immune cells that is a hallmark of pancreatic cancer - by inhibiting the activation of the pancreatic stellate cells that produce the extracellular matrix and by reprogramming immune cells to reduce inflammation," says Dai Fukumura, MD, PhD, of the Steele Laboratory of Tumor Biology in the MGH Department of Radiation Oncology, the study's co-senior author. "We also found these effects only evident in tumors from overweight or obese individuals, who appear to have tumors with increased fibrosis."

The study focused on pancreatic ductal adenocarcinoma, the most common form of pancreatic cancer, which accounts for almost 40,000 cancer death in the U.S. ever year. Half of those diagnosed with this form of pancreatic cancer are overweight or obese, and up to 80 percent have type 2 diabetes or are insulin resistant. Diabetic patients taking metformin - a commonly used generic medication for type 2 diabetes - are known to have a reduced risk of developing pancreatic cancer; and among patients who develop the tumor, those taking the drug may have a reduced risk of death. But prior to the current study the mechanism of metformin's action against pancreatic cancer was unclear, and no potential biomarkers of response to metformin had been reported.

The researchers first found that levels of hyaluronan, a component of the extracellular matrix, were 30 percent lower in tumor samples from overweight or obese patients who were taking metformin to treat diabetes than in those who did not take the drug. In an obese animal model of pancreatic cancer, those that received metformin had reduced expression of both hyaluronan and collagen-1 and fewer activated pancreatic stellate cells (PSCs). Studies in cultured cells identified the signaling pathway by which metformin reduces the production of hyaluronan and collagen-1 by PSCs and also prevents the recruitment of tumor-associated macrophages, which increase the inflammatory environment.

In obese mouse models, the researchers found that metformin treatment reduced levels of tumor-associated macrophages by 60 percent and reduced expression of genes involved in remodeling the extracellular matrix of tumor tissue. The tumors of animals treated with metformin also had reductions in a metastasis-associated change in cellular characteristics called epithelial to mesenchymal transition (EMT) and in the overall level of metastasis. These tumor-related effects of metformin appear to be independent of the drug's effects on metabolic pathways involved in glucose metabolism and body weight.

"Nearly 200 clinical trials are currently underway investigating the effect of metformin on tumors in both diabetic and non-diabetic patients," say co-senior author Rakesh K. Jain, PhD, director of the Steele Laboratory. "Understanding the mechanism behind metformin's effects on pancreatic and other cancers may help us identify biomarkers - such as patient body weight and increased tumor fibrosis - that can identify the patients for whom metformin treatment would be most beneficial." Fukumura is an associate professor of Radiation Oncology, and Jain is the Cook Professor of Tumor Biology at Harvard Medical School. Later this year Jain will be among nine recipients of the 2016 National Medal of Science.

The co-lead authors of the PLOS One paper are Joao Incio, MD, and Priya Suboj, PhD, of the Steele Laboratory of Tumor Biology in the MGH Department of Radiation Oncology. Additional co-authors are Shan Chin, Trupti Vardam-Kaur, PhD, Hao Liu, MD, Tai Hato, MD, PhD, Suboj Babykutty, PhD, and Ivy Chen, all of the Steele Lab; and Vikram Deshpande, MBBS, MGH Pathology. This work was supported by National Institutes of Health grants R35-CA197743, CA80124, A85140, CA96915, CA115767, and CA126642, and grants from the Lustgarten Foundation and the Foundation for Science and Technology of Portugal.

http://www.eurekalert.org/pub_releases/2016-01/uonc-uhr011416.php

UNC-Chapel Hill researchers kill drug-resistant lung cancer with 50 times less chemo

Cancer drugs packaged in immune bubbles home in directly to tumors without getting sidetracked and destroyed; less chemo with better results

The cancer drug paclitaxel just got more effective. For the first time, researchers from the University of North Carolina at Chapel Hill have packaged it in containers derived from a patient's own immune system, protecting the drug from being destroyed by the body's own defenses and bringing the entire payload to the tumor.

"That means we can use 50 times less of the drug and still get the same results," said Elena Batrakova, Ph.D., an associate professor in the UNC Eshelman School of Pharmacy. "That matters because we may eventually be able to treat patients with smaller and more accurate doses of powerful chemotherapy drugs resulting in more effective treatment with fewer and milder side effects."

The work, led by Batrakova and her colleagues at the UNC Eshelman School of Pharmacy's Center for Nanotechnology in Drug Delivery, is based on exosomes, which are tiny spheres harvested from the white blood cells that protect the body against infection. The exosomes are made of the same material as cell membranes, and the patient's body doesn't recognize them as foreign, which has been one of the toughest issues to overcome in the past decade with using plastics-based nanoparticles as drug-delivery systems.

"Exosomes are engineered by nature to be the perfect delivery vehicles," said Batrakova, who has also used this technique as a potential therapy for Parkinson's disease. "By using exosomes from white blood cells, we wrap the medicine in an invisibility cloak that hides it from the immune system. We don't know exactly how they do it, but the exosomes swarm the cancer cells, completely bypassing any drug resistance they may have and delivering their payload."

Paclitaxel is a potent drug used in the United States as a first- and second-line treatment for breast, lung and pancreatic cancers. It can have serious and unpleasant side effects, such as hair loss, muscle and joint pain and diarrhea, and it can put patients at greater risk of serious infection.

In their experiment, Batrakova's team extracted exosomes from mouse white blood cells and loaded them with paclitaxel. They then tested the treatment -- which they call exoPXT -- against multiple-drug-resistant cancer cells in petri dishes. The team saw that they needed 50 times less exoPXT to achieve the same cancer-killing effect as formulations of the drug currently being used, such as Taxol.

The researchers next tested the therapy in mouse models of drug-resistant lung cancer. They loaded the exosomes with a dye in order to track their progress through the lungs and found that the exosomes were thorough in seeking out and marking cancer cells, making them a surprisingly effective diagnostic tool in addition to being a powerful therapeutic.

"Accurately mapping the extent of tumors in the lungs is one of the biggest challenges in treating lung-cancer patients," said Batrakova. "Our results show how powerful exosomes can be as both a therapeutic and a diagnostic."

Batrakova's study, which appears in Nanomedicine: Nanotechnology, Biology and Medicine, was supported by the National Institutes of Health and the Carolina Partnership, a strategic partnership between the UNC Eshelman School of Pharmacy and the University Cancer Research Fund through the Lineberger Comprehensive Cancer Center, as well as the Russian Federation Ministry of Education and Science.

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Much like white light, spacetime is also composed of a certain rainbow

In models of the Universe using any of the quantum theories of gravity there must also be a 'rainbow' of sorts

When white light is passed through a prism, the rainbow on the other side reveals a rich palette of colors. Theorists from the Faculty of Physics, University of Warsaw have shown that in models of the Universe using any of the quantum theories of gravity there must also be a 'rainbow' of sorts, composed of different versions of spacetime. The mechanism predicts that instead of a single, common spacetime, particles of different energies essentially sense slightly modified versions thereof.

We have probably all seen the experiment: when white light passes through a prism it splits to form a rainbow. This is because white light is in fact a mixture of photons of different energies, and the greater the energy of the photon, the more it is deflected by the prism. Thus, we might say that the rainbow arises because photons of different energies sense the same prism as having slightly different properties. For years now it has been suspected that particles of different energies in quantum universe models essentially sense spacetimes with slightly different structures. Earlier hypotheses were not derived from quantum theory, however, but based on guesses. Currently, a group of physicists from the Faculty of Physics, University of Warsaw, led by Prof. Jerzy Lewandowski, has formulated a general mechanism responsible for the emergence of such a spacetime rainbow.

"Two years ago we reported that in our quantum cosmological models, different types of particles feel the existence of spacetimes with slightly different properties. Now it turns out that the situation is even more complicated. We have discovered

a truly generic mechanism, whereby the fabric of spacetime felt by a given particle must vary depending not only on its type, but even on its energy," says Prof. Lewandowski.

In the current discussion the Warsaw physicists are using a cosmological model that contains just two components: gravity and one type of matter. Under the general theory of relativity, a gravitational field is described by deformations of spacetime, whereas matter is represented as a scalar field (the simplest type of field where every point in space is assigned only one value).

"Today there are many competing theories of quantum gravity. Therefore, we formulated our model in very general terms so that it can be applied to any of them. Someone might assume the kind of gravitational field - which in practice means spacetime - that is posited by one quantum theory, and someone else might assume another. Some mathematical operators in the model will then change, but this will not change the nature of the phenomena occurring in it," says PhD student Andrea Dapor (UW Physics).

The model so devised was then quantized - in other words continuous values, which may differ from one another in terms of any arbitrarily small amount, were converted to discrete values, which may only differ by specific intervals (quanta). Research on the dynamics of the quantized model revealed an amazing result: processes modeled using the quantum theory on quantum spacetime turned out to exhibit the same dynamics as when the quantum theory takes place in a classical continuous spacetime, i.e. the kind we know from everyday experience.

"This result is simply astonishing. We start with the fuzzy world of quantum geometry, where it is even difficult to say what is time and what is space, yet the phenomena occurring in our cosmological model still look as if everything was happening in ordinary spacetime!", says PhD student Mehdi Assanioussi (UW Physics).

Things took a more interesting turn when physicists looked at excitations in the scalar field, which are interpreted as particles. Calculations showed that in this model, particles that differ in terms of energy interact with quantum spacetime somewhat differently - much as photons of different energies interact with a prism somewhat differently. This result means that even the effective structure of classical spacetime sensed by individual particles must depend on their energy.

The occurrence of a normal rainbow can be described in terms of a refractive index, the value of which varies depending on the wavelength of light. In the case of the analogous spacetime rainbow, a similar relationship has also been proposed: the beta function, a measure of the extent to which the structure of classical spacetime differs as experienced by different particles. This function reflects the degree of non-classicalness of quantum spacetime: in conditions similar to classical it is close to zero, whereas in truly quantum conditions its value is close to one. Today the Universe is in a classical-like state, so now the beta value should be near zero, and estimates performed by other groups of physicists indeed suggest that it does not exceed 0.01. This small value for the beta function means that currently the spacetime rainbow is very narrow and cannot be detected experimentally.

The study by the UW Physics theorists, funded by grants from Poland's National Science Centre, has yielded another interesting conclusion. The spacetime rainbow is a result of quantum gravity. Physicists generally share the view that effects of this type only become visible at gigantic energies near the Planck energy, millions of billions of times the energy of particles now being accelerated in the Large Hadron Collider (LHC). However, the beta function value depends on time, and at moments close to the Big Bang it could have been much higher. When beta is close to one, the spacetime rainbow expands considerably. As a result, under such conditions the rainbow effect of quantum gravity could potentially be observed even at energies of particles hundreds of times smaller than the energy of protons in today's LHC.

SCIENTIFIC PAPERS:

"Rainbow metric from quantum gravity"; M. Assanioussi, A. Dapor, J. Lewandowski; Physics Letters B, vol. 751, 17 December 2015, pp 302-305; DOI: 10.1016/j.physletb.2015.10.043

http://www.eurekalert.org/pub_releases/2016-01/mcsc-obf011216.php

Odor biomarker for Alzheimer's disease

Non-invasive urine test could provide early diagnosis

PHILADELPHIA - A new study from the Monell Center, the U.S. Department of Agriculture (USDA), and collaborating institutions reports a uniquely identifiable odor signature from mouse models of Alzheimer's disease. The odor signature appears in urine before significant development of Alzheimer-related brain pathology, suggesting that it may be possible to develop a non-invasive tool for early diagnosis of Alzheimer's disease.

"Previous research from the USDA and Monell has focused on body odor changes due to exogenous sources such as viruses or vaccines. Now we have evidence that urinary odor signatures can be altered by changes in the brain characteristic of Alzheimer's disease," said study author Bruce Kimball, PhD, a chemical ecologist with the USDA National Wildlife Research Center (NWRC) who is stationed at the Monell Center. "This finding may also have implications for other neurologic diseases."

Identification of an early biomarker for Alzheimer's disease could potentially allow physicians to diagnose the debilitating disorder before the onset of brain

decline and mental deterioration, paving the way for upcoming treatments to slow early progression of the disease.

Alzheimer's is the most common form of dementia, afflicting an estimated 5.1 million Americans over the age of 65. There is no test to definitively diagnose Alzheimer's disease in living persons. Although the progression of Alzheimer's currently cannot be stopped or reversed, an accurate diagnosis can give patients and families time to plan for the future and seek treatments for symptom relief.

"While this research is at the proof-of-concept stage, the identification of distinctive odor signatures may someday point the way to human biomarkers to identify Alzheimer's at early stages," said study author Daniel Wesson, PhD, a neuroscientist at the Case Western Reserve University School of Medicine.

In the study, published in the online journal Scientific Reports, researchers studied three separate mouse models, known as APP mice, which mimic Alzheimer's-related brain pathology.

Using both behavioral and chemical analyses, the researchers found that each strain of APP mice produced urinary odor profiles that could be distinguished from those of control mice.

The odor changes did not result from the appearance of new chemical compounds, but instead reflected a relative shift of the concentrations of existing urinary compounds.

The odor differences between APP and control mice were mostly independent of age and preceded detectable amounts of plaque build-up in the brains of the APP mice. These findings suggest that the characteristic odor signature is related to the presence of an underlying gene rather than to the actual development of pathological changes in the brain.

Additional studies showed that the distinctive odor profiles could be used to predicatively identify APP mice versus control mice.

Because Alzheimer's is a uniquely human disease, scientists create models of associated brain pathology to study the disease in mice. One of the hallmark pathological indicators of Alzheimer's disease is an excess formation of amyloid plaque deposits in the brain. Scientists mimic this pathology in mouse models by introducing human genes associated with mutations of the amyloid-β precursor protein gene into the mouse genome. These genes are then pharmacologically activated to make excess amyloid-β protein, leading to plaque buildup in the brains of APP mice.

Wesson and study co-author Donald Wilson of the Nathan Kline Institute for Psychiatric Research and New York University School of Medicine utilize the mouse Alzheimer's models to examine the role of olfactory dysfunction as an early biomarker of Alzheimer's disease and other neurodegenerative disorders.

The researchers note that extensive studies are needed to identify and characterize Alzheimer's-related odor signatures in humans.

Research reported in the publication was supported by grants from the National Institute on Deafness and Other Communication Disorders and National Institute on Aging (DC003906 and AG037693) of the National Institutes of Health and from the Spitz Brain Health Innovation Fund, Mt. Sinai Health Care Foundation, and Alzheimer's Association. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health or other funders.

The NWRC has maintained a Field Station at Monell for over 42 years. To date, more than 200 publications on bird and wildlife chemical senses have resulted from the Monell-USDA affiliation, disseminating information on the biology and behavior of many animal and avian species, along with knowledge to aid in effective management of wildlife resources.

http://www.eurekalert.org/pub_releases/2016-01/tkf-rcb011116.php

Record-shattering cosmic blast could help crack the case of extreme supernova explosions

Exploding star is 200 times more powerful than a typical supernovae

Records are made to be broken, as the expression goes, but rarely are records left so thoroughly in the dust. Stunned astronomers have witnessed a cosmic explosion about 200 times more powerful than a typical supernova--events which already rank amongst the mightiest outbursts in the universe--and more than twice as luminous as the previous record-holding supernova.

At its peak intensity, the explosion--called ASASSN-15lh--shone with 570 billion times the brightness of the Sun. If that statistic does not impress, consider that this luminosity level is approximately 20 times the entire output of the 100 billion stars comprising our Milky Way galaxy.

The record-breaking blast is thought to be an outstanding example of a "superluminous supernova," a recently discovered, supremely rare variety of explosion unleashed by certain stars when they die. Scientists are frankly at a loss, though, regarding what sorts of stars and stellar scenarios might be responsible for these extreme supernovae. As described in a new study published today in Science, ASASSN-15lh is amongst the closest superluminous supernovae ever beheld, at around 3.8 billion light years away. Given its uncanny brightness and closeness, ASASSN-15lh might offer key clues in unlocking the secrets of this baffling class of celestial detonations.

"ASASSN-15lh is the most powerful supernova discovered in human history," said study lead author Subo Dong, an astronomer and a Youth Qianren Research

Professor at the Kavli Institute for Astronomy and Astrophysics (KIAA) at Peking University. "The explosion's mechanism and power source remain shrouded in mystery because all known theories meet serious challenges in explaining the immense amount of energy ASASSN-15lh has radiated."

ASASSN-15lh was first glimpsed in June 2015 by twin telescopes with 14-centimeter diameter lenses in Cerro Tololo, Chile conducting the All Sky Automated Survey for SuperNovae (ASAS-SN), an international collaboration headquartered at The Ohio State University. (Hence ASASSN-15lh's somewhat menacing moniker.) These two tiny telescopes sweep the skies to detect suddenly appearing objects like ASASSN-15lh that are intrinsically very bright, but are too far away for human observers to notice.

"ASAS-SN is the first astronomical project in history to frequently scan the entire optical sky for optical transients," said Krzysztof Stanek, professor of astronomy at the Ohio State University and the co-Principal Investigator of ASAS-SN. "Every time in science we open up a new discovery space, exciting findings should follow. The trick is not to miss them."

Dong and colleagues immediately put out word about the sighting of ASASSN-15lh in order for as much data as possible to be gathered. Multiple, far larger ground-based telescopes across the globe, as well as NASA's Swift satellite, have since taken part in an intense observing campaign that continues to this day.

In just the first four months after it went kablooie, so much energy beamed out of ASASSN-15lh that it would take our Sun in its current state more than 90 billion years to equal its emissions. By examining this bright, slowly fading afterglow, astronomers have gleaned a few basic clues about the origin of ASASSN-15lh.

Using the 2.5-meter du Pont telescope in Chile, Dong's colleagues Ben Shappee and Nidia Morrell at the Carnegie Observatories in the United States took the first spectrum of ASASSN-15lh to identify the signatures of chemical elements scattered by the explosion. This spectrum puzzled the ASAS-SN team members, for it did not resemble any of spectra from the 200 or so supernovae the project had discovered to date.

Inspired by suggestions from Jose Prieto at Universidad Diego Portales and Millennium Institute of Astrophysics in Chile and Stanek, Dong realized that ASASSN-15lh might in fact be a superluminous supernova. Dong found a close spectral match for ASASSN-15lh in a 2010 superluminous supernova, and if they were indeed of a kind, then ASASSN-15lh's distance would be confirmable with additional observations. Nearly 10 days passed as three other telescopes, stymied by bad weather and instrument mishaps, attempted to gather these necessary spectra. Finally, the 10-meter South African Large Telescope (SALT) secured the observations of elemental signatures verifying ASASSN-15lh's distance and extreme potency. "Upon seeing the spectral signatures from SALT and realizing that we had discovered the most powerful supernova yet, I was too excited to sleep the rest of the night," said Dong, who had received word of the SALT results at 2 AM in Beijing on July 1, 2015.

The ongoing observations have further revealed that ASASSN-15lh bears certain features consistent with "hydrogen-poor" (Type I) superluminous supernovae, which are one of the two main types of these epic explosions so named for lacking signatures of the chemical element hydrogen in their spectra. ASASSN-15lh has likewise shown a rate of temperature decrease and radius expansion similar to some previously discovered Type I superluminous supernova.

Yet in other ways, besides its brute power, ASASSN-15lh stands apart. It is way hotter, and not just brighter, than its apparently nearest of supernova kin. The galaxy it calls home is also without precedent. Type I superluminous supernova seen to date have all burst forth in dim galaxies both smaller in size and that churn out stars much faster than the Milky Way.

Noticing the pattern, astronomers hoped this specific sort of galactic environment had something to do with superluminous supernovae, either in the creation of the exotic stars that spawn them or in setting these stars off. Exceptionally, however, ASASSN-15lh's galaxy appears even bigger and brighter than the Milky Way. On the other hand, ASASSN-15lh might in fact reside in an as-yet-unseen, small, faint neighboring galaxy of its presumed, large galactic home.

To clear up where exactly ASASSN-15lh is located, as well as numerous other mysteries regarding it and its hyper-kinetic ilk, the research team has been granted valuable time this year on the Hubble Space Telescope. With Hubble, Dong and colleagues will obtain the most detailed views yet of the aftermath of ASASSN-15lh's stunning explosion. Important insights into the true wellspring of its power should then come to light.

One of the best hypotheses is that superluminous supernovae's stupendous energy comes from highly magnetized, rapidly spinning neutron stars called magnetars, which are the leftover, hyper-compressed cores of massive, exploded stars. But ASASSN-15lh is so potent that this compelling magnetar scenario just falls short of the required energies. Instead, ASASSN-15lh-esque supernovae might be triggered by the demise of incredibly massive stars that go beyond the top tier of masses most astronomers would speculate are even attainable.

"The honest answer is at this point that we do not know what could be the power source for ASASSN-15lh," said Dong. "ASASSN-15lh may lead to new thinking and new observations of the whole class of superluminous supernova, and we look forward to plenty more of both in the years ahead."

1] The Kavli Institute for Astronomy and Astrophysics (KIAA) is jointly supported by Peking University and the Kavli Foundation. Website: http://kiaa.pku.edu.cn
2] ASAS-SN Survey. Website: http://www.astronomy.ohio-state.edu/~assassin/index.shtml
3] The preprint of the paper can be accessed at: http://arxiv.org/abs/1507.03010
4] A review article on superluminous supernova by Prof. Avishay Gal-Yam published in Science in 2012 can be found at: http://arxiv.org/abs/1208.3217

http://nyti.ms/1n4iUW1

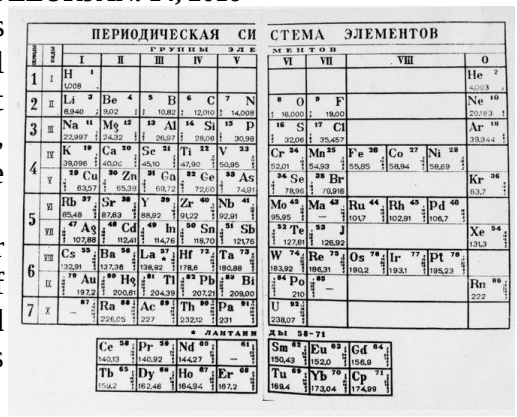
Godzillium vs. Trumpium: Some Suggestions to Add to the Periodic Table

What would you name a new element on the periodic table?

By NICHOLAS ST. FLEURJAN. 14, 2016

That's a question that groups of scientists from Japan, the U.S. and Russia will have to decide as they replace the current identifiers of four elements — 113, 115, 117 and 118 — with something a little more evocative.

With the ushering in of these four superheavy elements, and the approval of the International Union of Pure and Applied Chemistry, the Periodic Table's seventh row will be complete.



An earlier periodic table of the elements. **Sovfoto, via Getty Images**

Though the researchers have yet to put forth their suggestions, tons of ideas are already floating around science circles. One online petition aims to name "heavy metal" 115 "lemmium" after the deceased Motörhead frontman Ian 'Lemmy' Kilmister, and has already reached more than 145,000 signatures as of Wednesday afternoon. Another, with more than 44,000 signatures, wants to name element 117 "octarine" after the late Terry Pratchett and his Discworld book series.

We recently solicited reader suggestions. Many proposed naming them after prominent scientists such as Rosalind Franklin, Ada Lovelace, Nikola Tesla and Carl Sagan or after chemistry professors that they admired in college and high school.

Others tapped into popular culture, picking "adamantium" after the material, in Marvel lore, that makes Wolverine's indestructible claws, and "unobtanium," the coveted element from the movie Avatar. Donald Trump is shaking up this contest, too — readers suggested "trumpium," "trumpillium," "trumpissum" and "AnyoneButTrumpium."

Here are some other standouts:

Rikenium

The most popular suggestion we received was to name element 113 after Riken institute in Japan. The team of scientists from the institute were the first researchers in Asia to discover an element and gain the right to name it. But "Rikenium" does not follow the rules set out by the International Union of Pure and Applied Chemistry, which ultimately must approve the winning names (Riken is an institute, not a place, and therefore would most likely be disqualified as a contender).

Ghiorsonium

David Bernklau, a reader from Brooklyn, suggested naming one of the new elements after Albert Ghiorso, who codiscovered an astonishing 12 elements, a record. Over the course of 30 years, his inventions contributed to the discovery of americium, curium, berkelium, californium, einsteinium, fermium, mendelevium, nobelium, lawrencium, rutherfordium, dubnium and seaborgium. Seaborgium was named after his colleague Glenn Seaborg, a nuclear scientist.

"In a nutshell, it is unbelievable that an element has yet to be named after him!" said Mr. Bernklau.

Godzillium

Several people suggested naming one of the new elements after the 300-foot-tall mutant lizard.

"Godzillium," Susan Sampson wrote, "is mythical, Japanese, and worthy of an element that is unnatural, radioactive and rapidly self-destructive."

Nipponium

This popular suggestion comes from a Japanese word for Japan, "Nippon." This name actually isn't a newcomer to the periodic table. In 1908, Japanese chemist Masataka Ogawa ascribed nipponium, with the symbol Np, to what he thought was element 43.

It appeared in periodic tables in Britain, according to the book "The Lost Elements." But other scientists were unable to isolate the element. Later analysis of Dr. Ogawa's samples in 1930 showed that Dr. Ogawa had actually found element 75, which is just one row directly below element 43. Unfortunately by the time researchers realized the mistake it was too late: element 75 had already been named rhenium in 1925. Dr. Ogawa died a few weeks after learning the fate of nipponium.

Element 43 was later found and named technetium in 1937 and the symbol "Np" was used to describe neptunium in 1940.

Sisyphisium

Lisa DeBenedittis said she would bestow the name sisyphisium on element 118 because it is the heaviest synthetic element. Her logic:

"The credit for discovering element 118 — the heaviest ever created — has been assigned to the Dubna and Lawrence Livermore teams. The element has a checkered history: a 1999 claim to have made it was retracted two years later amid accusations that data had been falsified."

"Therefore, I look to two attributes: its heaviness and its second appearance, as noteworthy. Like the heavy boulder that Sisyphus was condemned to push up a mountain, only to watch it roll down, for eternity, this name evokes 118's emblematic characteristics."

Narcissium

Holly Triebe also decided to borrow a name from Greek mythology for her suggested name. She went with "narcissium" after the handsome hunter, Narcissus, who upon looking into a pool of water, fell deeply in love with his reflection and stared at it until he died.

"This word suits any of the newfound elements because they are all man-made elements, and scientists have begun to play God in this aspect. They decide what is created and what they believe is necessary," she said. "It is a form of self-importance because the elements present on Earth are no longer good enough."

http://bit.ly/1WloUpD

Star Light, Star Bright, Here's Why the Heavens Look Brighter Tonight

It's not just because the air is clearer

By Danny Lewis

For stargazers, the months of December, January, and February are a treat not only because they have some of the most spectacular meteor showers of the year, but because the stars themselves seem to shine just a little bit brighter. But while conventional wisdom holds that cold winter weather makes for better viewing conditions, that's not the whole story, as Deborah Byrd writes for EarthSky.org.

Related Content

Long-Lost Photos of Eclipses and Stars Found in an Observatory Basement

No matter where you are on the planet right now, if you look up at the stars they might seem just a little bit brighter than at other times of the year—from those in the North, bundled up against the cold, to those in the South, soaking in the sun. While different atmospheric conditions like humidity and haze do affect night views to a degree, that doesn't explain everything.

So what is going on? The Earth's night sky now faces away from the center of the Milky Way, out to one of its spiral arms, Byrd writes. Known as the Orion Arm or Orion Spur, this outer arm of the galaxy is much less densely populated by stars than the center.

You might think that the brightest stars would come from the heart of the galaxy, and in a way, you would be right. During the months of June, July, and August, as Earth's night sky faces the galactic center, billions of stars crowd the view. But as it turns out, the light from that wealth of stars actually tends to muddle the view, according to Byrd.

It's a bit like looking right at a floodlamp during a football game, writes Byrd. But if you turned off most of the bulbs in the giant floodlamp, with only a few shining bright, it would be easy to pick out the individual bulbs.

During December, January, and Feburary, though, the Earth's night sky faces the opposite direction: away from the galactic center and out towards the nearby spiral arms. Because there are relatively fewer stars from this view, the ones we can see at night appear brighter because they don't have to compete with the bright center of the Milky Way. Against the backdrop of deep space and with less competition in the telescope lens, the stars we can see at this time of year can pop out even more.

There are plenty of other factors that can affect one's view of the night sky, including light pollution, humidity and atmospheric haze. But if you're looking for a sharper view of the stars, now might be your best bet.

http://bit.ly/1RZFBqd

Commercial spaceflight newcomer allows quick ISS return trips

Dream Chaser spacecraft will bring cargo back from the ISS within 3 to 6 hours

There's a new kid on the commercial spaceflight block. On Thursday, NASA announced that the second round of contracts for commercial resupply missions to the International Space Station will include Sierra Nevada Corporation, whose Dream Chaser spacecraft will bring cargo back from the ISS within 3 to 6 hours.

It was hoped that the Dream Chaser could carry astronauts to the ISS as a replacement for NASA's retired space shuttle. That dream was disappointed in 2014, when NASA awarded "space taxi" contracts to two other companies, SpaceX and Boeing.

But the craft's ability to cut the return trip from the ISS from 24 hours to 3, plus its soft landing, will allow a wide range of experiments with living and delicate systems in space.

"This is a huge advance," said ISS chief scientist Julie Robinson in a press conference at Johnson Space Center in Houston, Texas. Current studies that

involve bringing home live organisms can only study characteristics that won't change in landing, such as bone density. Behaviour or genetic changes require quicker access to the samples, she says. "If they have a hard landing or land at sea, you've really disrupted that before the scientists can get at it. Rapid return and soft landing is really valuable."

The winners also included SpaceX and Orbital Sciences, which have been supplying cargo to the ISS for a few years. But those two companies have recently suffered high-profile failures: Orbital Sciences' Antares rocket exploded just after a launch in October 2014, and SpaceX's Dragon capsule exploded during flight in June 2015.

Choosing a third company to run ISS resupply missions will help cover any future gaps, says ISS program manager Kirk Shireman. "From an operational perspective, it's important to have more than one supply chain," he said. "If you lose one, you have the ability to have another right after from a dissimilar supplier." Each company will fly a minimum of 6 missions to the ISS beginning in 2019. The details of those missions will be determined later this year.

http://www.eurekalert.org/pub_releases/2016-01/uoca-cas011416.php

CU Anschutz School of Pharmacy study shows medical marijuana decreases migraines

Frequency of headaches show clinically significant drop

AURORA, Colo. - Patients diagnosed with migraine headaches saw a significant drop in their frequency when treated with medical marijuana, according to a new study from researchers at the Skaggs School of Pharmacy and Pharmaceutical Sciences at the University of Colorado Anschutz Medical Campus.

The study, published this week in the journal Pharmacotherapy, examined patients diagnosed with migraines and treated with medical marijuana between Jan. 2010 and Sept. 2014. It found the frequency of migraines dropped from 10.4 to 4.6 headaches per month, a number considered statistically and clinically significant.

Of the 121 patients studied, 103 reported a decrease in monthly migraines while 15 reported the same number and three saw an increase in migraines.

"There was a substantial improvement for patients in their ability to function and feel better," said the study's senior author Professor Laura Borgelt, PharmD, FCCP, BCPS. "Like any drug, marijuana has potential benefits and potential risks. It's important for people to be aware that using medical marijuana can also have adverse effects."

The study looked at the charts of patients treated at Gedde Whole Health, a private medical practice in Colorado that specializes in recommending marijuana for a variety of conditions. About a two-thirds of the patients studied had a history of or were currently using cannabis at the time of their initial visit.

The researchers found various forms of cannabis utilized. Inhaled marijuana appeared to be the favorite for treating acute migraines while edible cannabis, which takes longer to impact the body, helped prevent headaches.

But exactly how cannabis relieves migraines is still not fully understood.

Borgelt said cannabinoid receptors can be found throughout the body, including the brain, connective tissues and immune system. And they appear to have anti-inflammatory and pain-relieving properties. These cannabinoids also seem to affect critical neurotransmitters like serotonin and dopamine.

"We believe serotonin plays a role in migraine headaches, but we are still working to discover the exact role of cannabinoids in this condition," Borgelt said.

The study is one of the first to reveal a drop in migraine frequency due to medical marijuana. Borgelt said the results were `quite remarkable' but stressed the need for more controlled studies in the future.

The ideal study, she said, would be a randomized, placebo-controlled clinical trial with a marijuana washout period prior to start. It would also require providing subjects with standardized quantities and potencies of medical marijuana while tracking the occurrence of migraines just like prescription drug studies. But given federal anti-drug laws, that kind of study would likely require legislative changes before it could be done, Borgelt said.

"If patients are considering medical marijuana they should speak to their health care provider and then follow up so we can track the impact of their overall treatment," Borgelt said. "Open communication is necessary because we need to know how all of these treatments work together."

The other study authors include Danielle Rhyne, PharmD, BCPS and Sarah Anderson PharmD, BCPS of the CU Anschutz Skaggs School of Pharmacy and Pharmaceutical Sciences and Margaret Gedde, MD, PhD of Gedde Whole Health.

http://www.eurekalert.org/pub_releases/2016-01/uog-pct011516.php

Public contributions to science increasingly common

So-called citizen science has become a significant force in several scholarly disciplines.

The phenomenon can be found in both the natural and the social sciences, according to the largest systematic analysis to date on the topic, the results of which are published in the scientific journal PLOS ONE.

'We see that in particular researchers in the natural sciences have collected and classified data with the help of interested volunteers. In the social sciences, there has been a focus on inviting select parts of the public to find out the effects of science on people's everyday lives. This may for example concern environment

problems and risks,' says Christopher Kullenberg, researcher in the field of theory of science.

To make the study as broad as possible, the analysis included 2 568 scientific articles based on citizen science. A feat that turned out to be quite a challenge, since researchers in different disciplines have referred to citizen science in many different ways.

'Since the mid-1990s, it has usually been called "citizen science". But the terms "participatory science", "crowd science", "civic science" and even "street science" are also frequently used,' says Dick Kasperowski, assistant professor of theory of science. All these concepts imply active participation by the public in some part of the research process.

'What's exciting about citizen science is that it enables non-researchers to make important contributions to science. If you think about it, it sounds impossible. After all, don't you need years of training and experience to do that?' says Kullenberg.

The fields of biology and ecology have a long tradition of citizen science. Researchers have for example relied on the public's ability to observe and classify animals and plant species for over 100 years. This has clearly been very successful and enormous amounts of data have been collected, for example to identify the migration patterns of birds and other animals. Such studies are important in order to understand the ongoing changes in the climate. Citizen science has recently also gone digital. For example, astronomy researchers have benefitted greatly from having regular citizens classify uncountable pictures of galaxies.

Citizen scientists make millions of observations that the researchers would never be able to make themselves. But this has not always been acknowledged.

'Nobody knows the true extent of it. Scientists have not always communicated that they have received help from the public. But this is changing. It has become more OK to involve the public, and better methods for non-scientist participation have also been created,' says Kasperowski.

'One finding in this study is that a large number of citizen science projects never make it to the scientific journals. We studied 490 research projects, but only 78 had resulted in scientific articles. This does not necessarily mean that the quality of the research was bad, but may imply that there were different ambitions involved, such as political lobbying or dealing with local environmental problems. At any rate, we need to learn more about this,' says Kullenberg. But there are also fields that have not invited the public to participate in their work. 'The humanities have not, with a few exceptions, managed to facilitate broad public participation. And our study shows that we're still waiting for the big breakthrough in medical research. The hesitation in medicine may have to do with patient safety and issues related to research ethics. But this will probably change in the future,' says Kullenberg.

The study was carried out within the framework of the interdisciplinary research project Taking Science to the Crowd: Researchers, Programmers and Volunteer Contributors Transforming Science Online at the University of Gothenburg, with funding from the Marianne and Marcus Wallenberg Foundation.

http://nyti.ms/1nsG3lB

6 Hospitalized, One of Them Brain-Dead, After Drug Trial in France

The health minister of France, Marisol Touraine, confirmed that six men were hospitalized after a drug trial in Rennes, with one brain-dead.

By SEWELL CHAN JAN. 15, 2016

By REUTERS on Publish Date January 15, 2016. Photo by Stephane Mahe/Reuters.

Watch in Times Video »

LONDON — Six men were hospitalized — and one of them was pronounced brain-dead — after a drug trial in northwestern France, the country's health minister said on Friday.

Marisol Touraine, the minister for social affairs, health and women's rights, said in a statement that her office was informed Thursday evening about a "serious accident" that resulted in the hospitalization of the six men, at the Centre Hospitalier Universitaire de Rennes, in eastern Brittany.

Calling the incident "unprecedented" at a news conference in Rennes, Ms. Touraine said: "I have no knowledge of a comparable event."

The patients, all men, were ages 28 to 49, she said. The head of the hospital's neurology department said that three men may have suffered irreversible brain damage, based on magnetic resonance imaging scans, but cautioned that the scans were not conclusive.

"I was deeply moved by their suffering," Ms. Touraine said after visiting the patients and their families.

The drug was administered orally to healthy volunteers as part of a Phase 1 clinical trial by Biotrial, a drug evaluation company based in Rennes, on behalf of a Portuguese drug manufacturer, Bial. The drug is intended to help with mood, anxiety and motor problems linked to neurodegenerative diseases by having an effect on the endocannabinoid system, a set of brain receptors. Of 128 participants, 90 were given the drug, and the rest a placebo.

Experts in clinical trials said serious injuries involving early-stage clinical trials were rare but must be thoroughly investigated since they typically involve healthy subjects who would not otherwise have fallen ill.

Carl Elliott, a bioethicist at the University of Minnesota, said investigators should look into questions like how much the men were paid and whether they properly consented to the trial. “Many Phase 1 trial volunteers are poor and unemployed, and they volunteer for trials like this because they are desperate for money,” he said. “This means they are easily exploited.”

In a statement, Biotrial acknowledged “serious adverse effects” in a trial, adding: “The trial has been conducted in full compliance with the international regulations, and Biotrial’s procedures were followed at every stage throughout the trial, in particular the emergency procedures for the transfer of subjects to the hospital. We are in close and regular contact with the health authorities and ministry in France.”

Bial, based in Coronado, Portugal, also said that it had followed all guidelines and regulations for clinical trials. The company, it said, “is strongly committed to ensuring, first of all, the well-being of the participants in this trial and to determine thoroughly and exhaustively the causes which are at the origin of this situation.”

Biotrial submitted its application to conduct the trial on April 30, Ms. Touraine said. The French Agency for the Safety of Health Products, the country’s drug regulator, authorized the trial on June 26, and it began on July 9. Biotrial, which recently announced that it was building a clinical trial site in Newark, had been subjected to two “routine” inspections in 2014, she said, which did not find any problems.

Ms. Touraine said the drug had previously been tested on animals, including chimpanzees, and was administered to 90 people under the trial. The six men received the drug several times, starting on Jan. 4. The first symptoms appeared in one man on Sunday. He was quickly hospitalized, and the others followed. The trial was halted the next day.

Contrary to several reports in the French news media, the drug was not a cannabis-based painkiller, Ms. Touraine said.

Bial identified the drug as an inhibitor of an enzyme known as FAAH, or fatty acid amide hydrolase. Other FAAH inhibitors have been tested safely in Phase 1 and Phase 2 clinical trials, said Andrea G. Hohmann, a professor of neuroscience at Indiana University who studies the endocannabinoid system and pain.

Daniele Piomelli, professor of anatomy and neurobiology, pharmacology and biological chemistry at the University of California, Irvine, said it was difficult to comment on the drug because its structure and pharmacological properties were unknown.

He said in an email that the main problem with other FAAH inhibitors, which have been tested by Pfizer, Sanofi, Organon and others, was that they did not work very well, not that they were unsafe.

Along with the French drug regulation agency, the country’s General Inspectorate of Social Affairs, the Rennes prosecutor’s office and the health branch of the Paris prosecutor’s office have opened investigations.

Deaths or serious adverse reactions during Phase 1 clinical trials are rare.

In March 2006, six previously healthy young men fell ill and spent weeks in intensive care, with severe damage to their immune systems, at Northwick Park Hospital in London after being injected with an immune-system stimulant, known as TGN1412, during a Phase 1 trial.

Despite its potency, the drug, which was held up as a potential treatment for multiple sclerosis, leukemia and rheumatoid arthritis, was tested under much the same standards as those governing ordinary pharmaceuticals. British regulators approved the trial in just 17 days, and the testing company, based in Massachusetts, did not have an adequate response plan in the event of a disastrous adverse reaction, British investigators concluded.

“Toxicity deaths in Phase 1 trials are rare,” said Daniel P. Carpenter, a professor of government at Harvard and an authority on the United States Food and Drug Administration. Some deaths were reported in Phase 1 trials early in the effort to treat AIDS, he said, but “nothing like this in a long time.”

A meta-analysis of noncancer Phase 1 drug trials, published last year in The British Medical Journal, found serious adverse events in only 0.31 percent of participants, and no deaths.

http://bit.ly/1OzMPfO

Comets can’t explain weird ‘alien megastructure’ star after all

The weirdest star in the cosmos just got a lot weirder. And yes, it might be aliens.

Known as KIC 8462852, or Tabby’s star, it has been baffling astronomers for the past few months after a team of researchers noticed its light seemed to be dipping in brightness in bizarre ways. Proposed explanations ranged from a cloud of comets to orbiting “alien megastructures”.

Now an analysis of historical observations reveals the star has been gradually dimming for over a century, leaving everyone scratching their heads as to the cause.

The first signs of this space oddity came from NASA’s planet-hunting Kepler space telescope, which continually watched the star’s region of the sky between 2009 and 2013. Most planet-hosting stars show small, regular dips in light when their planets pass in front of them. But Tabby’s star dipped erratically throughout the four years, sometimes losing as much as 20 per cent of its brightness.

Space oddity

In September, a team led by Tabetha Boyajian of Yale University, who lends the star its informal name, tried to make sense of this unusual signal. Ultimately they determined that dust from a large cloud of comets was the best explanation.

A month later, the star made headlines across the globe thanks to a paper by Jason Wright of Pennsylvania State University and his colleagues, who suggested that "alien megastructures", such as satellites designed to collect light from the star, could be responsible for the signal.

Now Bradley Schaefer of Louisiana State University has discovered that the mystery goes even further. When Boyajian's team studied the star, they looked at data from a Harvard University archive of digitally scanned photographic plates of the sky from the past century or so to see if the star had behaved unusually in the past, but found nothing.

Schaefer decided this unusual star deserved a second look. He averaged the data in five-year bins to look for slow, long-term trends, and found that the star faded by about 20 per cent between 1890 and 1989. "The basic effect is small and not obvious," he says.

Starman

To confirm the fade was real, Schaefer went to Harvard to look at the original photographic plates and inspected them by eye for changes, a skill few astronomers possess these days. "Since no one uses photographic plates any more, it's basically a lost art," says Wright. "Schaefer is an expert at this stuff."

Schaefer saw the same century-long dimming in his manual readings, and calculated that it would require 648,000 comets, each 200 kilometres wide, to have passed by the star – completely implausible, he says. "The comet-family idea was reasonably put forth as the best of the proposals, even while acknowledging that they all were a poor lot," he says. "But now we have a refutation of the idea, and indeed, of all published ideas."

"This presents some trouble for the comet hypothesis," says Boyajian. "We need more data through continuous monitoring to figure out what is going on."

What about those alien megastructures? Schafer is unconvinced. "The alien-megastructure idea runs wrong with my new observations," he says, as he thinks even advanced aliens wouldn't be able to build something capable of covering a fifth of a star in just a century. What's more, such an object should radiate light absorbed from the star as heat, but the infrared signal from Tabby's star appears normal, he says.

"I don't know how the dimming affects the megastructure hypothesis, except that it would seem to exclude a lot of natural explanations, including comets," says Wright. "It could be that there were just more dimming events in the past, or that astronomers were less lucky in the past and caught more dimming events in the 1980s than in the 1900s. But that seems unlikely."

There's no doubt KIC 8462852 is behaving strangely, so something must be responsible, says Schaefer. "Either one of our refutations has some hidden loophole, or some theorist needs to come up with some other proposal."

Reference: arxiv.org/abs/1601.03256

http://nyti.ms/2099TcH

New Guidelines Nudge Doctors to Give Patients Access to Medical Records

Obama administration removes barriers that make it difficult for patients to access their own medical records

By ROBERT PEAR JAN. 16, 2016

WASHINGTON — The Obama administration is tearing down barriers that make it difficult for patients to get access to their own medical records, telling doctors and hospitals that in most cases they must provide copies of these records within 30 days of receiving a request.

In theory, patients have long had a right to obtain copies of their records, but federal officials say they receive large numbers of complaints from consumers frustrated in trying to exercise that right.

In new guidelines, issued this month, the administration says doctors and hospitals cannot require patients to state a reason for requesting their records, and cannot deny access out of a general concern that patients might be upset by the information.

"Based on recent studies and our own enforcement experience, far too often individuals face obstacles to accessing their health information," said Jocelyn Samuels, the director of the Office for Civil Rights at the Department of Health and Human Services, which enforces federal health privacy standards. "This must change."

When patients can see their medical records, the administration said, it is easier for them to participate in their health care. They can, for example, review what they were told by their doctors and, perhaps, consider other options for care.

Christopher S. Moore of Alpharetta, Ga., said he had great difficulty obtaining hospital records for his 4-year-old son, Oliver, who has a rare genetic disorder and has seen at least eight medical specialists in Atlanta, Cincinnati and Boston.

"The hospital in Atlanta was very slow to respond," Mr. Moore said. "We had to escalate our request to the hospital leadership to get the records."

Mr. Moore said insurers had spent $800,000 on care for his son, generating several thousand pages of medical records.

"Some doctors seem to believe that medical records are intended only for doctor-to-doctor communication, and that patients would not understand those records," Mr. Moore said. "We want the records so we have control over them — so we can provide them to any doctor who sees our son."

Under the new guidelines, a health care provider cannot require patients to pick up their records in person if they ask that the records be sent by mail or email. A health care provider cannot deny a request for access to health information because a patient has failed to pay medical bills. A doctor or a hospital may charge a fee to cover the cost of copying, but cannot charge for the cost of searching for data and retrieving it.

Dr. Francis S. Collins, the director of the National Institutes of Health, said consumers needed access to their records so they could "take more control over decisions regarding their health," follow treatment plans and correct errors in the files.

In addition, Dr. Collins said, some people want access to their records so they can contribute information to biomedical research projects like President Obama's "precision medicine" initiative.

Researchers working on the project will collect data on the health, genetic characteristics and lifestyle habits of a million or more volunteers.

The same rules that protect the privacy of medical records also give patients a right to see a broad array of health information about themselves. The rules were issued under the Health Insurance Portability and Accountability Act of 1996.

Doctors and hospitals are supposed to provide consumers with access to personal health information within 30 days and, in some cases, can extend the deadline by 30 days. But, the administration said, most requests should be fulfilled in fewer than 30 days.

Melinda R. Hatton, a senior vice president of the American Hospital Association, said the guidelines were "a helpful reminder." Hospitals, she said, "strongly support patients' access to their medical records," and many have web portals that let patients view information about their care.

But Deven McGraw, a deputy director of the Office for Civil Rights, said complaints about access to medical records were one of the top five issues investigated by her agency.

Megan O'Boyle of Arlington, Va., whose 15-year-old daughter has intellectual disabilities, autism and epilepsy, said, "It burns me up that I had to jump through hoops to get her records."

She said she wanted copies so new doctors could see the history of her daughter's illness and would not have to repeat medical tests and imaging procedures.

"It's empowering when you get all this information," Ms. O'Boyle said. "You can be a much better advocate for the patient. More information is better. It means better services for my daughter."

For patients with chronic illnesses, the fees charged by doctors and hospitals for providing medical records can add up. "Why should I have to pay 25 cents to 50 cents a page for what really belongs to me in the first place?" Ms. O'Boyle asked.

Joy L. Pritts, a former privacy officer at the Department of Health and Human Services, said that "many health care providers still don't understand that patients have a right to get their medical records," and she suggested a possible reason.

"It may be contrary to the financial interests of health care providers to give patients broad access to their medical records," Ms. Pritts said. "Once patients have that information, they can share it with competing health care providers."

Under the rules, doctors and hospitals do not have to disclose psychotherapy notes that are kept separate from the rest of a patient's medical record.

Health care providers may also deny requests if the disclosure of personal health information is "reasonably likely to endanger the life or physical safety" of a patient or another person. Thus, certain information might be denied to a suicidal patient. But, the administration said, this exception is to be narrowly construed.

http://www.bbc.com/news/world-europe-35337671

France drug trial: Brain-dead man dies in hospital

A man left brain-dead after an experimental drug trial in France has died, local media report.

He was one of six people being treated in hospital in the city of Rennes.

The hospital said the other five remained in a stable condition - four had "neurological problems" and the fifth had no symptoms.

Reports that the drug was a cannabis-based painkiller have been denied by the French health ministry. The Paris prosecutor has opened an investigation

The trial, which involved taking the drug orally and has now been suspended, was conducted by a private laboratory in Rennes.

Ninety volunteers took the drug, manufactured by the Portuguese company Bial.

Ten of the other 84 have been tested, but did not display any of the "anomalies" of those admitted, the Rennes hospital said in its statement (in French).

On Friday, the chief neuroscientist at the hospital, Gilles Edan, said there was no known antidote to the drug. The trial was conducted by Biotrial, a French-based company with an international reputation which has carried out thousands of trials since it was set up in 1989.

The study was a Phase I clinical trial, in which healthy volunteers take the medication to evaluate the safety of its use, the ministry said.

Analysis: James Gallagher, health editor, BBC News website

This is the bitter price of the new medicines we take for granted. Testing such experimental drugs, at the cutting edge of science, can never be completely risk-free.

The safety and effectiveness of these drugs are rigorously tested in animals. The risks are low but there must still be a leap of faith when they are tried in people for the first time.

This trial has been taking place since July without such major events being reported. Generally in Phase I trials the dose is increased slowly over time, which could be why the side-effects are appearing now.

The hospitalised men started taking the drug regularly on 7 January and began showing severe side-effects three days later.

It is a high price to pay, but thousands of people do safely take part in similar trials each year.

Before any new medicine can be given to patients, detailed information about how it works and how safe it is must be collected.

Clinical trials are the key to getting that data - and without volunteers to take part in the trials, there would be no new treatments for serious diseases such as cancer, multiple sclerosis and arthritis.

New EU regulations to speed up clinical drug trials and streamline testing procedures across the 28-nation bloc are due to take effect in 2018.

Clinical trials

Trials typically have three phases to assess a new medicine for safety and effectiveness

- **Phase I** ***tests for safety. A small number of people, sometimes healthy, and sometimes with a medical condition, are given a tiny dose of the drug under careful supervision, not to test if the drug works, but in order to check for any side effects***
- **Phase II** ***sees the drug given to people who have a medical condition to see if it does indeed help them***
- **Phase III** ***trials are only for medicines or devices that have already passed the first two stages, and involve them being compared to existing treatments or a placebo. The trials often last a year or more, involving several thousand patients***