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Wind farms play key role in cutting carbon emissions, study finds

Wind farms have made a significant impact in limiting carbon emissions from other sources of power generation in Great Britain, a study shows.

Power from wind farms prevented the creation of almost 36 million tonnes of greenhouse gas emissions from sources such as coal and gas, in a six-year period - the equivalent of taking 2.3 million cars off the road, analysis of nationwide output shows.

The figures from 2008-2014, analysed in the most accurate study of its kind to date, suggest that a greater investment in wind energy could help meet Scottish and UK government targets for carbon emissions reduction.

Engineers from the University of Edinburgh analysed National Grid figures for the power generated by various sources including wind, coal and gas. Their data detailed generator energy output figures for every half hour, creating a comprehensive picture of how demand over time was met by power from the various sources.

Their study improves on previous estimates because it uses real, rather than estimated, energy output figures and takes into account the inefficiency of individual conventional generators, researchers say. The calculations are complex because energy demand is met from a mix of sources at any one time, and when output from wind turbines increases, a number of different conventional sources may need to decrease their outputs.

The study demonstrates that government estimates for carbon savings underestimated the benefits from wind farms. Over the six year period, 3.4 million more tonnes of greenhouse gases were saved than thought - the equivalent of taking an extra 220,000 cars off the road.

Engineers say their methodology could be applied to give accurate estimates of possible future emissions savings for energy developers, planners and policymakers. They suggest wind power generation could play an increasingly important role in the future energy mix, which could also include carbon capture and storage, marine and nuclear power.

The study, published in Energy Policy, was supported by the Engineering and Physical Sciences Research Council.

Dr Camilla Thomson, from the University of Edinburgh's School of Engineering, who led the study, said: "Until now, the impact of clean energy from wind farms was unclear. Our findings show that wind plays an effective role in curbing emissions that would otherwise be generated from conventional sources, and it has a key role to play in helping to meet Britain's need for power in future."

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Is historic Soviet radiation health data too hot to handle?

A series of secret nuclear disasters has spawned a unique database about the effects of radiation. But health researchers must think hard before using it

IN SEPTEMBER 1957, an explosion at a nuclear bomb factory in the Soviet Union released a vast plume of radioactivity into the air. The fallout covered hundreds of square kilometres of populated countryside.

The accident was not revealed to the world until 1976, and the area is still heavily contaminated. This year our correspondent Fred Pearce became the first Western journalist to visit the exclusion zone. His report reveals how the explosion was just one of many massive contamination events (see “Exclusive: First visit to Russia’s secret nuclear disaster site“).

It also reveals that the Soviet authorities clearly understood the danger to health. Why else would they have evacuated 41 villages? But because the facility was a secret, none of the villagers was told why they were being moved or what the dangers were. Doctors monitored their health, collecting data on 53,000 individuals. A secret code hid cases of chronic radiation sickness.

Those events may now seem just a footnote in history – just another human rights abuse by a famously despotic regime. But the health database is not simply a historical document. Many of the affected people are still alive, and the database is maintained to this day. What is more, it is being used as evidence in an ongoing dispute about how much radiation exposure is safe for workers in present-day nuclear facilities.

That raises serious ethical issues about how the results were gathered and whether health researchers should use them. Guidelines on cases like this are enshrined in the Nuremberg code, drawn up after the second world war in response to Nazi atrocities. Its first tenet is very clear: “The voluntary consent of the human subject is absolutely essential.”

“There is no question that health records were gathered without informed consent”

It is debatable whether failing to evacuate villagers quickly and covertly monitoring their health amounts to experimenting on them. But there is no question that records were collected without informed consent, and thus that the code was breached.

We are faced with a familiar ethical quandary. Should the data be used at all? On the one hand you could say that the results are irredeemably tainted. On the other you could argue that this is a unique data set arising from unique circumstances, and that if it can safeguard the health of people today, it would be unethical not to use it.

Similar arguments have swirled around data gathered by the Nazis. Even after 70 years, there is still no consensus. At best, each case must be meticulously debated and dissected to reach an acceptable position.

Ethical considerations aside, the scientific value of the data set must also be questioned. Is it complete and unbiased? Does its methodology conform to today’s standards? Perhaps Soviet researchers were under pressure to underplay the dangers. If the integrity of the data set cannot be verified beyond reasonable doubt, it should never be used.

But not forgotten. One argument for using ethically tainted data is that it means the victims did not suffer or die in vain. And even if such material is not used, the wrongs must be accepted and acknowledged.

One thing is clear: anybody who uses this dubious database must do so with the utmost scientific and ethical integrity – including total transparency about how it was obtained, and full acknowledgement of the suffering and human rights abuses that produced it. If we do not learn from history, we are fated to repeat it.

http://bit.ly/2qSLpX1

Mysterious 'crater' on Antarctica indication of vulnerable ice sheet

The East Antarctic ice sheet appears to be more vulnerable than expected, due to a strong wind that brings warm air and blows away the snow.

That is the conclusion reached by a team of climate researchers led by Jan Lenaerts (Utrecht University/KU Leuven) and Stef Lhermitte (TU Delft/KU Leuven), based on a combination of climate models, satellite observations and on-site measurements. Their conclusions will be published in Nature Climate Change on 12 December. "Tens of meters of rising sea levels are locked away in Antarctica", says Lenaerts. "And our research has shown that also East Antarctica is vulnerable to climate change."

Current IPCC projections show large uncertainties in Antarctica's contribution to sea level rise, because the role of ice shelf processes remains uncertain. Lenaerts explains: "Little climate change is observable in East Antarctica, because the area is so isolated from the rest of the world." However, to the researchers' astonishment, the ice shelves in some regions of East Antarctica are melting faster than scientists had previously assumed. These ice shelves appear to be extremely sensitive to climate change.

Hotspots

Through a unique combination of field work, satellite data and a climate model, the researchers were able to explain why some parts of

the East Antarctica ice shelves are melting so rapidly. This is because the strong and persistent wind transports warm, dry air to the region, and blows away the snow. This darkens the surface, which subsequently absorbs more of the sun's heat. The result is a local warmer microclimate with a few literal 'hotspots'. Because the ice shelf is floating in the ocean, its melting does not immediately contribute to sea level rise. However, the ice shelves around Antarctica are extremely important for ice sheet stability, because they hold back the land ice. If the ice shelves collapse, this land ice ends up in the ocean and consequently sea level will rise.

Mysterious crater

Part of the research conducted by Lenaerts and Lhermitte focused on a mysterious crater that was spotted on the King Baudoin ice shelf. "At the time, the media reported that it was probably a meteorite impact crater", Lenaerts says. "My response was: in that area? Then it's definitely not a meteorite; it's proof of strong melting."

In January 2016, the researchers visited the crater and discovered that it was a collapsed lake, with a moulin - a hole in the ice- which allowed the water to flow into the ocean. Lhermitte: "That was a huge surprise. Moulins typically are observed on Greenland. And we definitely never see them on an ice shelf." Moreover, the researchers discovered that there were many meltwater lakes hidden under the surface of the ice, some of which were kilometres across. Underwater video images provide a clear image of the amount of meltwater present in the area.

Vulnerable

Is this a sign of climate change? "The crater isn't new; we found it on satellite images from 1989. The amount of melt water differs immensely from year to year, but it clearly increases during warm years", according to Lhermitte. Last year, an influential publication showed that Antarctica's contribution to rising sea levels depends largely on the stability of these melting ice shelves. Lenaerts: "That study indicated that West Antarctica is extremely sensitive to climate change. But our research now suggests that the much larger East Antarctica ice sheet is also very vulnerable."

The study is a collaborative effort by Utrecht University, TU Delft, KU Leuven, Université Libre de Bruxelles and the Alfred-Wegener-Institut.

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Winds of rubies and sapphires strike the sky of giant planet

Signs of powerful changing winds have been detected on a planet 16 times larger than Earth, over 1,000 light years away -- the first time ever that weather systems have been found on a gas giant outside our solar system

Signs of powerful changing winds have been detected on a planet 16 times larger than Earth, over 1000 light years away - the first time ever that weather systems have been found on a gas giant outside our solar system - according to new research by the University of Warwick.

Dr David Armstrong in Warwick's Astrophysics Group has discovered that the gas giant HAT-P-7b is affected by large scale changes in the strong winds moving across the planet, likely leading to catastrophic storms.

This discovery was made by monitoring the light being reflected from the atmosphere of HAT-P-7b, and identifying changes in this light, showing that the brightest point of the planet shifts its position.

This shift is caused by an equatorial jet with dramatically variable wind-speeds - at their fastest, pushing vast amounts of cloud across the planet.

The clouds themselves would be visually stunning - likely made of up corundum, the mineral which forms rubies and sapphires.

The planet could never be inhabitable, due to its likely violent weather systems, and unaccommodating temperatures. One side of the planet always faces the star, because it is tidally locked, and that side remains much hotter than the other - the day side average temperature on HAT-P-7 being 2860K.

Thanks to this pioneering research, astrophysicists can now begin to explore how weather systems on other planets outside our solar system change over time. Dr Armstrong comments on the discovery:

"Using the NASA Kepler satellite we were able to study light reflected from HAT-P-7b's atmosphere, finding that the atmosphere was changing over time. HAT-P-7b is a tidally locked planet, with the same side always facing its star. We expect clouds to form on the cold night side of the planet, but they would evaporate quickly on the hot dayside.

"These results show that strong winds circle the planet, transporting clouds from the night side to the dayside. The winds change speed dramatically, leading to huge cloud formations building up then dying away. This is the first detection of weather on a gas giant planet outside the solar system."

First discovered in 2008, HAT-P-7b is 320 parsecs (over 1040 light years) away from us. It is an exoplanet 40% larger than Jupiter and 500 times more massive than the Earth - and orbits a star 50% more massive, and twice as large, as the Sun.

The work was led by the University of Warwick, and performed by a team of scientists from Warwick, Queens University Belfast, Dublin City University and University College London. The paper, 'Variability in the Atmosphere of the Hot Jupiter HAT-P-7', is published in the first issue of Nature Astronomy.

http://bit.ly/2qIWciX

UT Southwestern study shows fasting kills cancer cells of common childhood leukemia

UT Southwestern Medical Center researchers have found that intermittent fasting inhibits the development and progression of the most common type of childhood leukemia.

DALLAS This strategy was not effective, however, in another type of blood cancer that commonly strikes adults.

"This study using mouse models indicates that the effects of fasting on blood cancers are type-dependent and provides a platform for identifying new targets for leukemia treatments," said Dr. Chengcheng "Alec" Zhang, Associate Professor of Physiology at UT Southwestern and senior author of the study, published online today by Nature Medicine. "We also identified a mechanism responsible for the differing response to the fasting treatment," he added.

The researchers found that fasting both inhibits the initiation and reverses the progression of two subtypes of acute lymphoblastic leukemia, or ALL - B-cell ALL and T-cell ALL. The same method did not work with acute myeloid leukemia (AML), the type that is more common in adults.

ALL, the most common type of leukemia found in children, can occur at any age. Current ALL treatments are effective about 90 percent of the time in children, but far less often in adults, said Dr. Zhang, who also holds the Hortense L. and Morton H. Sanger Professorship in Oncology and is a Michael L. Rosenberg Scholar in Medical Research.

The two types of leukemia arise from different bone marrow-derived blood cells, he explained. ALL affects B cells and T cells, two types of the immune system's disease-fighting white blood cells. AML targets other types of white blood cells such as macrophages and granulocytes, among other cells.

In both ALL and AML, the cancerous cells remain immature yet proliferate uncontrollably. Those cells fail to work well and displace healthy blood cells, leading to anemia and infection. They may also infiltrate into tissues and thus cause problems.

The researchers created several mouse models of acute leukemia and tried various dietary restriction plans. They used green or yellow florescent proteins to mark the cancer cells so they could trace them and determine if their levels rose or fell in response to the fasting treatment, Dr. Zhang explained.

"Strikingly, we found that in models of ALL, a regimen consisting of six cycles of one day of fasting followed by one day of feeding completely inhibited cancer development," he said. At the end of seven weeks, the fasted mice had virtually no detectible cancerous cells compared to an average of nearly 68 percent of cells found to be cancerous in the test areas of the non-fasted mice.

Compared to mice that ate normally, the rodents on alternate-day fasting had dramatic reductions in the percentage of cancerous cells in the bone marrow and the spleen as well as reduced numbers of white blood cells, he said. The spleen filters blood.

"In addition, following the fasting treatment, the spleens and lymph nodes in the fasted ALL model mice were similar in size to those in normal mice. Although initially cancerous, the few fluorescent cells that remained in the fasted mice after seven weeks appeared to behave like normal cells," he said. "Mice in the ALL model group that ate normally died within 59 days, while 75 percent of the fasted mice survived more than 120 days without signs of leukemia."

Fasting is known to reduce the level of leptin, a cell signaling molecule created by fat tissue. In addition, previous studies have shown weakened activity by leptin receptors in human patients with ALL. For those reasons, the researchers studied both leptin levels and leptin receptors in the mouse models.

They found that mice with ALL showed reduced leptin receptor activity that then increased with intermittent fasting, he said.

"We found that fasting decreased the levels of leptin circulating in the bloodstream as well as decreased the leptin levels in the bone marrow. These effects became more pronounced with repeated cycles of fasting. After fasting, the rate at which the leptin levels recovered seemed to correspond to the rate at which the cancerous ALL cells were cleared from the blood," he added.

Interestingly, AML was associated with higher levels of leptin receptors that were unaffected by fasting, which could help explain why the fasting treatment was ineffective against that form of leukemia. It also suggests a mechanism - the leptin receptor pathway - by which fasting exerts its effects in ALL, he said.

"It will be important to determine whether ALL cells can become resistant to the effects of fasting," he said. "It also will be interesting to investigate whether we can find alternative ways that mimic fasting to block ALL development."

Given that the study did not involve drug treatments, just fasting, researchers are discussing with clinicians whether the tested regimen might be able to move forward quickly to human clinical trials

Current or former UT Southwestern coauthors in Physiology involved in this research include: co-lead authors Instructor Dr. Zhigang Lu and postdoctoral researcher Dr. Jingjing Xie; senior research associate Dr. Guojin Wu; research scientist Dr. Jinhui Shen, now in Biophysics; and former Instructor Dr. Xunlei Kang.

http://nyti.ms/2qVRTEo

Investment Funds Worth Trillions Are Dropping Fossil Fuel Stocks

688 institutions and nearly 60,000 individuals in 76 countries have divested themselves of shares in at least some kinds of oil, gas and coal companies, according to a new report.

By JOHN SCHWARTZ DEC. 12, 2016

Investors controlling more than $5 trillion in assets have committed to dropping some or all fossil fuel stocks from their portfolios, according to a new report tracking the trend.

The report, released Monday, said the new total was twice the amount measured 15 months ago — a remarkable rise for a movement that began on American college campuses in 2011. Since then, divestment has expanded to the business world and institutional world, and includes large pension funds, insurers, financial institutions and religious organizations. It has also spread around the world, with 688 institutions and nearly 60,000 individuals in 76 countries divesting themselves of shares in at least some kinds of oil, gas and coal companies, according to the report.

“It’s a stunning number,” said Ellen Dorsey, the executive director of the Wallace Global Fund, which has promoted fossil fuel divestment and clean energy investment as part of its philanthropy.

The movement has also received a boost from last year’s Paris climate agreement, which set targets for reducing greenhouse gas emissions to avoid the worst effects of climate change. The push for emissions reductions underscored the potential for the industry to be faced with

reserves of fuels that cannot be burned if the targets are to be met — a prospect known as "stranded assets."

Ms. Dorsey argued that since its beginnings as a moral statement against profiting from companies whose products were exacerbating climate change, more institutions have come to detect vulnerabilities in fossil fuel companies as the world shifts toward renewable sources of energy.

"This movement began as an ethical concern, was quickly matched with financial concerns, and I think it's now being increasingly recognized as a fiduciary duty," she said, with liability risks to trustees of institutions who fail to recognize those weaknesses and act on them.

Divesting from coal, an industry in the midst of a long-term decline, has proved to be relatively straightforward, and recent drops in the prices of oil and gas have hurt the fortunes of those industries as well.

Christopher D. Tucker, a spokesman for the Independent Petroleum Association of America, said that the pro-divestment argument had been strengthened by industry troubles. "This was always going to be a kick-you-while-you're-down strategy," he said, "but we're on the way up now, so the case has gotten weaker."

While the overall value of the funds announcing divestment is measured in the trillions of dollars, the actual amount of investment that was tied to fossil fuels within those funds is much smaller, because no single industry sector predominates in most broad investment funds. Ryan Strode, the director of Arabella Advisors, the group that produced the report, said the precise value of dropped investments was impossible to know. The group focuses on the overall value of the funds under management with divestment pledges, he said, because "This is the measure of the level of influence that these investors have on the market."

Many institutions remain unconvinced. Some universities, in rejecting calls for divestment, have cited their fiduciary responsibility to produce the greatest income from their endowments. Harvard's president, Drew Gilpin Faust, has said that the university supported research and efforts to fight climate change, but that "The endowment is a resource, not an instrument to impel social or political change. "

With the election of Donald J. Trump, who has called climate change a hoax and has pledged to reverse President Obama's signature global warming initiatives, activism will be more important, Ms. Dorsey said. And, she added, if the new president wants job growth, continuing to invest in renewable energy is the way to go.

"They should focus on the explosive industries where manufacturing jobs are being created," she said. "In a fact-driven world, it's just very clear."

http://bit.ly/2hZJVHR

Topical skin cream for treatment of basal cell carcinoma shows promise as an alternative to surgery

Initial treatment success with imiquimod appears to be sustained over a 5-year period, reports the Journal of Investigative Dermatology

Philadelphia, PA, December Basal cell carcinoma (BCC), a type of skin cancer, is the most common form of human cancer. With a growing aging population, BCC rates are climbing at an alarming rate, with reported cases rising by as much as 10% per year. Rising demand makes a simple and effective treatment for BCC appealing to both practitioners and patients. A new study funded by Cancer Research UK and published in the Journal of Investigative Dermatology examines the effectiveness of imiquimod, a topical skin cream used to treat low-risk BCC lesions, over a five-year period.

Currently, the gold standard of treatment for BCC is excisional or Mohs surgery, both of which require a dermatologist or plastic surgeon. Requiring specialized care for such a ubiquitous and mostly low-risk cancer can tie up resources that are needed for more serious and difficult cases. In order to help alleviate some of the burden, alternative treatments for BCC are emerging, many of which can be administered by general practitioners. One of these treatments is

imiquimod, a topical treatment cream that boosts the body's immune response.

This extension of a prior study, which looks at the effectiveness of imiquimod treatment, is based on a previously conducted randomized control trial (RCT) that followed BCC patients for three years post-treatment. The first study had an 83.6% success rate for patients treated with imiquimod, versus 98.4% for traditional surgery. In the additional two years of follow up time tracked in this new study, researchers found that 82.5% of imiquimod patients had successful outcomes at the five-year mark compared to 97.7% for surgery.

"The absolute response rate for topical imiquimod of 83% at five years, although clearly inferior to the 98% for excisional surgery for low-risk BCC, might still represent a clinically useful treatment modality, because a cream treatment can be carried out in a primary care setting, and some patients may also prefer the option of a cream rather than surgery," remarked lead investigator Hywel C. Williams, DSc, FMedSci, NIHR Senior Investigator, Professor of Dermato-Epidemiology and Co-Director of the Centre of Evidence-Based Dermatology at the University of Nottingham, Nottingham, UK. "If you had told me 15 years ago that one day we would be treating low risk nodular and superficial BCC with a cream that enhanced the body's local immune response, I would have walked away. But it is a reality nowadays."

Doctors have expressed concerns that the use of topical treatments instead of surgery may leave patients vulnerable to so-called "submarine lesions," which can emerge after the superficial cancer appears to have been treated. However, mirroring the results of the three-year follow-up, the extended five-year study illustrates that if imiquimod treatment is successful in the first year, BCC reoccurrence is unlikely. "Most treatment failures with topical imiquimod occurred in the first year of treatment, a finding that throws light on the possible mechanisms of topical immunotherapy of skin cancer, suggesting that once an immunological response has occurred, such a response is sustained," said Professor Williams.

These new data are important information for practitioners and their patients to consider with treatment options for low-risk BCC. This new study confirms that if a benefit is seen from imiquimod treatment, those results are likely to hold over a five-year period. Added Professor Williams, "Very few RCTs have been conducted for BCC, which is odd considering that it is the most common form of human cancer. Only a handful of such RCTs have been followed up for five years, which is important as some treatments, such as photodynamic therapy, produce reasonable results in the short term, but seem to result in more and more recurrences the longer patients are tracked."

Investigators hope that these findings will encourage further research to develop creams that work in a similar way, yet produce better results. For now, this information provides an important part of the roadmap for treating BCC and potentially alleviating some of the burden on specialized health care providers.

"The most important results are the precise estimates of three- and five-year tumor clearance for imiquimod cream versus surgery," concluded Professor Williams. "This will allow patients and their doctors to engage in a shared decision-making conversation on a range of possible treatment options. Because BCC is reaching epidemic proportions, some countries like the UK are struggling to keep up. One possible strategy for the future is to treat more low-risk (biopsy proven) BCCs with imiquimod cream and only refer patients who don't respond to secondary care services."

http://bit.ly/2huDjnV

Study identifies why some people can smell asparagus in urine

More research needed to help asparagus anosmic people discover what they're missing

In The BMJ's Christmas edition this week, a study identifies the genetic origin of the ability to smell the strong, characteristic odor in

human urine produced after eating asparagus. A team of U.S. and European researchers found hundreds of variants in the DNA sequence across multiple genes involved in sense of smell that are strongly associated with the ability to detect asparagus metabolites in urine.

They say more research is needed to understand why such food results in a particular odor, and what selective pressures would result in such a significant genetic predisposition to be able to smell - or not smell - the metabolites.

Asparagus is considered a delicacy, but it's also known to produce a distinctive odor in urine. Not everyone can detect the odour of metabolites (methanethiol and S-methyl thioesters) produced by consumption of asparagus.

The researchers, led by Sarah Markt and Lorelei Mucci at the Harvard T.H. Chan School of Public Health, set out to determine whether genetic factors are important in the ability to smell the odor.

Their study involved 6,909 men and women of European-American descent from two cohorts: the Nurses' Health Study and Health Professionals Follow-up Study.

Findings show that 40% (2,748/6,909) of participants agreed that they could smell a distinct odor in their urine after eating asparagus, and 60% (4,161/6,909) said they could not and were labelled as 'asparagus anosmic'. The researchers linked information from genome wide association studies on over 9 million genetic variants with the asparagus anosmia trait.

They discovered 871 particular variations in DNA sequence, known as single nucleotide polymorphisms, on chromosome 1 which were associated with being asparagus anosmic. These genetic variants were found in several different genes responsible for sense of smell.

They also found that a higher proportion of women reported they were unable to detect the odor, compared to men, despite women being known to more accurately and consistently identify smells.

The researchers suggest that this unexpected result might be due to under-reporting by a few modest women, or because they might be less likely to notice an unusual odor because of their position during urination.

Study limitations include self reporting of odor, rather than an objective measurement, although this is unlikely to explain their findings, and the sample focusing on people of European descent, so it's unknown whether the same genetic variants predict asparagus anosmia in other ethnicities.

The authors explain that "our findings present candidate genes of interest for future research on the structure and function of olfactory (sense of smell) receptors and on the compounds responsible for the distinctive odor produced by asparagus metabolites."

"Future replication studies are necessary before considering targeted therapies to help anosmic people discover what they are missing."

They also note that asparagus provides a rich source of iron, fiber, zinc, folate, and vitamins A, E and C, and consumption is thought to reduce risk of cancer, cognitive impairment, and cardiovascular related diseases.

Therefore, they call for research to "consider using these identified single nucleotide polymorphisms to better understand how a lifetime of eating asparagus might protect people from developing chronic conditions."

Research: Sniffing out significant "Pee values": genome wide association study of asparagus anosmia

http://bit.ly/2hJyTHv

Research identifies a molecular basis for common congenital brain defect

Scientists have discovered a molecular cause of hydrocephalus

La Jolla, Calif. Scientists at Sanford Burnham Prebys Medical Discovery Institute (SBP) have discovered a molecular cause of hydrocephalus, a common, potentially life-threatening birth defect in which the head is enlarged due to excess fluid surrounding the brain. Because the same

molecule is also implicated in Down's syndrome, the finding, published today in the Journal of Neuroscience, may explain the ten-fold increased risk of hydrocephalus in infants born with Down's.

"We found that deleting the gene for sorting nexin 27, or SNX27, which plays a major role in the development of Down's syndrome, causes hydrocephalus," said Huaxi Xu, Ph.D., the Jeanne and Gary Herberger Leadership Chair of SBP's Neuroscience and Aging Research Center. "The mechanism we uncovered likely only accounts for a fraction of hydrocephalus cases, but we identified potential non-surgical treatments for these cases that deserve further study."

Hydrocephalus affects one or two of every 1,000 births. Some causes of hydrocephalus are known, including several well-characterized brain and skull malformations that block fluid outflow, but it can also arise in the absence of other obvious abnormalities. The condition is treated by surgically inserting a shunt to divert the fluid to another part of the body where it can be absorbed. However, these tubes can become infected, and about half the time, they fail, causing headaches, vomiting, fever, and irritability until the shunt is replaced.

The new study followed up on prior results from Xu's lab showing that SNX27, a protein that regulates traffic of other proteins within cells, is found at lower than normal levels in the brains of individuals with Down's syndrome. They also found that inactivating the gene for SNX27 in mice causes learning and memory problems similar to those in Down's.

Here, Xu's team looked at overall brain development in mice without SNX27. They observed severe hydrocephalus, with fluid-filled cavities (ventricles) in the brain that were much larger than normal. Examining potential causes, they saw that these mice lacked the cells that normally line the ventricles and circulate fluid in the brain, called ependymal cells.

The researchers also determined why ependymal cells aren't generated--without SNX27, brain stem cells generate too much of the active form of a protein called Notch that keeps them from becoming ependymal cells. The active form of Notch is created by an enzyme called gamma-secretase, whose activity is regulated by SNX27. Without SNX27, too much gamma-secretase remains active.

"Proper flow of fluid out of the brain isn't just crucial in brain development--it also helps eliminate toxic proteins such as amyloid beta, which causes Alzheimer's," added Xu. "Since we've already shown that lack of SNX27 increases production of amyloid beta, genetic variants that cause lower than normal levels of SNX27 would greatly increase risk for Alzheimer's. This double effect likely explains why Down's syndrome patients' brains exhibit Alzheimer's pathology by adulthood."

Wang, Xu, and their collaborators went on to show that giving either a drug that inhibits gamma-secretase to SNX27-deficient mice prevents them from developing hydrocephalus.

"Gamma-secretase inhibitors could be a future treatment for cases of hydrocephalus caused by ependymal cell defects," commented Xu. "However, further study is required to determine whether this approach is relevant to humans."

This research was performed in collaboration with scientists at Xiamen University in China and the Institute of Molecular and Cell Biology in Singapore. Funding was provided by the National Natural Science Foundation of China, the Thousand Young Talents Program of China, the Fundamental Research Funds for the Chinese Central Universities, the National Institutes of Health, the Alzheimer's Association, the Global Down Syndrome Foundation, the BrightFocus Foundation, and the Cure Alzheimer's Fund.

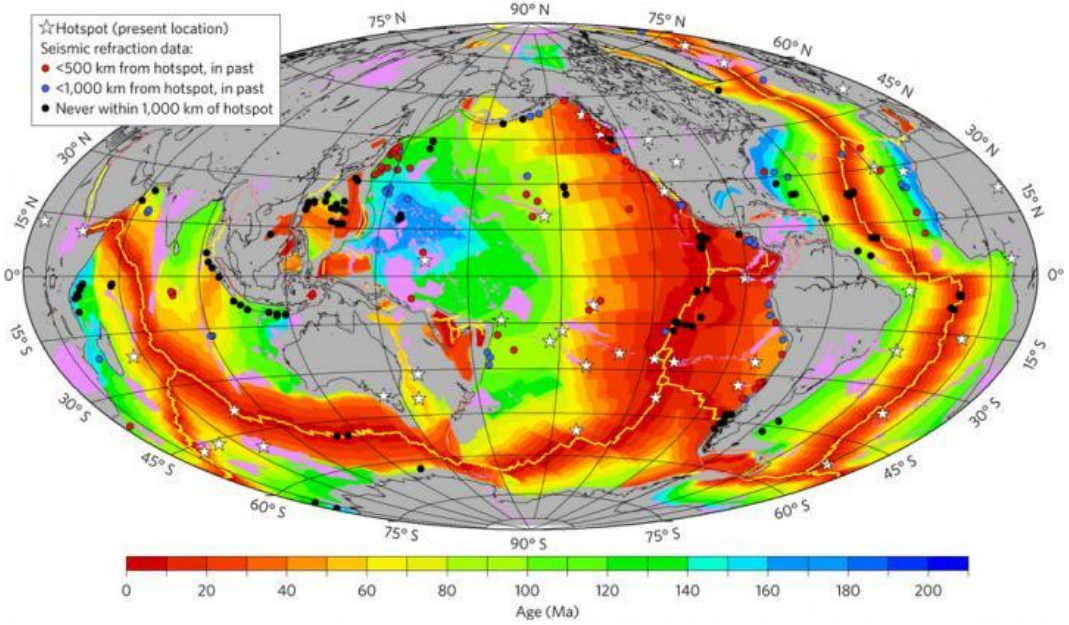
http://bit.ly/2hFz3CQ

Breakup of supercontinent Pangea cooled mantle and thinned crust

Light shed on how plate tectonics has influenced the cooling of the Earth's mantle

The oceanic crust produced by the Earth today is significantly thinner than crust made 170 million years ago during the time of the supercontinent Pangea, according to University of Texas at Austin researchers.

The thinning is related to the cooling of Earth's interior prompted by the splitting of the supercontinent Pangaea, which broke up into the continents that we have today, said Harm Van Avendonk, the lead author of the study and a senior research scientist at The University of Texas Institute for Geophysics. The findings, published in Nature Geosciences on Dec. 12, shed light on how plate tectonics has influenced the cooling of the Earth's mantle throughout geologic history.



"What we think is happening is that the supercontinent was like an insulating blanket," Van Avendonk said. "So when these continents started opening up and the deeper mantle was exposed, more or less, to the atmosphere and the ocean it started cooling much faster."

All authors are from the University of Texas Institute for Geophysics (UTIG), a research unit of the Jackson School of Geosciences.

The mantle is the very hot, but mostly solid, layer of rock between the Earth's crust and core. Magma from the mantle forms oceanic crust when it rises from the mantle to the surface at spreading centers and cools into the rock that forms the very bottom of the seafloor. Since about 2.5 billion years ago, the mantle has been cooling --a phenomenon that doesn't influence the climate on the surface of the Earth and has nothing to do with the issue of short-term man-made climate change. This study suggests that since the breakup of Pangea, the cooling rate of the mantle has increased from 6-11 degrees Celsius per 100 million years to 15-20 degrees per 100 million years. Since cooler mantle temperatures generally produce less magma, it's a trend that's making modern day ocean crust thinner.

"It's important to note the Earth seems to be cooling a lot faster now than it has been over its lifetime," Van Avendonk said. "The current state of the Earth, where we have a lot of plate tectonic events, this allows the Earth to cool much more efficiently than it did in the past."

The research that led to the connection between the splitting of the supercontinent and crust thickness started when Van Avendock and Ph.D. student Jennifer Harding, a study co-author, noticed an unexpected trend when studying existing data from young and old seafloor. They analyzed 234 measurements of crustal thickness from around the world and found that, on a global scale, the oldest ocean crust examined--170 million year old rock created in the Jurassic--is about one mile thicker than the crust that's being produced today.

"It's something that Jenny and I found, more or less, by accident," Van Avendonk said.

The link between crust thickness and age prompted two possible explanations--both related to the fact that hotter mantle tends to make more magma: Mantle hot spots--highly volcanic regions, such as the Hawaiian Islands and Iceland--could have thickened the old crust by covering it in layers of lava at a later time. Or, the mantle was hotter in the Jurassic than it is now.

Van Avendonk mentioned this problem during a casual conversation with Joshua "Bud" Davis, a Ph.D. student in UTIG's plate tectonics research group and co-author, who said that the group could investigate both of the explanations using computer models of plate movement since the Jurassic and a global database of hotspots.

The analysis ruled out the hot spot theory--thick layers of old crust formed just as easily at distances greater than 600 miles from hotspots, a distance that the researchers judged was outside the influence of the hotspots. In contrast, the analysis supported the hypothesis of mantle heating during the age of Pangea, and mantle cooling after the breakup of the supercontinent.

The finding that splitting up Pangea cooled the mantle is important because it gives a more nuanced view of the mantle temperature that influences tectonics on Earth, Van Avendonk said. The researchers also note that the study illustrates the success that can come from spontaneous collaboration and leveraging basic research on a global scale.

"A cool part of this study is that it didn't need funding," Harding said. "We went through all the literature, and collected all the data ourselves. There's always more information out there."

http://nyti.ms/2i25w2I

An (Edible) Solution to Extend Produce's Shelf Life

What if a Florida tomato could be left on the vine long enough to turn red and fully develop its flavor — and still be ripe and juicy when it arrived at a grocery store in New York days later?

By STEPHANIE STROM DEC. 13, 2016

SANTA BARBARA, Calif. — That is precisely the promise of a start-up here in Southern California, Apeel Sciences, that aims to make obsolete the gas, wax and other tricks growers use to keep fruits and vegetables fresh over time.

Using leaves, stems, banana peels and other fresh plant materials left behind after fruits and vegetables are picked or processed, Apeel has developed a method for creating imperceptible, edible barriers that the company says can extend the life of produce like green beans and berries by as much as five times. Apeel can even deliver a day-of-the-week bunch of bananas, each ripening on a different day.

An Apeel product already has been used to stretch the shelf life of cassava in Africa.

"It takes 30 days to get blueberries grown in Chile to market in the United States, which means they have to be picked before they're ripe and shipped under heavy refrigeration," said James Rogers, the founder and chief executive of Apeel. "We can change that."

Continue reading the main story

If the product performs as advertised, it could bring sweeping changes to the produce industry and grocery aisles. It could reduce food waste and the use of pesticides and increase the varieties of fruits and vegetables available.

Berries treated with an Apeel product, bottom row, compared with untreated fruit. Apeel has developed a method for creating imperceptible, edible barriers that promise to extend the life of produce.

But the company's product is still largely untested at a commercial level, and it faces several potential hurdles beyond effectiveness. Consumers may be wary of a new coating on fresh food, for example, and growers may decide it adds too much cost.

"The socioeconomic factors are as important as these technologies themselves," said Christopher B. Watkins, a professor at the College of Agriculture and Life Sciences at Cornell University.

Americans have greater access than ever to a wide variety of fruits and vegetables year-round. That abundance can come at the expense of taste, as plants are chosen for their ability to withstand time and transportation, not necessarily for their flavor. And yet an enormous amount of what's produced still rots before it can be shipped.

Another effort to alter that trade-off is SmartFresh, a product developed with Professor Watkins's research that keeps apples from ripening too quickly in storage.

Apeel's products, sold under the brand names Edipeel and Invisipeel, take plant materials and extract all liquids from them to produce tiny pellets. The company then uses molecules from those pellets to control the rate of water and gases that go in and out of produce, thus slowing down the rate of decay.

The version of Apeel for avocados, for example, creates a barrier that effectively fools anthracnose, a fungus that exploits tiny cracks that develop in the fruit's skin when it begins to shrivel. Anthracnose extends a little leg through those cracks and into the fruit itself, creating the ugly brown spots that are such a nasty surprise when an avocado is opened.

Edipeel can stave off anthracnose by up to 30 days longer than existing techniques for combating the fungus. "It basically sees a different molecule than it's used to seeing and moves on," Mr. Rogers said.

Invisipeel can be applied while crops are still in the field. Edipeel can be applied after a harvest; crops can be coated while on a conveyor belt or dipped in the solution.

So far, the products are derived primarily from the remains of produce that has been certified organic, like grape skins left over from wine production and stems left behind after broccoli is harvested. They can be easily washed away with water.

The Food and Drug Administration has approved Edipeel as "generally recognized as safe," a status that means a product is safe to eat and good for sale.

Some big venture capital firms are now placing bets on Apeel. Andreessen Horowitz and DBL Partners recently led a round of $33 million investment in the company that was announced Tuesday. It has raised $40 million in total.

Apeel has just begun sales of its products and said it was starting negotiations with produce companies that together account for some $6 billion in sales, according to a presentation made to potential investors.

Vijay Pande, who leads Andreessen Horowitz's $200 million bio fund, said Apeel's appeal was the many different issues it could tackle, from reducing a company's carbon footprint to increasing the diversity of fruits and vegetables available.

"There are one or two first markets to go after and demonstrate impact, but where you go from there with this company is extremely broad," Mr. Pande said.

He said Apeel could, for instance, increase yields by reducing losses at the harvest level, which would translate into lower prices for consumers. It could reduce agriculture's environmental impact by allowing growers to ship products with an Edipeel barrier at higher temperatures. And before harvest, an Edipeel barrier could repel pests and fungi and thus reduce the use of pesticides.

And then there is the impact on wasted food.

"The answer to feeding the growing world population isn't just to grow more food, it's to preserve more of what we already grow and make optimal use of the resources we already have," said Ira Ehrenpreis, a managing partner at DBL.

Apeel came into being when Mr. Rogers was a doctoral student in materials science at the University of California, Santa Barbara. He began to wonder whether the same processes he was studying to develop coatings that could be used to produce inexpensive plastic solar cells might also be applied to extend the life of produce.

He then drafted Jenny Du, a fellow grad student who had studied the synthesis and application of inorganic nanostructured films among other things, and the two of them began working in his garage to develop Edipeel.

In 2012, the concept won $10,000 in the UCSB New Venture Competition, and then Mr. Rogers received a $100,000 award from

the Bill and Melinda Gates Foundation, which was interested in how the idea might help small farmers in Africa.

The foundation has used the product on the cassava root, an important source of calories in the African diet and thus is grown widely by small farmers there. Cassava root also can be processed into starch for use in commercial food preparation.

Once plucked from the ground, however, the roots deteriorate rapidly, making it virtually impossible for small farmers to exploit the crop commercially. “If not consumed or processed in 24 to 48 hours, you lose significant amounts,” said Rob Horsch, who leads the agricultural research and development team at the Gates Foundation. “That makes it hard to generate any income from what’s produced, and a lot of it goes to waste.”

Edipeel more than doubled the shelf life of cassava, helping the root retain starch long enough to get it to a processing plant. According to an analysis by Apeel, use of its Edipeel product will create $1 billion in the market value of cassava in Nigeria alone.

“Farmers who used the product during trials in Africa are now clamoring for it,” Mr. Rogers said.

Edipeel is also being tested by Jay Ruskey, the proprietor of Good Land Organics in Goleta, Calif. Mr. Ruskey grows finger limes, which produce a citrus “caviar” prized by chefs and bartenders. The limes, which look rather like gherkins, are good for two weeks at the most, making broad distribution almost impossible.

“Most people do not understand how much is applied to fruits and vegetables to keep them looking good — there’s a lot of wax out there,” Mr. Ruskey said. “It’s gotten to the point that if you have iced tea with us, we no longer give you a lemon slice because of the wax on it.”

The barrier Apeel has created for Good Land almost doubles the viability of the limes at this point, and Mr. Ruskey is now testing the application process and shelf life in the market.

“So far,” he said, “it looks very promising.”

http://bbc.in/2hHQhiD

'Gender-biased infections' may exist

Viruses can evolve to become more aggressive in men than in women - at least in theory, a study suggests.

By James Gallagher Health and science reporter, BBC News website

The report, published in Nature Communications, argues there is a benefit to a virus "going easy" in women as it helps it spread. Some infections are known to be less deadly in women, but this is largely put down to differences in the immune system. Experts said the findings were intriguing.

Viruses have ways of spreading that are unique to women - such as to a child in the womb, during birth or breastfeeding. Scientists at Royal Holloway University in London used mathematics to model whether this altered the way viruses behaved. Their findings suggest there may be an advantage to infections being less aggressive in women as reducing the risk of killing the mother increases the chance of infecting the child.

Dr Francisco Ubeda, one of the researchers, said: "Viruses may be evolving to be less dangerous to women, looking to preserve the female population, the virus wants to be passed from mother to child, either through breastfeeding, or just through giving birth."

Studies have shown that gender plays a role in the types and severity of infections. The main ideas are differences in the immune system, hormones or sex chromosomes affecting risk.

Dr Ubeda told the BBC News website: "We're turning it on its head and taking the pathogen's eye view. "We show theoretically it is possible, which is challenging, but we haven't proven what the mechanism is that would trigger this difference. "Or that there will be a difference in the pathogen's behaviour between in men and women."

The researchers argue that eventually it may be possible to use drugs to trick viruses into thinking they were infecting women in order to make them less aggressive. But Dr Ubeda agrees this is firmly in the realm of "science fiction" at the moment.

Prof Jonathan Ball, a virologist from the University of Nottingham, told the BBC: "The possibility that a virus - or indeed any other infection - can fine-tune its ability to cause disease to help its transmission in either males or females is intriguing.

"Whilst the data is compelling, we have to remember that these are models nonetheless and testing them in real biological systems will be an important next step."

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Anti-tumor effect of novel plasma medicine caused by lactate

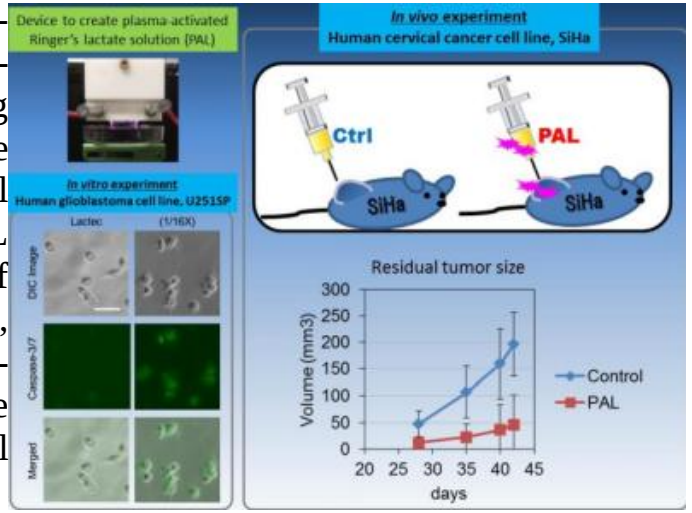
Nagoya University researchers develop cold plasma-activated Ringer's solution for chemotherapy; the solution has anti-tumor effects in vitro and in vivo that derive from the lactate component

Nagoya, Japan - Physical plasma is one of the four fundamental states of matter, together with solid, liquid, and gas, and can be completely or partially ionized (thermal/hot or non-thermal/cold plasma, respectively). Non-thermal plasma has many industrial applications, but plasma medicine is a new field of therapy based on non-thermal atmospheric pressure plasma that has been used in cancer treatment, wound healing, and blood coagulation. Plasma is known to react with air to produce highly reactive free radicals, and with liquid to produce long-lived reactive molecules that can be used for chemotherapy. However, the exact components responsible for the anti-tumor effects were unknown.

Now, a research team based at Nagoya University used plasma to activate Ringer's solution, a salt solution with existing therapeutic functions, and showed that its lactate component had anti-tumor effects. The study was reported in Scientific Reports.

Previous work by the researchers developed plasma-activated cell culture medium as a form of chemotherapy, but selected Ringer's solution in the present work because of its simpler composition and likelihood of forming less complex reaction products. Ringer's lactate solution (Lactec) was irradiated with plasma for 3-5 minutes, after which it demonstrated anti-tumor effects on brain tumor cells.

Other plasma-activated solutions have previously been shown to induce reactive oxygen species within cells, but these were not detected in plasma-activated Lactec (PAL)-treated cells, suggesting an alternative mechanism triggered cell death. Analysis of PAL identified high levels of hydrogen peroxide, which is a known anti-tumor factor and the probable cause of cell death.



We created plasma-activated Ringer's lactate solution (PAL) and investigated its anti-tumor effects on cancer cells. We detected an apoptotic marker, cleaved Caspase3/7 in PAL-treated glioblastoma cells, suggesting that PAL induced apoptosis. We created a mouse xenograft model in which SiHa cervical cancer cells were injected into mice subcutaneously, and the resultant tumors were treated with PAL three times a week for six weeks. PAL effectively reduced tumor volumes. **Nagoya University**

Lactec contains lactate and the salts sodium chloride, calcium chloride, and potassium chloride, in addition to water, so the team systematically analyzed plasma-activated synthetic versions of each component to identify which was responsible for killing cancer cells. "Only lactate demonstrated anti-tumor properties and generated hydrogen peroxide following plasma irradiation," first author Hiromasa Tanaka says. "This indicates that activated lactate increases intracellular hydrogen peroxide levels which cause apoptosis of the tumor cells."

Some cell types were not killed by treatment with PAL, suggesting it could be used as a specific tumor therapy. "PAL also appears to be

safe for use in vivo," corresponding author Kae Nakamura says, "as we observed no adverse effects when PAL successfully reduced the tumor volume of mice."

The article "Non-thermal atmospheric pressure plasma activates lactate in Ringer's solution for anti-tumor effects" was published in the Nature journal Scientific Reports at DOI: 10.1038/srep36282

http://bit.ly/2qY3zGx

Researchers reveal how cancer can spread even before a tumor develops

Even before tumors develop, breast cancer cells with a few defined molecular alterations can spread to organs, remain quiet for long periods of time

New York, NY - Even before tumors develop, breast cancer cells with a few defined molecular alterations can spread to organs, remain quiet for long periods of time, and then awaken to form aggressive, deadly breast cancer metastasis, says a team of investigators led by researchers at Icahn School of Medicine at Mount Sinai and the University of Regensburg in Germany.

They say their finding, published in two papers in the journal Nature, and conducted in animal models and tested in human samples, now solves the mystery of how breast cancer metastasis forms without a primary tumor in this new model of early dissemination and metastasis. Furthermore, a clinical primary tumor may never develop, investigators say.

The University of Regensburg team had discovered that cancer cells could spread not only from a highly mutated, overtly evolved and pathologically-defined invasive tumors, but also from early stage cancers commonly considered incapable of spreading cells. However, how these early cancer lesions could spawn cells with traits of malignant tumors was unknown.

In two papers published in the journal Nature, and conducted in animal models and tested in human samples, the two teams now have identified the first mechanisms that allow cells to spread early in cancer progression and contribute to metastasis.

In the study from Mount Sinai, two changes in mammary cancer cells -- a switched-on oncogene and a turned-off tumor suppressor-- motivated cells to travel from breast tissue to the lungs and other parts of the body. There, the cells stayed quiet until a growth switch was activated and metastases developed in lungs.

"This research provides insight into the mechanisms of early cancer spread and may shed light into unexplained phenomena -- among them, why as many as 5 percent of cancer patients worldwide have cancer metastases but no original tumor, and most importantly, why it is so difficult to treat cancer that has spread," says the study's senior investigators, Julio A. Aguirre-Ghiso, PhD, Professor of Medicine, Hematology and Medical Oncology, Maria Soledad Sosa, PhD, Assistant Professor of Pharmacological Sciences, and graduate student Kathryn Harper of The Tisch Cancer Institute at the Icahn School of Medicine at Mount Sinai.

"Biologically, this new model of early metastasis challenges everything we thought we knew about how cancer spreads and forms metastasis. It feels like we are going to have to adjust our ideas about the subject of metastasis," he says. "Our hope is that these findings will reshape the way we think about how metastasis should be treated."

An important finding from the Mount Sinai team is that most early spread cells remain dormant and most chemotherapy and targeted therapies are aimed at those cells that are proliferative. So early spread cancer cells would escape these conventional therapies even if it kills a primary tumor, Dr. Aguirre-Ghiso says. The work also poses new questions on how early spread cancer cells support metastasis development. Do they do it on their own, do they set the soil for later arriving cells from tumors not caught early, or do they cooperate with later arriving cells? This study reveals a new biological mechanism of early dissemination that must be explored to fully understand how to target the seeds of metastasis.

The companion paper headed by Dr. Christoph Klein at the University of Regensburg in Germany, published in the same issue of Nature and co-authored by Dr. Aguirre-Ghiso and members of his team provides additional key mechanistic clues on how early spread is controlled and proof in human cancer cells and tumors of the preclinical findings in this study. Researchers from both teams arrived at their findings independently and then collaborated on the project.

Researchers from both teams studied very early stages of breast cancer including DCIS (ductal carcinoma in situ), a noninvasive breast lesion, since 2-3 percent of women who have been treated for DCIS die of metastasis without ever developing a primary tumor. "The best explanation for this phenomenon is that early metastasis occurs before or as DCIS develops. A key finding from this second paper is that in the mouse models, 80% of metastasis originated from the early spread cells and not from the large tumors. In fact, the Klein group identified a mechanism by which spread is more efficient in early lesions than in large tumors.

In both studies, investigators found that early cancer cell spread is an extension of the normal process of creating a branching tree of breast milk ducts in females.

Two major pathways are activated in this ancient process -- p38, a tumor suppressor, and HER2, an oncogene. Switching off p38 and turning on HER2 activates a module of the EMT (epithelial to mesenchymal transition) signaling pathway. EMT promotes movement of cells during embryogenesis and tissue development. The Klein paper also shows that progesterone receptor signaling, which controls branching of the mammary tree, is important for this early spread by regulating cues involved in EMT and growth programs, a mechanism that was hinted in his earlier studies.

As a mammary tree develops, p38, HER2, and EMT are alternatively turned on and off. This, in cooperation with progesterone signaling, allows mammary cells to move through the mammary gland, hollow out a tubular, branching network of milk ducts that flow to the nipple. "Tweaking these pathways are a normal way of forming hollow branching tubes," Dr. Aguirre-Ghiso says. But in their experiments, they found that if HER2 is over-activated (not switched off) or mutated, and p38 is permanently turned off, EMT was continually activated, allowing cells to move out of the mammary gland and into the animal's body through the blood.

"We were able to use organoids in three-dimensional cultures, and high resolution imaging directly in the live animal models to actually see these cells enter the blood stream from the mammary tree and travel to the lung, the bone marrow, and other places," he says. "We hadn't thought about oncogenes and tumor suppressors in this way before. This is a new function for these pathways."

John S. Condeelis, PhD, co-Director of the Gruss Lipper Biophotonics Center and its Integrated Imaging Program at Einstein, where the high resolution intravital imaging was performed, noted that "We were surprised to learn that cancer cells from DCIS-like lesions could show such robust dissemination using similar machinery found in tumor cells from invasive carcinoma. This is a new insight with implications beyond our expectations." Also David Entenberg MSc, Director of Technological Development and Intravital Imaging who led the imaging efforts within the same Center said, "A few years ago, it would not have been possible to image these disseminating cells inside a living animal with this level of detail. We're pleased that Einstein's imaging technology could, through this collaboration, contribute to the definitive proof of early dissemination."

And while both studies focus on the mechanisms of early dissemination in breast cancer, similar processes could control early dissemination and metastasis in other human cancers, including melanoma and pancreatic cancer. In fact, pancreatic cancer early dissemination has also been linked to an EMT process, Dr. Aguirre-Ghiso says.

Among the critical avenues they are investigating, Mount Sinai researchers are looking for the growth switch that pushes early spread

of dormant cancer cells to form metastases. "While our findings add a whole new level of complexity to the understanding of cancer, they also add energy to our efforts to finally solve the big issue in cancer -- stop the metastasis that kills patients," Dr. Aguirre-Ghiso says.

Study contributors include lead co-authors Kathryn L. Harper, PhD, Maria Soledad Sosa, PhD, Julie F. Cheung, BSc, Rita Nobre MSc, Alvaro Avivar-Valderas, PhD, Chandandaneep Nagi, MD, and Eduardo F. Farias, PhD, from Icahn School of Medicine at Mount Sinai; Christoph Klein, MD and Hedayatollah Hosseini, PhD from the University of Regensburg, Germany; Nomeda Girnius, PhD and Roger J. Davis, PhD from Howard Hughes Medical Institute at the University of Massachusetts Medical School; and David Entenberg, MSc and John Condeelis, PhD from Albert Einstein College of Medicine in New York.

The study was supported by grants SWCRF, CA109182, CA196521, CA163131, CA100324, F31CA183185, BC132674, BC112380, NIH 1S10RR024745 Microscopy CoRE at ISMMS, the Integrated Imaging Program at Einstein, HHMI, DFG KL 1233/10-1 and the ERC (322602).

http://bit.ly/2i2bIYx

True lies: People who lie via telling truth viewed harshly, study finds

'Paltering' seen as equivalent to intentional lying

The ability to deceive someone by telling the truth is not only possible, it has a name -- paltering -- it's common in negotiations and those who palter can do serious harm to their reputations, according to research published by the American Psychological Association.

"To date, research has primarily focused on two types of deception: Lying by commission -- the active use of false statements - and lying by omission -- the passive act of misleading by failing to disclose relevant information," said lead author Todd Rogers, PhD, of Harvard University. "In this study, we make a novel contribution to the deception literature by identifying a third, and common, form of deception. Rather than misstating facts or failing to provide information, paltering involves actively making truthful statements to create a mistaken impression."

Paltering is used by politicians commonly, according to Rogers. "Politicians often palter when the truthful answer to a question would be harmful," he said. "When candidates get questions they don't want to hear, they often focus on continuing to make truthful statements, but try to mislead listeners."

One famous example Rogers cited was when President Bill Clinton said "there is not a sexual relationship" between him and former White House intern Monica Lewinski. The Starr commission later discovered that there had been a sexual relationship but it had ended months before Clinton made that statement - thus, it was technically true but clearly misleading.

Rogers and his colleagues conducted two pilot studies and six experiments involving over 1,750 participants.

The first pilot study confirmed that people in general could distinguish paltering as a distinct form of deception, different from lying by commission or omission. In the second pilot study, the researchers determined that it is a common form of deception, with over 50 percent of business executives enrolled in an advanced negotiation course at Harvard Business School admitting they had paltered in some or most of their negotiations.

In the experiments, the researchers discovered that people preferred paltering to lying by commission, but the results of being found out can be just as harsh. While palterers tended to think of their actions as more ethical because they essentially told the truth, when the deception was revealed, they were graded as harshly by their counterparts as if they had lied by commission.

"When individuals discover that a prospective negotiation partner has paltered to them in the past, they are less likely to trust that partner and, therefore, less likely to negotiate with that person again, "said Rogers.

"Taken together, our studies identify paltering as a distinct and frequently employed form of deception." Rogers postulates that people palter because they have a flawed mental model. Palterers think it is OK because they are telling the truth but their audience sees it as lying.

The results were published in the Journal of Personality and Social Psychology.

Article: "Artful Paltering: The Risks and Rewards of Using Truthful Statements to Mislead Others," by Todd Rogers PhD, Richard Zeckhauser, PhD, Francesca Gino, PhD, and Mike Norton, PhD, Harvard University and Maurice Schweitzer, Phd, University of Pennsylvania. Journal of Personality and Social Psychology, published online Dec. 12, 2016.

Full text of the article is available from the APA Public Affairs Office and at http://www.apa.org/pubs/journals/releases/psp-pspi0000081.pdf.

http://bit.ly/2qYtIGY

Study dispels myth that Santa only visits children who are nice

A study in the Christmas issue of The BMJ dispels the myth that Santa Claus rewards children based on how nice or naughty they have been in the previous year.

Instead, the results suggest that socioeconomic deprivation seems to play a greater role in determining a visit by Santa Claus, with children in hospitals in the most deprived areas less likely to receive a visit.

The researchers say further studies are needed to examine whether Santa Claus actively discriminates or whether deeper structural factors are at play.

It has long been thought that Santa Claus gives presents to nice but not naughty children. However, no evidence exists to support this - or to establish whether this is the only factor determining the likelihood of a visit from him. So a team of UK and US based researchers set out to determine which factors influence whether Santa Claus will visit children in hospital on Christmas Day.

They surveyed every UK hospital with a paediatric ward to find out if Santa had visited during Christmas 2015. They then correlated this with rates of absenteeism from primary school, conviction rates in young people (aged 10-17 years), distance from hospital to North Pole, and socioeconomic deprivation.

Santa Claus visited most of the paediatric wards in all four countries: 89% in England, 100% in Northern Ireland, 93% in Scotland, and 92% in Wales. The odds of him not visiting, however, were significantly higher for paediatric wards in areas of higher socioeconomic deprivation. In contrast, there was no correlation with school absenteeism, conviction rates, or distance to the North Pole.

The researchers are unable to explain why this association exists, but one possible theory may be that Santa Claus is forced to sustain existing inequality, as he is contractually not allowed to change anyone's socioeconomic status.

"It has long been thought that Santa Claus gives presents to nice but not naughty children," say the authors. "This is the first study, to our knowledge, to dispel the myth that Santa visits children based on behaviour and suggests socioeconomic deprivation plays a greater role in determining a visit."

"Undoubtedly deeper socioeconomic factors are at play, even impacting Santa Claus's abilities to reach out to every child," they add. "Whether his contract needs to be reviewed or local Santas employed in "hard to reach" areas, all we want is for every child to be happy this Christmas," they conclude.

Research: Dispelling the nice or naughty myth: retrospective observational study of Santa Claus

http://bit.ly/2qY28Il

Carbonaceous chondrites shed light on the origins of life in the universe

A CSIC study discovers that the minerals which make up this type of meteorite can synthesise certain complex organic compounds in the presence of water and formamide

A Spanish-Italian team led by the Spanish National Research Council (CSIC) has discovered that one type of meteorite known as carbonaceous chondrites are capable of synthesising organic compounds which are key to prebiotic chemistry. Such catalysing properties are unknown in other rocks on Earth and in other planetary bodies in the Solar System. This type of meteorite may well have played a vital role in the origins of life in the universe. The results of the study have been published in the magazine Scientific Reports.

The meteorite samples analysed in this study come from NASA's Antarctic collection and derive from asteroids and, possibly, from comets. "Chondrites are non-differentiated meteorites, a legacy fossil from the creation of planetesimals. These provide us not only with information about the processes of aggregation of the earliest building blocks of the planets, but also about everything which occurred in their interiors shortly after their formation", explains CSIC scientific investigator at the Institute of Space Sciences and at Institute of Space Studies of Catalonia, Josep María Trigo, the study's codirector.

The results of the work highlight the fundamental role played by the water soaking the asteroids which were progenitors of certain carbonaceous chondrites around 50 million years before the Earth was formed. These processes encouraged the synthesis of complex organic molecules in those asteroids which, upon reaching other planets, would have fertilised their surfaces with these prebiotic compounds.

"Commonly, the abrupt arrival of these meteorites causes their fragmentation and, due to the high temperatures involved, the degradation of organic compounds. For that reason, we decided to develop experiments which were capable of synthesising organic material originating from chondrite minerals, once they had reached the ground though not necessarily with any surviving primordial organic compounds", adds Trigo.

During the experiments, which took place at the University of Tuscany in Italy by Prof. Raffaele Saladino team, the samples which came from NASA's Johnson Space Centre were crushed in a mortar, treated to eliminate all traces of organic material, and placed with formamide and both thermal and sea water at 140 °C. These waters had previously been filtered to avoid the presence of, or contamination from, any type of living organism.

"It is fascinating to see that chondrites possess unique properties which, in a relatively short period, allow their complex organic compound contents to reproduce if they are treated with an aqueous solution containing formamide.

We could be looking at the discovery of the key chemical processes involved in the origins of organic material in the Universe. These phases of hydration possibly marked the early stages of asteroids and comets", explains CSIC researcher Carles E. Moyano, from Spain's Institute of Space Science.

Implications for the emergence of life on other planets.

The results of these experiments signal that these meteorites possess the amazing properties of catalysing complex organic compounds which are not present in terrestrial rocks. The minerals which form carbonaceous chondrites are capable of synthesising carboxylic acids, amino acids and all the nitrogenous bases which form ribonucleic acid (ARN), considered to be the precursor of the first living organism.

"The data obtained indicates that, even if chondrites were pulverised and lost their organic compounds during the phases of deceleration and ablation in the atmosphere, those minerals which reached the Earth's surface and were heated in the presence of both water and formamide would be able to reproduce the organic compounds fundamental to prebiotic chemistry. This clearly points to life being fertilised from outside Earth's atmosphere- life which could reach any part of our Solar System and, for that matter, of the Universe wherever conditions were conducive to maintaining liquid water for a reasonable length of time. Mars, Europa and Titan could possibly be excellent candidates for our exploration" indicates Trigo.

L. Rotelli, J. M. Trigo-Rodriguez, C. E. Moyano-Cambero, E. Carota, L. Botta, E. Di Mauro and R. Saladino. 2016. The key role of meteorites in the formation of relevant prebiotic molecules in a formamide water environment. Nature - Scientific Reports, DOI: 10.1038/srep38888

http://bit.ly/2hUJQt4

Woman gives birth thanks to ovary removed when she was 8

Conceived using an ovary removed 16 years ago

A woman who had her fertility restored using frozen ovarian tissue which was removed when she was a child has given birth in the UK.

Moaza Al Matrooshi, 24, is thought to be the first person in the world to conceive and give birth to a baby after having an ovary removed and cryopreserved before she entered puberty.

Matrooshi was eight when she had the organ removed before having chemotherapy and a bone marrow transplant for the inherited blood disorder beta thalassaemia.

Her remaining ovary was only partially functioning following the chemotherapy and she went into early menopause. But at the age of 21, Matrooshi received a transplant of her frozen ovarian tissue that allowed her to undergo IVF at a CARE Fertility clinic. Now, aged 24, she has given birth to a baby boy.

“Moaza has become the first woman in the world to give birth following the transplant of her own ovarian tissue removed before puberty,” says Rob Smith, at CARE London.

“This is a ground-breaking step in this area of fertility preservation, and has the potential to help many young people who face cancer treatment preserve their fertility chances in the future,” says Adam Balen, at the British Fertility Society, an organisation that represents specialists in reproductive medicine.

http://bit.ly/2hwsX7c

Ancient Mars Could Have Harbored Life for a Long, Long Time

New data suggest Mars was habitable for perhaps hundreds of millions of years

By Mike Wall, SPACE.com on December 14, 2016

SAN FRANCISCO - Parts of Mars were capable of supporting life as we know it for lengthy stretches in the ancient past—perhaps hundreds of millions of years at a time, new observations by NASA's Mars rover Curiosity suggest.

Since it landed inside the Red Planet's Gale Crater in August 2012, Curiosity has studied a number of different rocks over an elevational range of about 650 feet (200 meters), which represents a time span of tens of millions to hundreds of millions of years.

The rovers' analyses indicate that the environment within Gale Crater changed considerably during this period, but never in a way that would preclude life from forming or surviving, mission scientists said today (Dec. 13) during a news conference here at the annual fall meeting of the American Geophysical Union (AGU).

"For that entire history [of Mars], it seems to have been favorable" for life, said Curiosity science team member (and former project scientist) John Grotzinger, a geologist at the California Institute of Technology in Pasadena.

Curiosity's observations—made by drilling into rocks, then studying the resulting samples—had already allowed scientists to determine that Gale Crater harbored a potentially habitable lake-and-stream system billions of years ago. (Like the rest of Mars, the area is dry today, at least on the surface.)

The new results paint a more detailed picture of that environment and how it changed over time. The results incorporate additional analyses that Curiosity has performed as it climbs the foothills of Mount Sharp, which rises 3.4 miles (5.5 kilometers) into the sky from Gale Crater's center.

The initial observations, made by Curiosity at lower elevations, suggest that the lake was first composed of fresh, neutral-pH water. That water got a bit more acidic over time, and then a bit saltier. The lake system probably dried up at times and then filled back in again, as the groundwater level rose, Grotzinger said.

But, despite all these changes, the area remained hospitable to microbial life, he added. (Simple organisms could have persisted in groundwater even during the lake system's "dry" stages.)

"This is all very good for habitability over long periods of time," Grotzinger said.

Furthermore, Curiosity's analyses show a complexity of minerals at the rover's various drill sites, from clays and magnetite lower down to hematite higher up. The six-wheeled robot also detected boron in Gale Crater, marking the first time this element has been discovered on

Mars. Again, this is all good news for ancient Mars' habitability, mission team members said.

"Variations in these minerals and elements indicate a dynamic system," Grotzinger said in a statement. "They interact with groundwater as well as surface water. The water influences the chemistry of the clays, but the composition of the water also changes. We are seeing chemical complexity indicating a long, interactive history with the water. The more complicated the chemistry is, the better it is for habitability. The boron, hematite and clay minerals underline the mobility of elements and electrons, and that is good for life."

Some samples also showed abundances of silica, which here on Earth is great at preserving ancient microbes, Grotzinger said. This find, of course, does not suggest that organisms have ever survived on Mars, but it could aid the planning of future life-hunting missions such as NASA's 2020 Mars rover, Grotzinger said.

"I think this is a tremendously exciting discovery," he said.

Curiosity will continue climbing up Mount Sharp's lower reaches, further fleshing out scientists' understanding of the ancient Martian environment and how it changed over time. The rover is in good health, though a problem with Curiosity's drill that cropped up earlier this month persists, mission team members said today.

http://bit.ly/2i2uH52

Potential treatment for pregnant women who suffer from preeclampsia found in a vitamin

Scientists in Japan and the US have found that vitamin B3 nicotinamide may help treat pregnant women who suffer from preeclampsia by preventing strokes and in some cases, even stimulating the growth of their fetus.

Up to 8% of pregnant women suffer from preeclampsia, a deadly disease characterized by high blood pressure, blood vessel damage, high levels of protein in the urine and fluid retention that causes swelling in the legs and feet. In some cases, preeclampsia is also believed to restrict a fetus' growth. Blood pressure-lowering drugs do not improve blood vessel damage. In fact, they reduce blood supply to the babies, which could lead to fetal death.

Until now, the only treatment for preeclampsia-affected pregnant women has been delivery of the baby. Now, researchers at Tohoku University, in collaboration with US scientists, have found that nicotinamide - also referred to as Vitamin B3 - relieves preeclampsia in mouse models. Moreover, they have also discovered that nicotinamide can even improve fetal growth in mothers with preeclampsia.

"We had previously shown that endothelin, a strong vessel narrowing hormone, worsens preeclampsia. But inhibiting the hormone is harmful to the babies," says Associate Professor Nobuyuki Takahashi of Tohoku University's Graduate School of Pharmaceutical Sciences, who co-led the study.

"In contrast, nicotinamide is generally safe to mothers and babies, corrects the blood vessel narrowing effect of endothelin, and reduces stress to the babies. Accordingly, we evaluated the effects of nicotinamide using two mouse models of preeclampsia caused by different mechanisms."

The researchers concluded that nicotinamide is the first safe drug that lowers blood pressure, reduces urine protein and alleviates blood vessel damage in preeclampsia-affected mice. The researchers went on to show that in many cases, nicotinamide also prevents miscarriage, prolongs pregnancy period and improves the growth of the babies in mice with preeclampsia.

"Nicotinamide merits evaluation for preventing and treating preeclampsia in humans," says Oliver Smithies, a Weatherspoon Eminent Distinguished Professor at the University of North Carolina at Chapel Hill. Smithies is a Nobel Laureate in Physiology or Medicine, and co-leader of this study.

The research team hopes that if the treatment works in humans, nicotinamide could help treat preeclampsia and prevent fetal growth restriction associated with the disease in pregnant women.

The findings from this study were published on November 7 in the *Proceedings of the National Academy of Sciences* (PNAS). The article is titled "Nicotinamide benefits both mothers and pups in two contrasting mouse models of pre-eclampsia."

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Herpes virus linked to most common type of childhood cancer

Newborns with congenital cytomegalovirus may have an increased risk of developing acute lymphocytic leukemia

Newborns with congenital cytomegalovirus (CMV) -- a common virus in the herpes family -- may have an increased risk of developing acute lymphocytic leukemia (ALL), according to new research published online today in Blood, the Journal of the American Society of Hematology (ASH). The study suggests the risk is even greater in Hispanic children.

Although it has long been suspected that infection plays a role in childhood ALL, the most common form of childhood leukemia, this is the first time researchers have tracked ALL back to a specific virus.

Researchers first identified all known infections present in the bone marrow of 127 children diagnosed with ALL and 38 children diagnosed with acute myeloid leukemia (AML). A state-of-the-art assay screened samples for all known viruses. They detected CMV DNA in the bone marrow samples from children with ALL but rarely in those with AML.

Next, the scientists used an ultra-sensitive digital droplet screen to examine newborn blood samples for CMV from 268 children who went on to develop ALL. They compared the samples with healthy children (270). ALL typically develops in children between the ages of two and six.

"Our goal in tracking CMV back from the time of diagnosis to the womb was to establish that this infection occurred well before initiation of disease," said lead study author Stephen Francis, PhD, assistant professor of epidemiology at the University of Nevada and University of California, San Francisco. Study collaborators also included investigators at the University of California, Berkeley, where the California Childhood Leukemia Study -- through which investigators obtained the bone marrow samples -- is based.

The study shows that children who went on to develop ALL are 3.71 times more likely to be CMV-positive at birth. Moreover, stratification by Hispanic ethnicity shows a 5.9-fold increased risk of ALL in Hispanics infected perinatally with CMV. This is important because Hispanics are at the highest risk for developing ALL.

"If it's truly that in utero CMV is one of the initiating events in the development of childhood leukemia, then control of the virus has the potential to be a prevention target," Dr. Francis said. "That's the real take-home message."

Up to 80 percent of Americans are infected with CMV. The virus is normally dormant, causing few symptoms. But during pregnancy the virus can flare up and be transmitted to the fetus, causing serious consequences such as birth defects and hearing loss in newborns.

While this research is in the early stages, the researchers hope these results will inspire more studies that will validate these findings and lead to the development of a CMV vaccine.

"This is the first step, but if we do end up finding a causal link to the most common childhood cancer, we hope that will light a fire in terms of stopping mother-to-child transmission of CMV," Dr. Francis said.

http://bit.ly/2heliHA

U of T researchers make autism breakthrough

One protein's sweeping influence on the development of autism revealed

As many as a third of autism cases could be explained by a scarcity of a single protein in the brain, Toronto scientists have revealed. The

findings provide a unique opportunity to develop treatments for a disorder that is rooted in a motley crew of genetic faults.

Researchers induced autistic-like behaviour in mice by lowering the levels of a protein called nSR100 (also known as SRRM4), which is important for normal brain development. The study, published in the December 15 issue of the journal Molecular Cell, builds on the teams' previous work which showed that the nSR100 protein was reduced in the brains of autistic people.

The teams were led by Professors Benjamin Blencowe of the University of Toronto's Donnelly Centre and Sabine Cordes of the Department of Molecular Genetics and Sinai Health System's Lunenfeld-Tanenbaum Research Institute.

"We previously reported an association between nSR100 protein levels and autism. But this time we show that reduced levels of this protein could really be causative--that's a big deal. Just by reducing the nSR100 levels by 50 per cent, we observe hallmarks of autistic behaviour," said Cordes.

The data also suggest that nSR100 acts as a hub that channels diverse molecular miscues which contribute to autism.

Known best for altered social behaviours, the degree of which can vary tremendously, autism is a common neurological disorder affecting more than one per cent of the population. While its origins are genetic, the specific causes are known in only a fraction of cases that fall into the autism spectrum disorder (ASD). For the majority of people diagnosed with ASD, the reasons behind their disorder remain unknown.

The U of T study provides evidence for the sweeping influence that nSR100 protein has on social behaviour and other features of autism. In the brain, nSR100 acts as a key regulator of alternative splicing--a process that generates a remarkable diversity of proteins, the building blocks of cells.

Proteins are encoded in the DNA sequence of the genes, but the useful instructions are broken up and separated by non-coding DNA. During alternative splicing, non-coding spacers are spliced out and protein-coding segments are brought together to make a finished protein template. But the order in which the coding instructions are stitched together can change so that a single gene can spawn a variety of proteins. This way, cells can expand their protein toolbox to vastly outstrip the number of genes. It's no surprise then, that alternative splicing is especially pronounced in the brain, where the mushrooming protein diversity is thought to be the driving force behind the brain's astonishing complexity.

Blencowe's team previously discovered nSR100 and had shown that it is diminished in the brains of many autistic people. This finding suggested that autism could, in part, stem from an accumulation of incorrectly spliced proteins in brain cells. This could then lead to mistakes in brain wiring and autistic behaviour further down the road.

This time, the teams decided to test head-on if nSR100 scarcity can indeed cause autism. To do this, Mathieu Quesnel-Vallieres, a graduate student jointly supervised by Blencowe and Cordes, created a mutant mouse that lacks nSR100 in order to study its behaviour.

The researchers were amazed to find that reducing nSR100 protein levels only by half was enough to trigger the behavioural hallmarks of autism, including avoidance of social interactions and heightened sensitivity to noise. The nSR100 mutant mice also shared many other features of autism with human patients, such as changes in alternative splicing and brain wiring.

Working with graduate student Zahra Dargaei and Professor Melanie Woodin in the Department of Cell and Systems Biology at the University of Toronto, and with Dr. Manuel Irimia at the Centre for Genomic Regulation in Barcelona, the researchers were also able to show that nSR100 levels are linked to neuronal activity. "If you have an increase in neuronal activity, which is the case in many forms of autism, the nSR100-controlled alternative splicing program is disrupted and this likely underlies autistic behaviour," said Quesnel-Vallieres.

"A major value of the nSR100 deficient mouse is that it can explain other causes of autism and how they impact neurobiology by converging on the nSR100 protein", said Blencowe who is also a Professor in U of T's Department of Molecular Genetics. "Our mouse model will also serve as a useful testing ground for small molecules that have potential to reverse nSR100 deficiency in autism," he added.

"Instead of focusing on individual mutations linked to autism, it's much more powerful to identify regulatory hubs like nSR100. In the future, if you turned this protein up a little bit in autistic patients, you might be able to improve some of the behavioural deficits" said Cordes.

http://bit.ly/2hwyOJt

Avoiding over-the-counter heartburn meds could save cancer patients' lives

Medications for heartburn and gastric issues could lower possibility of survival and recovery for cancer patients

Something as seemingly harmless as a heartburn pill could lead cancer patients to take a turn for the worse. A University of Alberta study published in journal JAMA Oncology discovered that proton pump inhibitors (PPIs), which are very common medications for heartburn and gastrointestinal bleeding, decrease effects of capecitabine, a type of chemotherapy usually prescribed to gastric cancer patients.

The study by Department of Oncology's Michael Sawyer, Michael Chu and their team included more than 500 patients and the results were conclusive: PPIs affected progression-free survival by more than a month; the overall survival in cancer patients was reduced by more than two months, and the disease control rate decreased by 11 per cent.

Although this research was focused on gastric cancer patients, Sawyer's team has followed up with another study in early stage colorectal cancer and discovered that those who took PPIs and capecitabine were also at risk for decreased cancer treatment efficacy. In that study, patients who took PPIs while on capecitabine had a decreased chance of being cured of their colorectal cancer.

PPIs are very popular for their efficacy and many of them are over-the-counter drugs (some common brands are Nexium, Prevacid and Protonix).

Sawyer explains the risk of this interaction is high as some cancer patients may not even have these medications prescribed by a physician, but could obtain them easily over-the-counter at a pharmacy and accidentally alter their chemotherapy treatment without knowing it: "This could be a very common and underappreciated side effect. One study estimated that at 20 per cent of cancer patients in general take proton pump inhibitors."

The explanation for the negative outcome may be in gastric pH levels. Previous studies had been done on the interaction of this type of chemo with the antacid medication Maalox, without obtaining any alarming results; but unlike Maalox, PPI's are able to raise pH to a point where they could affect disintegration of capecitabine tablets. "Given that PPIs are much more potent and can essentially abolish gastric acidity there may be a significant interaction between capecitabine and PPIs," says Sawyer.

Sawyer, a clinical pharmacologist and medical oncologist and member of the U of A's Faculty of Medicine & Dentistry since 2001, is currently conducting more research on this topic to unveil more about the interaction of chemotherapy with other medications.

This discovery may lead to change the usual procedures for prescription of PPIs. Some cancer patients cannot discontinue these medications in order to treat bleedings or other gastric conditions that must be kept under control. "In that case, there are alternatives for oncologists or family doctors that become aware of this risk," says Sawyer.

"Physicians should use caution in prescribing PPIs to patients on capecitabine and, if they must use PPIs due to gastrointestinal bleeding issues, maybe they should consider using other types of chemotherapy that don't present this interaction."

http://bit.ly/2hUI775

Earth's Biggest Diamonds May Form in Strange 'Metal Pools'

The world's largest, most valuable diamonds may be born in pockets of liquid metal located deep within the Earth, a new study finds.

By Charles Q. Choi, Live Science Contributor | December 15, 2016

Examples of rough CLIPPIR diamonds from the Letseng mine in Lesotho. **GIA copyright, credit Robert Weldon and Gem Diamonds Ltd.**

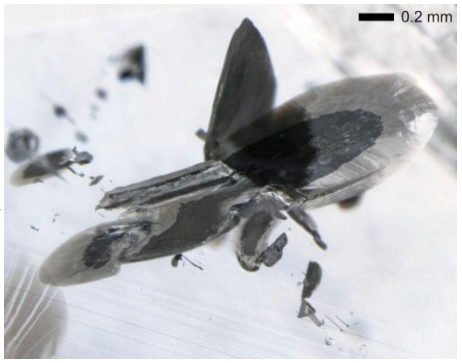
This discovery suggests that pockets of liquid metal peppered throughout Earth's mantle layer, between the planet's crust and core, may play a key role in how carbon and other elements key to life cycle between the Earth's interior and the planet's surface, the researchers said.

In general, diamonds form deep in the hot rock of Earth's mantle, rising to the surface with volcanic eruptions. The biggest gem-quality diamond found to date is the Cullinan diamond, which was unearthed in South Africa in 1905. The 3,106.75-carat diamond, which was later cut up into several polished pieces, originally weighed 1.37 lbs. (621.35 grams), and was about 3.86 inches (9.8 centimeters) long.

Previous research found that the world's largest gem-quality diamonds stand out from smaller jewels not just in size, but also in composition and structure.

"They have very few inclusions trapped inside them - that is, material that isn't diamond," said study lead author Evan Smith, a geologist at the Gemological Institute of America in New York. "They are also relatively pure, which means most of these diamonds are made just of carbon atoms, unlike a lot of other diamonds, which contain nitrogen atoms here and there substituting for their carbon atoms."

In addition, when the biggest diamonds are in their rough, unpolished state, "they're irregular in shape, like a lollipop that's been in someone's mouth for a while, instead of the nice, symmetrical crystals one often thinks of with diamonds," Smith told Live Science.



A close-up view of a metallic inclusion in a CLIPPIR diamond. The inclusion is reflective/silver in appearance, surrounded by a black, graphite-bearing decompression crack. **Evan Smith**

These differences led scientists to speculate that large diamonds might form in different ways from smaller, more common diamonds. However, the world's biggest gem-quality diamonds "are worth so much money that it's very difficult to get access to them for research," Smith said. This has stymied studies that might solve the mystery of these large gems' origins, he explained.

Now, Smith and his colleagues have analyzed 42 finished specimens of such jewels that were each loaned to the researchers for a few hours at a time. In addition, the scientists examined two unfinished samples and nine so-called "offcuts," the pieces left over after a jewel's facets are cut and polished for maximum sparkle.

The researchers detected tiny metallic grains trapped inside these samples. The inclusions consisted of solidified mixtures of iron, nickel, carbon and sulfur, a combination never seen in common diamonds, said study co-author Steven Shirey, a geochemist at the Carnegie Institution for Science in Washington, D.C. The scientists also detected traces of methane and hydrogen in the thin spaces between these inclusions and the encasing diamond.

The metallic grains are evidence that massive diamonds likely have unusual origins, the researchers said. The chemistry of these metal inclusions suggests that large diamonds crystallize from pockets of metallic liquid. In contrast, other diamonds likely grow from a chemical soup loaded with carbon, oxygen and hydrogen, Smith said.

A number of the samples the researchers examined also possessed silicon-bearing mineral inclusions that form at the high pressures

found at extreme depths, the scientists said. Researchers estimated that large diamonds are "superdeep" gems that likely form at depths of about 254 to 410 miles (410 to 660 kilometers). In comparison, previous research suggested that most other gem diamonds form at depths of just 93 to 124 miles (150 to 200 km).

These findings provide direct evidence of long-suspected, theoretically predicted chemical reactions in Earth's mantle that create pockets of metallic iron-nickel alloy, Smith said. Most of the iron and nickel in Earth's mantle, in contrast, is usually bound to oxygen or another chemical, he explained.

Although large diamonds and more common diamonds are sometimes found together, that does not mean they formed together, Shirey told Live Science. Instead, the same magma that flows upward to bring large diamonds to the surface can also drag up smaller diamonds that formed at shallower depths, he said.

These findings should not be taken to suggest "that there is an ocean of liquid metal deep in the Earth's mantle," Smith said. The liquid metal likely comes only in pockets "limited to perhaps fist-sized, if I were to guess, that are peppered throughout the mantle," he added.

"There's not a lot of this metallic iron — just about 1 percent or so of the mantle," Smith said. "Still, it changes the way we have to think about the deeper Earth, because elements like carbon dissolve well in metallic iron. This means the presence of this metal can impact the cycling of carbon, nitrogen and hydrogen from the deep Earth to the surface, from the Earth's mantle to where we live."

Future research could investigate what other elements are in these large diamonds or their offcuts, and what isotopes are included, Smith said.

"That might help shed light on the origin of this metal. Where does it come from, how does it form, what lifetime does it have, what processes does it participate in," he said.

The scientists detailed their findings online today (Dec. 15) in the journal Science.

http://bit.ly/2hI3yp6

Solar System's Biggest Asteroid Is an Ancient Ocean World

NASA spacecraft finds that Ceres is full of water

By Alexandra Witze on December 16, 2016

Asteroids might look dry and barren, but the Solar System's biggest asteroid - Ceres - is chock full of water, NASA's Dawn spacecraft has found.

"It's just oozing," says Thomas Prettyman, a nuclear engineer at the Planetary Science Institute in Tucson, Arizona. He led the team that built the neutron-counting instrument aboard Dawn, which reported its findings on 15 December in *Science*[1].

Today, the water is either frozen as ice, filling pore spaces deep inside Ceres, or locked inside hydrated minerals at the surface. But billions of years ago, early in Ceres's history, heat left over from the Solar System's formation probably kept the asteroid warm inside. This allowed the water to churn and flow, helping to separate Ceres into layers of rock and ice.

"We know the water and the rock have separated and interacted over time," said Carol Raymond, a planetary scientist at NASA's Jet Propulsion Laboratory in Pasadena, California, at a meeting of the American Geophysical Union in San Francisco on 15 December.

The discovery adds to a growing awareness of Ceres as an active, wet world that pushes the boundary of what it means to be a planet. Today it sports a 4-kilometer-high ice volcano and bright spots of salt mixed with ice and rock.

At 940 kilometers across, Ceres is so big that it contains roughly one-third of all the mass in the asteroid belt — and it is technically both an asteroid and a dwarf planet. Researchers knew that Ceres was rich in water on the basis of its estimated density, by studying light reflecting off the hydrated minerals on its surface and because they spotted water apparently steaming from it. But they did not know exactly how much water was there until Dawn showed up in March 2015.

Hydrogen highs and lows

The spacecraft studies chemical elements by counting the gamma-rays and neutrons reflecting off Ceres as cosmic rays bombard it. Prettyman's team generated a map of the asteroid's hydrogen, which appears in water ice and hydrated minerals.

Hydrogen levels were richest in the middle to high latitudes, with the greatest concentrations — up to 30% water — present at the north pole. Around the equator, frozen water has probably sublimated into space and dried out Ceres's surface, Prettyman says. An astronaut there would have to dig down about 1 meter to find frozen water, whereas at the north pole, a visitor "would just swipe and find the ice table", he says.

Ceres's dampness stands in stark contrast to Vesta, a much drier asteroid visited by Dawn in 2011–12. On average, Ceres is more than 100 times richer in hydrogen than Vesta, Prettyman says.

A second paper, appearing on 15 December in *Nature Astronomy*, shows where other frozen water might lie[2]. A team led by Thomas Platz of the Max Planck Institute for Solar System Research in Göttingen, Germany, studied 634 craters on Ceres that are always in the dark. Ten of those have bright areas on the crater floor, and spectral studies of one of them found that it consisted of water ice.

Similarly to the Moon and Mercury, the airless Ceres apparently manages to trap frozen water in dark areas on its surface, the team says.

http://bit.ly/2i2KnoY

Internet use in class tied to lower test scores

Warning: Surfing the internet in class is now linked to poorer test scores, even among the most intelligent and motivated of students.

EAST LANSING, Mich. - Michigan State University researchers studied laptop use in an introductory psychology course and found the average time spent browsing the web for non-class-related purposes was 37 minutes. Students spent the most time on social media, reading email, shopping for items such as clothes and watching videos.

And their academic performance suffered. Internet use was a significant predictor of students' final exam score even when their intelligence and motivation were taken into account, said Susan Ravizza, associate professor of psychology and lead author of the study. "The detrimental relationship associated with non-academic internet use," Ravizza said, "raises questions about the policy of encouraging students to bring their laptops to class when they are unnecessary for class use."

Funded by the National Science Foundation, the findings will be published online soon in the journal Psychological Science. The article is titled "Logged in and zoned out: How laptop internet use impacts classroom learning."

The research was conducted in a one-hour, 50-minute lecture course with 507 students taught by Kimberly Fenn, MSU associate professor of psychology and study co-author. In all, 127 students agreed to participate in the study, which involved logging onto a proxy server when the students went online. Of those participants, 83 checked into the proxy server in more than half of the 15 course sessions during the semester and were included in the final analysis.

Intelligence was measured by ACT scores. Motivation to succeed in class was measured by an online survey sent to each participant when the semester was over.

Interestingly, using the internet for class purposes did not help students' test scores. But Ravizza said she wasn't surprised. "There were no internet-based assignments in this course, which means that most of the 'academic use' was downloading lecture slides in order to follow along or take notes."

Previous research, she added, has shown that taking notes on a laptop is not as beneficial for learning as writing notes by hand. "Once students crack their laptop open, it is probably tempting to do other sorts of internet-based tasks that are not class-relevant."

In her courses, Ravizza said she has stopped posting lecture slides before class. Instead, she waits until the week before the exam to

upload them so there is no reason for students to bring a laptop to class.

"I now ask students to sit in the back if they want to bring their laptop to class so their internet use is not distracting other students," she said.

http://bit.ly/2qOvKVq

Frequent sauna bathing protects men against dementia

Frequent sauna bathing can reduce the risk of dementia, according to a recent study carried out at the University of Eastern Finland.

In a 20-year follow-up, men taking a sauna 4-7 times a week were 66% less likely to be diagnosed with dementia than those taking a sauna once a week. The association between sauna bathing and dementia risk has not been previously investigated.

The effects of sauna bathing on the risk of Alzheimer's disease and other forms of dementia were studied in the Kuopio Ischaemic Heart Disease Risk Factor Study (KIHD), involving more than 2,000 middle-aged men living in the eastern part of Finland. Based on their sauna-bathing habits, the study participants were divided into three groups: those taking a sauna once a week, those taking a sauna 2-3 times a week, and those taking a sauna 4-7 times a week.

The more frequently saunas were taken, the lower was the risk of dementia. Among those taking a sauna 4-7 times a week, the risk of any form of dementia was 66% lower and the risk of Alzheimer's disease 65% lower than among those taking a sauna just once a week. The findings were published recently in the Age and Ageing journal.

Previous results from the KIHD study have shown that frequent sauna bathing also significantly reduces the risk of sudden cardiac death, the risk of death due to coronary artery disease and other cardiac events, as well as overall mortality. According to Professor Jari Laukkanen, the study leader, sauna bathing may protect both the heart and memory to some extent via similar, still poorly known mechanisms. "However, it is known that cardiovascular health affects the brain as well. The sense of well-being and relaxation experienced during sauna bathing may also play a role."

http://bit.ly/2hIjPKy

World's smallest radio receiver has building blocks the size of 2 atoms

Radio is made from atomic-scale defects in diamond

Researchers from the Harvard John A. Paulson School of Engineering and Applied Sciences have made the world's smallest radio receiver - built out of an assembly of atomic-scale defects in pink diamonds.

This tiny radio -- whose building blocks are the size of two atoms -- can withstand extremely harsh environments and is biocompatible, meaning it could work anywhere from a probe on Venus to a pacemaker in a human heart.

The research was led by Marko Loncar, the Tiantsai Lin Professor of Electrical Engineering at SEAS, and his graduate student Linbo Shao and published in Physical Review Applied.

The radio uses tiny imperfections in diamonds called nitrogen-vacancy (NV) centers. To make NV centers, researchers replace one carbon atom in a diamond crystal with a nitrogen atom and remove a neighboring atom -- creating a system that is essentially a nitrogen atom with a hole next to it. NV centers can be used to emit single photons or detect very weak magnetic fields. They have photoluminescent properties, meaning they can convert information into light, making them powerful and promising systems for quantum computing, phontonics and sensing.

Radios have five basic components -- a power source, a receiver, a transducer to convert the high-frequency electromagnetic signal in the air to a low-frequency current, speaker or headphones to convert the current to sound and a tuner.

In the Harvard device, electrons in diamond NV centers are powered, or pumped, by green light emitted from a laser. These electrons are sensitive to electromagnetic fields, including the waves used in FM radio, for example. When NV center receives radio waves it converts them and emits the audio signal as red light. A common photodiode

converts that light into a current, which is then converted to sound through a simple speaker or headphone.

An electromagnet creates a strong magnetic field around the diamond, which can be used to change the radio station, tuning the receiving frequency of the NV centers.

Shao and Loncar used billions of NV centers in order to boost the signal, but the radio works with a single NV center, emitting one photon at a time, rather than a stream of light.

The radio is extremely resilient, thanks to the inherent strength of diamond. The team successfully played music at 350 degrees Celsius -- about 660 Fahrenheit.

"Diamonds have these unique properties," said Loncar. "This radio would be able to operate in space, in harsh environments and even the human body, as diamonds are biocompatible."

This research was coauthored by Mian Zhang, Matthew Markham and Andrew M. Edmonds. It was supported in part by the STC Center for Integrated Quantum Materials.

http://bbc.in/2hwVHq4

Six pharmaceutical firms accused of price-fixing

US authorities have accused six pharmaceutical firms from the US, India and Australia of price-fixing.

It is alleged the companies conspired to raise the price of the antibiotic doxycycline and diabetes drug glyburide. The civil lawsuit has been filed in 20 US states. It follows criminal charges being brought against former executives at one of the accused firms.

'Tip of the iceberg'

US drugmakers Mylan, Heritage Pharmaceuticals, Teva Pharmaceutical USA and Citron Pharma are named in the lawsuit alongside India's Aurobindo Pharma and Australia's Mayne Pharmaceuticals. Mylan, Teva and Aurobindo have denied the allegations.

Heritage has been accused of being the "principal architect" of the case. On Wednesday the US Department of Justice charged two former executives with price-fixing. Heritage said it was co-operating fully with the probe and had filed its own civil complaint against the pair.

Australia's Mayne confirmed it was among the companies named in the case brought by anti-trust investigators. Its shares plunged 22% on the news, and while it did not comment on the allegations, it said the probe and legal proceedings would "not have a material impact on its future earnings". "No assurance can be given as to the timing or outcome of the investigation or legal proceedings," a spokesperson added.

Citron Pharma is yet to comment.

The civil case follows a two-year investigation started by the office of Connecticut's Attorney General George Jepsen - and alleges that firms conspired over steak dinners and "girls nights out." Mr Jepsen told Reuters that lawsuit was just "the tip of the iceberg", saying price fixing in the generic industry was "widespread and pervasive", involving "many other drugs and a number of other companies."

One Democrat Senator claims the price of 500 doxycycline tablets rose in the US from $20 to $1,849 in just seven months.

http://bit.ly/2hI9j8S

'Nightmare' Superbug May Have Spread Outside Hospitals

Six people in Colorado recently became infected with a "nightmare" superbug that until now, has mostly been limited to people in hospitals, according to a new report.

By Rachael Rettner, Senior Writer | December 16, 2016 05:51pm ET

The new cases suggest the superbug may have spread outside of health care facilities.

The superbug is known as carbapenem-resistant Enterobacteriaceae, or CRE, a family of bacteria that are difficult to treat because they are resistant to powerful antibiotics. So far, nearly all cases of CRE infections have been seen in people who stay health care facilities, or who have been treated with certain medical procedures or devices, according to the Centers for Disease Control and Prevention (CDC).

But the six people in the new report had not stayed in a health care facility for at least a year before they contracted the infection. They had not recently undergone surgery or dialysis, either, and hadn't received any invasive devices, such as having a catheter or feeding tube inserted — all of which can be risk factors for CRE infections, the report said.

Thus, the six cases appear to be "community-associated" CRE infections, meaning the patients may have picked up these bacteria from somewhere in their everyday lives, outside of a health care setting.

CRE infections outside of a health care setting are "unusual for these bacteria," said study researcher Sarah Janelle, a health care-associated infections epidemiologist at the Colorado Department of Public Health and Environment. These six cases suggest that "these bacteria might be moving from health care to community settings," Janelle told Live Science. "Further surveillance of CRE is needed to determine whether this pattern continues in Colorado and to determine if this trend is occurring in other parts of the United States," Janelle said.

CRE have been dubbed "nightmare" bacteria because they are resistant to nearly all antibiotics, and they can be highly lethal, killing up to 50 percent of infected patients, according to the CDC.

The type of bacteria that cause CRE infections can be found in human guts, where the bugs are usually harmless. But infections can arise if the bacteria enter another part of the body, such as the bloodstream, Janelle said. What makes CRE unique is that these bacteria have acquired the ability to produce enzymes that work against most antibiotics.

In the new report, the six patients ranged in age from 20 to 85, with an average age of 61. All of the patients had been diagnosed with urinary tract infections. (CRE can also cause pneumonia and blood infections.) The cases were identified from 2014 to 2016, and all of the patients survived.

All of the patients were infected with a type of CRE that produces an enzyme called New Delhi metallo-beta-lactamase. The enzyme makes the bacteria resistant to certain antibiotics, including the powerful carbapenem class of antibiotics. This type of CRE is not very common in the United States, but some people have become infected when they received health care abroad.

Of the six patients in the new report, two had traveled internationally shortly before their diagnoses, one to an unknown country in Africa and one to the Bahamas, the report said.

Two of the patients had underlying medical conditions, another risk factor for CRE, but three patients had no such conditions. One patient was pregnant at the time she tested positive for CRE. Being pregnant is known to suppress the body's immune system, which can increase the risk of infection.

In addition, one patient who had an underlying medical condition reported having provided care for a family member at several different health care facilities before testing positive for CRE, the report said.

Another risk factor for CRE infection is taking antibiotics. Studies have shown that when a person's normal gut bacteria community is disturbed (which happens when antibiotics are used), it puts that individual at risk for becoming sick with "bad" bacteria, including CRE. In addition, use of antibiotics increases the likelihood that bacteria will develop resistance to the drugs, either through a mutation or by acquiring genes from other bacteria.

"Any time antibiotics are used, this puts biological pressure on bacteria that promotes the development of resistance," Janelle said.

Of the six patients, two had taken antibiotics within the month before they tested positive for CRE and one had taken antibiotics 10 months prior to testing positive.

The findings point to the importance of prescribing antibiotics appropriately, Janelle said. Studies have shown that doctors sometimes prescribe antibiotics when the medicines aren't needed

(such as when patients have a viral infection that can't be treated with antibiotics).

"Proper use of antibiotics can slow the development of resistance in bacteria and can preserve this life-saving resource," Janelle said.

The six cases do not appear to be connected, and the source of these CRE infections remains unknown, the report said.

To prevent CRE and other infection, members of the general public can wash their hands frequently and take antibiotics only when they are prescribed, Janelle said. Patients should also expect their health care providers to wash their hands or use hand sanitizer before touching patients, the CDC said. If the health care provider doesn't do this, patients should ask them to do so, the agency said.