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New analyses of Martian chemical maps suggest water bound to sulfates in soil

Spatial association between sulfur and hydrogen found in martian soil A research team led by LSU Geology and Geophysics Assistant Professor Suniti Karunatillake reveals a spatial association between the presence of sulfur and hydrogen found in martian soil.

The work by this multi-institutional team of researchers from Georgia Tech (James Wray), Stony Brook University (Scott McLennan and Deanne Rogers), CNRS/ Université Fédérale Toulouse Midi-Pyrénées (Olivier Gasnault), Cornell University (Steve Squyres), and University of Arizona (William Boynton) may in turn identify hydrous iron sulfates as key carriers of H2O in bulk martian soil. The gamma spectral signature of hydrogen serves as a possible indicator of water, a primary driver of weathering and life processes on Earth. The analyzed elemental data from the Gamma Ray Spectrometer onboard the Mars Odyssey orbiter was published in Geophysical Research Letters on Nov. 22, 2014 (doi: 10.1002/2014GL061136).

The study indicates that within the southern latitudes of Mars, sulfur compounds are a key hydrated phase. This is revealed in part by water-to-sulfur molar ratios that fall within expected ranges corresponding to hydrated sulfate compounds. Reinforcing the data, hydrogen and sulfur correlate compellingly in the southern latitudes. The molar ratios were observed over 80 percent of Mars' southern hemisphere.

Consequently, sulfate compounds, acting as primary contributors of H2O, may also influence modern water-driven processes on Mars.

"Sulfur variation plays an important role as a control on inferred fluid pH, alteration environments, and water activity while the variation in hydration state reinforces the compelling possibility of H2O bound primarily in sulfates in the southern hemisphere," Karunatillake said.

"This applies specifically to bulk soil at decimeter depths, including the possibility that geochemical processes of iron sulfate-rich Paso Robles soil in Gusev Crater may have been more common at regional scales in ancient martian terrain than previously appreciated."

The team suggests that further observations by the Curiosity rover in Gale Crater could move forward models of aqueous processes on Mars. For example, recent analyses of "Rocknest" soil samples suggest complementary modes of soil hydration in the Gale Crater area.

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'Imaginary meal' tricks the body into losing weight Salk scientists made a more effective diet pill

LA JOLLA - Salk researchers have developed an entirely new type of pill that tricks the body into thinking it has consumed calories, causing it to burn fat. The compound effectively stopped weight gain, lowered cholesterol, controlled blood sugar and minimized inflammation in mice, making it an excellent candidate for a rapid transition into human clinical trials.

Unlike most diet pills on the market, this new pill, called fexaramine, doesn't dissolve into the blood like appetite suppressants or caffeine-based diet drugs, but remains in the intestines, causing fewer side effects.

"This pill is like an imaginary meal," says Ronald Evans, director of Salk's Gene Expression Laboratory and senior author of the new paper, published January 5, 2014 in Nature Medicine.

"It sends out the same signals that normally happen when you eat a lot of food, so the body starts clearing out space to store it. But there are no calories and no change in appetite."

In the United States, more than a third of adults are obese and 29.1 million people have diabetes, according to the Centers for Disease Control and Prevention. Both obesity and diabetes lead to an increase in health spending, a greater risk of health complications and a shorter lifespan.

Evans' laboratory has spent nearly two decades studying the farensoid X receptor (FXR), a protein that plays a role in how the body releases bile acids from the liver, digests food and stores fats and sugars.

The human body turns on FXR at the beginning of a meal, Evans and others have shown, to prepare for an influx of food. FXR not only triggers the release of bile acids for digestion, but also changes blood sugar levels and causes the body to burn some fats in preparation for the incoming meal.

Pharmaceutical companies aiming to treat obesity, diabetes, liver disease and other metabolic conditions have developed systemic drugs that activate FXR, turning on many pathways that FXR controls.

But these drugs affect several organs and come with side effects. Evans wondered whether switching on FXR only in the intestines - rather than the intestines, liver, kidneys and adrenal glands all at once - might have a different outcome.

"When you eat, you have to quickly activate a series of responses all throughout the body," says Evans. "And the reality is that the very first responder for all this is the intestine."

Evans and his colleagues developed the fexaramine compound by departing from the drug scaffold that most pharmaceutical companies typically pursue when 2 1/12/15

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targeting FXR. "It turns out that when we administer this orally, it only acts in the gut," explains Michael Downes, a senior staff scientist at Salk and co-corresponding author of the new work.

Giving one such drug in a daily pill form that only reaches the intestines - without transporting into the bloodstream that would carry the drug throughout the body - not only curtails side effects but also made the compound better at stopping weight gain.

When the group gave obese mice a daily pill of fexaramine for five weeks, the mice stopped gaining weight, lost fat and had lower blood sugar and cholesterol levels than untreated mice.

In addition, the mice had a rise in body temperature - which signals metabolism ramping up - and some deposits of white fat in their bodies converted into a healthier, energy-burning beige form of the tissue. Even the collection of bacteria in the guts of mice shifted when they received the drug, although what those changes mean isn't clear yet.

So, why does fexaramine in the intestines work even better than drugs that simultaneously activate FXR throughout the body? Evans thinks it has to do with the natural order in which the body's molecular pathways normally responds to a meal.

"The body's response to a meal is like a relay race, and if you tell all the runners to go at the same time, you'll never pass the baton," says Evans. "We've learned how to trigger the first runner so that the rest of the events happen in a natural order." Since fexaramine doesn't reach the bloodstream, it is also likely safer in humans than other FXR-targeting drugs, the researchers hypothesize.

They're already working to set up human clinical trials to test the effectiveness of fexaramine to treat obesity and metabolic disease. Ideally the drug, administered under a doctor's guidance, would work in conjunction with diet and lifestyle changes, similar to weight-loss surgeries or other obesity or diabetes drugs. *Other researchers on the study were Sungsoon Fang, Jae Myoung Suh, Elizabeth Yu, Eiji Yoshihara, Sandra Jacinto, Yelizaveta Lukasheva, Annette Atkins and Ruth Yu of the Salk Institute; Shannon Reilly and Alan Saltiel of the University of Michigan; Olivia Osborn, Denise Lackey, Bernd Schnabl, David Brenner and Jerrold Olefsky of the University of California, San Diego; Alessia Perino and Kristina Schoonjans of the École Polytechnique Fédérale de Lausanne; Alexander Khvat of ChemDiv; and Sally Coulter and Christopher Liddle of the University of Sydney.*

The work was supported by grants from the National Institutes of Health, Glenn Foundation for Medical Research, Leona M. and Harry B. Helmsley Charitable Trust, Ipsen Bioscience, California Institute for Regenerative Medicine, the Ellison Medical Foundation and the National Health and Medical Research Council of Australia. Ronald Evans also receives funding from the Howard Hughes Medical Institute.

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Hold your breath to protect your heart A simple technique may be most effective in preventing heart disease after radiation therapy for breast cancer

PHILADELPHIA - Women who have breast cancer on their left side present a particular challenge to radiation oncologists. Studies have shown that the risk of heart disease is higher in this group of women after radiation treatment because it can be difficult to ensure that a sufficient dose of radiation is delivered to the left breast while adequately shielding the heart from exposure. New research shows a woman who holds her breath during radiation pulses can greatly reduce radiation exposure to the heart.

"Radiation therapy is commonly prescribed to patients with breast cancer following surgery as a component of first-line therapy," said first author Harriet Eldredge-Hindy, M.D., a Chief Resident and researcher in the Department of Radiation Oncology at Thomas Jefferson University "We wanted to determine how effective breath-hold could be in shielding the heart from extraneous radiation exposure during treatment of the left breast."

Recent studies have shown women with cancer in the left breast are at higher risk of heart disease, and that the risk increases proportionately with the dose of radiation the heart is exposed to during treatment. A number of techniques have been developed to reduce exposure to the heart including prone positioning (lying flat on the belly on a bed that only exposes the left breast), intensity-modulated radiation therapy (IMRT), and accelerated partial breast irradiation. The breathhold technique allows doctors to monitor a patient's breath for the position that shifts the heart out of the range of the radiation beam.

In the largest prospective study to date, following women for 8 years post treatment, 81 women were asked to hold their breath during radiation treatment for breast cancer- a process that was repeated until therapeutic dose was reached. The researchers found that patients capable of holding their breath over the course of treatment had a 90 percent disease-free survival, and a 96 percent overall survival, with a median reduction in radiation dose to the heart of 62 percent. The findings were published online this week in the journal Practical Radiation Oncology.

"Given that this technique helps to shield the heart during radiation treatment for breast cancer," said Rani Anne, M.D., Associate Professor of Radiation Oncology at Thomas Jefferson University and senior author on the study, "we routinely offer breast cancer treatment with the breath hold technique at Jefferson."

Additional work recently presented at the 2014 American Society for Radiation Oncology in San Francisco carried the work further in order to determine whether protection from the

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	v	act translated to a reduction in is		http://www.eurekalert.org/pub_releases/2015-01/foas-etc010515.php
		riet Eldredge-Hindy, M.D., show		Exposure to cold reveals the 'switch' that controls the formation
		uced risk of ischemic heart diseas		of brown and white fat
		d their breath during radiation th e after 8 years of follow up and an		New research in the FASEB Journal uncovers metabolic flexibility: 30 percent
after 10 yea		a uner 8 years of follow up and an	estimated rate of 5.0 percent	of cells that appear to be white fat cells rapidly turn into brown fat cells after
•		alert.org/pub releases/2015-	01/cn-th123014 nhn	cold stress
		le lives over 200 years.		The roles that white fat and brown fat play in metabolism is well documented, but
		•	Can its genes ten us	new research published in the January 2015 issue of the FASEB Journal presents
4 1 1		why?		a new wrinkle: each type of fat may change into the other, depending on the
		er 200 years with little evide		temperature. In particular, cold temperatures may encourage "unhealthy" white fat
		ed insights into how to live a		to change into "healthy" brown fat.
	-	he Cell Press journal Cell Rej		"Fat cells can adopt a range of metabolic phenotypes, depending on physiological
-		ale genome and identify key	differences compared to	conditions and location in the body," said James G. Granneman, Ph.D., a
other man		1, 1, 11, 11, 11, 11, 11, 11, 11, 11, 1		researcher involved in the work from the Center for Integrative Metabolic and
	-	enes related to cell division, I	-	Endocrine Research at the Wayne State University School of Medicine in Detroit,
		crease its longevity and cance		MI. "Our long-term goal is to harness this cellular and metabolic flexibility for the
		ecies' differences in longevity		treatment of metabolic disorders linked to dysfunctional fat, such as type 2
		ndidate genes for future studi	-	diabetes."
		, of the University of Liverpo		Scientists used techniques that allowed them to tag specific cell populations
		evolved different 'tricks' to ha		(undifferentiated progenitors or differentiated adipocytes) in mice before exposure
	-	ed by the bowhead we may be		to cold. Mice were then exposed to mild cold stress, and researchers traced
-		er to fight age-related disease		whether these cells became brown adipocytes in various adipose tissues in the
-		ver 1000 times more cells tha cancer, suggesting the exister		body. Results suggested that in classic brown adipose tissue, tagged progenitors
		nore effectively than those of		divide and become new brown adipocytes. This process required neural activation
	* *	m would next like to breed m		of the tissue and was mediated by a specific receptor subtype. In contrast, the vast
-		with the hopes of determining	-	majority of brown adipocytes that appear in white adipose tissue were tagged
	-	esistance to diseases.	the importance of different	previously with a marker of mature fat cells. The study indicated that about 30
-		se the bowhead's genome is the	he first among large whales	percent of cells that appear to be white adipocytes before cold stress can rapidly
•		information may help reveal	00	turn on the brown adipocyte program following cold stress.
related to		internation may help reveal	physiological adaptations	"If you want to rev up your metabolism, don't throw out your winter coat just yet,"
		have a much lower metabolic	rate than those of smaller	said Gerald Weissmann, M.D., Editor-in-Chief of the FASEB Journal. "We still
	. .	hers found changes in one sp		need know if this holds true in humans. What's more, the important part of this
		that may be related to metab	-	research is that one type of fat can change to another, and that cold triggers
cells.		that may be related to metab	one uniterences in whate	cellular mechanisms that lead to the formation of more brown fat. The 'switch'
	esults from their m	roject are freely available to the s	ccientific community through	that controls what type of fat is created may be a promising drug target for a
		bowhead-whale.org/).		variety of obesity-related illnesses."
Cell Report		nsights into the evolution of longe	evity from the bowhead whale	Details: Yun-Hee Lee, Anelia P. Petkova, Anish A. Konkar, and James G. Granneman
genome"				Cellular origins of cold-induced brown adipocytes in adult mice. FASEB J. January 2015
				29:286-299; doi:10.1096/fj.14-263038 ; http://www.fasebj.org/content/29/1/286.abstract

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Human speech's surprising influence on young infants Listening to human speech has consequences for infants that go beyond

learning words

EVANSTON, III. - America's preoccupation with the "word gap" - the idea that parents in impoverished homes speak less to their children, which, in turn, predicts outcomes like school achievement and income later in life - has skyrocketed in recent years, leading to a rise in educational initiatives aiming to narrow the achievement gap by teaching young children more words. In a forthcoming article titled "Listen Up! Speech Is for Thinking During Infancy," to be published in Trends in Cognitive Sciences, Northwestern University psychologist Sandra Waxman and New York University's Athena Vouloumanos broaden the scope of this issue by assessing the impact of human speech on infant cognition in the first year of life.

"It's not because [children] have low vocabularies that they fail to achieve later on That's far too simple," said Waxman, the Louis W. Menk Chair in Psychology, a professor of cognitive psychology and a fellow in the University's Institute for Policy Research. "The vocabulary of a child - raised in poverty or in plenty - is really an index of the larger context in which language participates."

Consequently, Vouloumanos advocates speaking to infants, not only "because it will teach them more words," she said, but because "listening to speech promotes the babies' acquisition of the fundamental cognitive and social psychological capacities that form the foundation for subsequent learning."

In the article, Waxman and Vouloumanos open with a synopsis of classic research on infants' responses to human speech, but then take a step forward, bringing together a series of new findings that reveal that listening to speech promotes much more than language-learning alone.

Specifically, when it comes to noticing patterns or regularities among the sounds or objects that surround them, recognizing partners with whom they can communicate, and establishing coherent categories of objects and events, infants listening to human speech are more successful than their peers listening to other interesting sounds like tone sequences.

"These new results, culled from several different labs including our own, tell us that infants as young as 2 or 3 months of age not only love to listen to speech, but that they learn about fundamental cognitive and social relations better in the context of listening to speech than in any other context we've discovered yet. Nobody would have thought that," Waxman said. "This early tuned sensitivity to human language has positive, cascading developmental consequences that go way beyond learning language," she concluded.

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Super-Earths have long-lasting oceans

New research shows that oceans on super-Earths, once established, can last for billions of years

For life as we know it to develop on other planets, those planets would need liquid water, or oceans. Geologic evidence suggests that Earth's oceans have existed for nearly the entire history of our world. But would that be true of other planets, particularly super-Earths? New research suggests the answer is yes and that oceans on super-Earths, once established, can last for billions of years. "When people consider whether a planet is in the habitable zone, they think about its distance from the star and its temperature. However, they should also think about oceans, and look at super-Earths to find a good sailing or surfing destination," says lead author Laura Schaefer of the Harvard-Smithsonian Center for Astrophysics (CfA). Schaefer presented her findings today in a press conference at a meeting of the American Astronomical Society. Even though water covers 70 percent of Earth's surface, it makes up a very small fraction of the planet's overall bulk. Earth is mostly rock and iron; only about a tenth of a percent is water. "Earth's oceans are a very thin film, like fog on a bathroom mirror," explains study co-author Dimitar Sasselov (CfA). However, Earth's water isn't just on the surface. Studies have shown that Earth's mantle holds several oceans' worth of water that was dragged underground by plate tectonics and subduction of the ocean seafloor. Earth's oceans would disappear due to this process, if it weren't for water returning to the surface via volcanism (mainly at mid-ocean ridges). Earth maintains its oceans through this planet-wide recycling.

Schaefer used computer simulations to see if this recycling process would take place on super-Earths, which are planets up to five times the mass, or 1.5 times the size, of Earth. She also examined the question of how long it would take oceans to form after the planet cooled enough for its crust to solidify.

She found that planets two to four times the mass of Earth are even better at establishing and maintaining oceans than our Earth. The oceans of super-Earths would persist for at least 10 billion years (unless boiled away by an evolving red giant star).

Interestingly, the largest planet that was studied, five times the mass of Earth, took a while to get going. Its oceans didn't develop for about a billion years, due to a thicker crust and lithosphere that delayed the start of volcanic outgassing.

"This suggests that if you want to look for life, you should look at older super-Earths," Schaefer says.

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Sasse	lov agrees. "It ta	akes time to develop the chemical p	rocesses for life on a	The team also noted that not all planets less than six times the mass of Earth are
globa	l scale, and time	e for life to change a planet's atmosp	ohere. So, it takes time for	rocky. Some low-mass worlds with very low densities are known (such as the
life to	become detecta	able." This also suggests that, assum	ning evolution takes place	planets in the Kepler-11 system). But for typical close-in small planets, the
		rth's, you want to search for comple		chances are high that they share an Earth-like composition.
about	five and a half l	billion years old, a billion years old	er than Earth.	"To find a truly Earth-like world, we should focus on planets less than 1.6 times
	http://www.euro	ekalert.org/pub_releases/2015-01/l	<u>hcfa-nir010215.php</u>	the size of Earth, because those are the rocky worlds," recommends Dressing.
	New ins	trument reveals recipe for of	ther Earths	Making Other Earths
	ŀ	How do you make an Earth-like pla	anet?	Makes one small model planet
The "	test kitchen" of	Earth has given us a detailed recipe	, but it wasn't clear	Ingredients:
wheth	er other planeta	ry systems would follow the same f	formula. Now,	1 cup magnesium
astror	nomers have fou	nd evidence that the recipe for Eart	h also applies to	1 cup silicon
terres	trial exoplanets	orbiting distant stars. "Our solar sys	stem is not as unique as	2 cups iron
we m	ight have though	nt," says lead author Courtney Dress	sing of the Harvard-	2 cups oxygen
Smith	sonian Center fo	or Astrophysics (CfA). "It looks lik	e rocky exoplanets use	1/2 teaspoon aluminum 1/2 teaspoon nickel
		ients." Dressing presented the resea		1/2 teaspoon calcium
confe	rence at a meetin	ng of the American Astronomical S	lociety.	1/4 teaspoon sulfur
The k	ey to the discov	ery was the HARPS-North instrum	ent on the 3.6-meter	dash of water delivered by asteroids
Teles	copio Nazionale	Galileo in the Canary Islands. (HA	ARPS stands for High-	Blend well in a large bowl, shape into a round ball with your hands and place it
Accu	racy Radial velo	city Planet Searcher.) It is designed	I to accurately measure	neatly in a habitable zone area around a young star. Do not over mix. Heat until
the m	asses of small, H	Earth-sized worlds. Those measuren	nents are crucial to	mixture becomes a white hot glowing ball. Bake for a few million years. Cool
deterr	nine densities an	nd therefore compositions.		until color changes from white to yellow to red and a golden-brown crust forms. It
"Our	strategy for usin	g HARPS-North over the past year	has been to focus on	should not give off light anymore. Season with a dash of water and organic
plane	ts less than two	times the diameter of Earth and to s	study a few planets really	compounds. It will shrink a bit as steam escapes and clouds and oceans form.
well,"	explains Harva	rd astronomer David Charbonneau	(CfA), who currently	Stand back and wait a few more million years to see what happens. If you are
heads	up the HARPS-	North Science Team. Most recently	y the team targeted	lucky, a thin frosting of life may appear on the surface of your new world.
Keple	er-93b, a planet	1.5 times the size of Earth in a tight	, 4.7-day orbit around its	http://phys.org/news/2015-01-technology-recycle-plastics.html
star. 7	The mass and co	mposition of this world were uncer	tain. HARPS-North	Technology to recycle all type of plastics without using water
nailec	l the mass at 4.0	2 times Earth, meaning that the plan	net has a rocky	New green technology that doesn't require liquids, and has the capacity to
-	osition.			process more than 90 percent of any type of plastic
		compared all ten known exoplanets		Traditionally, plastic recycling processes involve using a lot of water. In order to
		had accurately measured masses. T		avoid this waste, Ak Inovex from Mexico developed a new green technology that
-		s smaller than 1.6 times Earth show	e 1	doesn't require liquids, and has the capacity to process materials such as
		e. Moreover, Venus and Earth fit or		styrofoam, polystyrene and ABS (Acrylonitrile butadiene styrene) using the same
		ese worlds have similar rock-iron co		type of customizable machinery.
	•	more massive exoplanets, their dens		The technology developed by Marco Adame, founder of Ak Inovex, can process
		neaning that they include a large fra-		more than 90 percent of any type of plastic, avoids water waste and reduces
		nd/or helium. They also showed mo	-	production costs by half without reducing the quality of the pellets (small beads of
rather	than fitting into	a single group like the smaller terr	estrial worlds.	recycled plastic) by avoiding stages with severe changes in temperature.

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Marco Adame said that the original process of obtaining recycled beads involves washing and then grinding plastic containers. However, this type of plastic has the Planet was a much warmer and wetter world back then. distinction of being hygroscopic (when it comes in contact with water it retains moisture at a molecular level), so it has to be dehydrated so it can be crystallized; this involves applying heat at 180° C and then cooling the material with water. However, the development of AK Inovex performs this process without water, so it goes directly to the formation of recycled beads. As a result, the energy consumption is reduced by half, plus the physical space required to perform the operation is reduced because the system is smaller. Similarly, the pellets are of better quality, which makes the recycling process more profitable.

"Ak Inovex has a pending patent registration for the three technologies that integrate the development, which are responsible for cooling the plastic through contact with special walls and forming the plastic beads," the founder of the company explained.

The advantage of this technology is its ability to process any type of plastic, such as styrofoam, polystyrene, PET and ABS; the difference lies in the mechanism, because there is a special piece for each type of material. The production capacity of plastic beads is two tons and the team is currently working on increasing it to ten.

For next year, the company wants to change its business strategy and add an ecological washing machine for plastics that uses a special biodetergent, which will reduce the cost of operation even more.

Marco Adame commented that during their participation in the Cleantech Challenge Mexico, a contest to promote the development of green companies, he had contact with the ALINSA group, which is engaged in the manufacture of environmentally friendly cleaning products using biodegradable chemicals. After the competition, the two companies started talking and joined efforts with the aim of integrating the ecological washing machine system using degradable plastic substances in less than 28 days without affecting the environment, hence replacing lye, which is the current substance used for washing the materials.

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Potential Signs of Ancient Life in Mars Rover Photos

A careful study of images taken by the NASA rover Curiosity has revealed intriguing similarities between ancient sedimentary rocks on Mars and structures shaped by microbes on Earth. By Johnny Bontemps - Jan 5, 2015

The findings suggest, but do not prove, that life may have existed earlier on the Red Planet. The photos were taken as Curiosity drove through the Gillespie Lake outcrop in Yellowknife Bay, a dry lakebed that underwent seasonal flooding

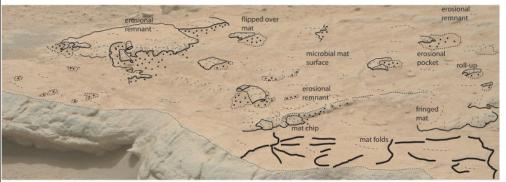
billions of years ago. Mars and Earth shared a similar early history. The Red

On Earth, carpet-like colonies of microbes trap and rearrange sediments shallow bodies of water such as lakes and costal areas, forming distinctive features that fossilize over time. These structures, known as microbiallyinduced sedimentary structures (or MISS), are found in shallow water settings all over the world and in ancient rocks spanning Earth's history.



A rock bed at the Gillespie Lake outcrop on Mars displays potential signs of ancient microbial sedimentary structures. Image credit: NASA

Nora Noffke, a geobiologist at Old Dominion University in Virginia, has spent the past 20 years studying these microbial structures. Last year, she reported the discovery of MISS that are 3.48 billion years old in the Western Australia's Dresser Formation, making them potentially the oldest signs of life on Earth. In a paper published online last month in the journal Astrobiology (the print version comes out this week), Noffke details the striking morphological similarities between Martian sedimentary structures in the Gillespie Lake outcrop (which is at most 3.7 billion years old) and microbial structures on Earth. The distinctive shapes include erosional remnants, pockets, domes, roll-ups, pits, chips and cracks, which on Earth can extend from a few centimeters to many kilometers. Overlay of sketch on photograph from above to assist in the identification of the



structures on the rock bed surface. Image credit: Noffke (2015). Courtesy of ASTROBIOLOGY, published by Mary Ann Liebert, Inc.

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Although Noffke makes a tantalizing case for possible signs of <u>ancient life on</u> <u>Mars</u>, her report is not a definitive proof that these structures were shaped by biology. Getting such confirmation would involve returning rock samples to Earth and conducting additional microscopic analyses, a mission that isn't scheduled anytime in the near future.

"All I can say is, here's my hypothesis and here's all the evidence that I have," Noffke says, "although I do think that this evidence is a lot."

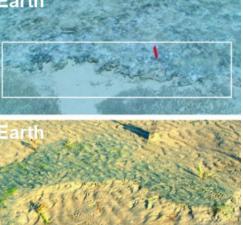
"The fact that she pointed out these structures is a great contribution to the field," says <u>Penelope Boston</u>, a geomicrobiologist at the New Mexico Institute of Mining and Technology. "Along with the recent reports of <u>methane and organics on Mars</u>, her findings add an intriguing piece to the puzzle of a possible history for life on

our neighboring planet."

A Careful Analysis

"I've seen many papers that say 'Look, here's a pile of dirt on Mars, and here's a pile of dirt on Earth," says Chris McKay, a planetary scientist at NASA's Ames Research Center and an associate editor of the journal Astrobiology. "And because they look the same, the same mechanism must have made each pile on the two planets." McKay adds: "That's an easy argument to make, and it's typically not very convincing. However, Noffke's paper is the most carefully done analysis of the sort that I've seen, which is why it's the first of its kind published in Astrobiology." The images on which Noffke drew are publicly available on the Mars Science Laboratory page on NASA's website. "In one image, I saw something that looked very familiar," Noffke recalls.





Potential MISS erosional remnant on Mars (top); edge of a microbial mat-overgrown erosional remnant on Portsmouth Island, USA (middle); erosional remnant of a modern MISS on Mellum Island, Germany (bottom). Image credit for Mars: NASA; Earth: Nora Noffke

"So I took a closer look, meaning I spent several weeks investigating certain images centimeter by centimeter, drawing sketches, and comparing them to data from terrestrial structures. And I've worked on these for 20 years, so I knew what to look for."

Noffke compared the rover pictures to images taken at several sites on Earth, including modern sediment surfaces in Mellum Island, Germany; Portsmouth Island, USA; and Carbla Point, Western Australia; as well as older fossils of microbial mats in Bahar Alouane, Tunisia; the Pongola Supergroup in Africa; and the Dresser Formation in Western Australia.

The photos showed striking morphological similarities between the terrestrial and Martian sedimentary structures.

The distribution patterns of the microbial structures on Earth vary depending on where they are found. Different types of structures are found together in different types of environments. For instance, microbial mats that grow in rivers will create a different set of associations than those that grow in seasonally flooded environments.

The patterns found in the Gillespie Lake outcrop are consistent with the microbial structures found in similar environments on Earth.

What's more, the terrestrial structures change in a specific way over time. As the microbial mats form, grow, dry up, crack and re-grow, specific structures become associated with them. Here again, Noffke found that the distribution pattern in Martian rocks correspond with microbial structures on Earth that have changed over time. Taken together, these clues strengthen her argument beyond simply pointing out the similarities in shape.

In her paper, she also describes alternative processes through which these could have formed. For instance, the chips, pits and cracks could be the product of erosion by salt, water, or wind.

"But if the Martian structures aren't of biological origin," Noffke says, "then the similarities in morphology, but also in distribution patterns with regards to MISS on Earth would be an extraordinary coincidence."

"At this point, all I'd like to do is point out these similarities," she adds. "Further evidence must be provided to verify this hypothesis."

Confirmation Pending

At the end of her report, Noffke outlines a detailed strategy for confirming the potential biological nature of the Martian structures. Unfortunately, one important step - returning samples to Earth for further analyses - is just not feasible yet. Noffke also lists a series of measurements Curiosity could potentially do to strengthen the case if it came across such structures again, including looking for organic or chemical signatures using its <u>Sample Analysis at Mars</u> (SAM) instrument.

Student number





Comparison of cracks in Gillespie Lake outcrop on Mars and in a modern microbial mat in Bahar NASA; Earth image: Nora Noffke

Knob-shaped structures on Mars compared to similar structures caused by erosion of microbial mats at Carbla Alouane, Tunisia. Credits Mars image: Point, Western Australia. Mars Image: NASA; Earth Image: Nora Noffke

But McKay says this likely would not work. "In principle, that instrument could tell us something about the nature of these materials biologically, if there were still large amounts of biological organics in the samples," he explains.

Mars

"But these are just ancient sedimentary structures, and biology has long since left "What's more, in practice this instrument is restricted," he adds.

"There was a contamination spill in the instrument presumably during landing. So it has a very high background contamination level."

On Earth, scientists typically confirm the biological nature of microbial sediment structures by searching for specific microscopic textures, which involves cutting rocks into thin slices and studying them under a microscope.

On Mars, this would be very difficult do from an engineering perspective, although McKay doesn't rule out the possibility for future missions.

"I don't know if it can be done, but engineers are pretty smart," he says. "If you give them a challenge, they usually find a solution."

He adds: "A sample return mission would be the gold standard. But that's just unlikely to happen anytime soon."

- See more at: http://www.astrobio.net/news-exclusive/potential-signs-ancient-life-marsrover-photos/#sthash.WEqkLL68.dpuf

http://bit.lv/1A4rkw0

Volcanic iron delayed explosion of life on Earth Those darned subsea volcanoes messed up our arrival on Earth. 16:35 05 January 2015 by Andy Coghlan

The iron they spewed into the primordial oceans poisoned cyanobacteria that were pumping out an element essential for complex life to take off: oxygen. Eventually the cyanobacteria - microbes with the ability to carry out photosynthesis – would release enough oxygen into the atmosphere to cause what's known as the Great Oxidation Event, approximately 2.5 billion years ago, when oxygen reached levels comparable to those of today. But oxygen-producing cyanobacteria themselves appeared 3 billion years ago, and the long gap between this and the Great Oxidation Event was unexplained.

Iron flooded into the primeval oceans through a multitude of eruptions from undersea volcanoes. Research by Elizabeth Swanner of the University of Tübingen in Germany and her team shows that high levels of iron could have poisoned the cyanobacteria and reacted with the oxygen they generated, locking it away.

They exposed modern-day cyanobacteria to iron at levels matching those in ancient sediments. Iron can be a nutrient for cyanobacteria, but they found that growth rates of the cyanobacteria tumbled at the iron concentrations tested, reducing the volume of oxygen they pumped out by as much as 70 per cent.

Wrong kind of iron

^{*} The form of iron that more easily reacts with oxygen, Fe^{2+} , was much more abundant in the early oceans than it is today. At these concentrations, Fe^{2+} appears to poison cyanobacteria cells, slowing their ability to generate oxygen. "We used the most conservative, lowest estimates of iron concentration to demonstrate that even if Fe^{2+} concentrations were low, the effect of iron toxicity on oxygen production is significant," says Swanner.

"The interesting new possibility that Swanner's team raises is that iron can act as an oxygen inhibitor as well as a nutrient if the concentrations of Fe^{2+} are too high," says geologist Ian Campbell of the Australian National University in Canberra, Australia.

"The toxic effect of iron on oxygen-producing cyanobacteria that this new study reports appears to be a rather solid and fundamental missing clue in the puzzle over the delayed Great Oxidation Event," says Stefan Lalonde of the University of Western Brittany in Brest, France.

Journal reference: Nature Geoscience, DOI: 10.1038/ngeo2327

http://www.bbc.com/news/health-30685732

Common cold 'prefers cold noses'

The virus behind the common cold is much happier in a cold nose, US

researchers suggest.

By James Gallagher Health editor, BBC News website

Their study showed the human immune system was weaker in cooler temperatures, allowing the virus to thrive. The researchers suggested keeping your nose warm and avoiding cold air while infected. The findings were <u>published in Proceedings</u> of the National Academy of Sciences. Rhinoviruses are one of the main groups of virus that leaves our noses streaming and us sneezing.

The team at Yale University tested rhinoviruses at a nose temperature of 33C, and a normal body temperature of 37C. "We've known for 50 years that it replicated better in the nose, but the mechanism has never been clearly defined," researcher Dr Akiko Iwasaki told the BBC. She said the immune system became weaker in a cold nose and gave the virus more opportunities to replicate.

Two important tools - a set of sensors that detect infection and chemicals that coordinate the immune response - were less effective at cooler temperatures.

Dr Iwasaki said: "In general, the lower the temperature, it seems the lower the innate immune response to viruses." She said her findings could help explain why the common cold is more common in the cold months of winter.

But cautioned that it was "much more complicated". Other factors including different human behaviour in winter compared with summer have also been implicated in winter colds. However, Dr Iwasaki did suggest some ways of fighting a cold: "You can always stay in warm tropical weather or try to prevent the nasal cavity experiencing very cold air."

Jonathan Ball, a professor of virology the University of Nottingham, said the findings could explain why rhinoviruses infect the nose rather than warmer parts of the body like the lungs. He told the BBC: "We know the temperature of the cells lining the nose are cooler than other less exposed parts of the body. "This could explain why the rhinovirus causes colds and is less able to cause more serious lung infections, like influenza does."

http://bit.ly/1C2savE

Why Black Widow Spider Venom Is So Potent

The painful bites and lethal venom of black widow spiders have evolved rapidly over the years, according to a new study that also found common house spiders

produce similar toxic compounds. Jan 6, 2015 12:01 AM ET // by Jennifer Viegas

The difference is that female black widows produce ample amounts of highly potent venom to the point that these spiders are even crafting stronger webs to

handle ever-bigger prey. The findings were presented at the 2015 annual

conference of the Society of Integrative and Comparative Biology in West Palm Beach, Fla. The most powerful neurotoxins present in black widow venom are called latrotoxins, which take their name from the group of widow spiders known as Latrodectus. The most toxic of these latrotoxins is alphalatrotoxin that hijacks the poor victim's own nervous system.



Photo: A female black widow spider. Credit: James Gathany, CDC "If you got bitten by a black widow, alpha-latrotoxin would travel to the presynaptic regions of your neurons: this is the juncture right between the synapse of one neuron and your muscle cells or another neuron, and it inserts itself into the membrane," explained Jessica Garb of the University of Massachusetts, Lowell, in a press release. She added, "This causes all of the neuron's vesicles to dump out their neurotransmitters. And that's really what's painful."

Garb and her colleagues determined that latrotoxins are more common in the world of arachnids than previously thought. Many spiders produce the toxins to help with their own hunting, but they make such a watered down version that they're not harmful to most people.

Female black widows, on the other hand, have quickly evolved super concentrated venom that can kill a person. Each year, about 2,200 people report being bitten by a black widow, but most recover within 24 hours with medical treatment. Many people who are bitten develop few symptoms since the spider may not inject its venom. Black widows are actually not very aggressive spiders, so you really have to startle or otherwise threaten one to get a hostile reaction. As for why black widows, in particular, have evolved such potent venom, Garb and her team think it was to expand the spider's diet. Black widows can consume small mammals and reptiles, in addition to more typical smaller prey. As their name suggests, females may also kill their mates, so it seems they are not averse to eating most things.

The researchers also discovered that black widow spider venom contains a cocktail of other toxins that boosts the effectiveness of alpha-latrotoxin. Understanding spider venom could lead to better treatments for bites. Some scientists also believe that the venom holds untapped medical benefits. Research is ongoing, for example, on how latrotoxins and related compounds might hold the keys to treating Alzheimer's, cancer, pain, and even sexual problems.

10 1/12/15 Name Student nu	mber
http://www.eurekalert.org/pub_releases/2015-01/nsfc-hdt010515.php	Fox's team was able to measure that the gas on the side of the bubble closer to
Hubble discovers that Milky Way Core drives wind at 2 million	Earth is moving towards us and the gas on the far side is travelling away. COS
miles per hour	spectra show that the gas is rushing from the galactic center at roughly 2 million
Clouds of gas tower 30,000 light-years above and below the plane of our galaxy	miles an hour, or 3 million kilometers an hour. "This is exactly the signature we
At a time when our earliest human ancestors mastered walking upright the heart	knew we would get if this was a bipolar outflow," explained Rongmon Bordoloi
of our Milky Way galaxy underwent a titanic eruption, driving gases and other	of the Space Telescope Science Institute, a co-author on the science paper. "This
material outward at 2 million miles per hour.	is the closest sightline we have to the Galaxy's center where we can see the bubble
Now, at least 2 million years later, astronomers are witnessing the aftermath of the	being blown outward and energized."
explosion: billowing clouds of gas towering about 30,000 light-years above and	The COS observations also measure the composition of the material being swept
below the plane of our galaxy.	up in the gaseous cloud. COS detected silicon, carbon, and aluminum, indicating
The enormous structure was discovered five years ago as a gamma-ray glow on	that the gas is enriched in the heavy elements produced inside stars and represents
the sky in the direction of the galactic center. Astronomers have since observed	the ancient remnants of star formation. COS measured the temperature of the gas at approximately 17,500 degrees
the balloon-like features in X-rays and radio waves, but needed NASA's Hubble	Fahrenheit, which is much cooler than most of the super-hot gas in the outflow,
Space Telescope to measure for the first time the velocity and composition of the	thought to be at about 18 million degrees Fahrenheit. "We are seeing cooler gas,
mystery lobes. They now seek to calculate the mass of the material being blown	perhaps interstellar gas in our galaxy's disk, being swept up into that hot outflow,"
out of our galaxy, which could help determine the cause of the outburst.	Fox explained.
Although astronomers have seen gaseous streams of charged particles blowing from the cores of other galaxies, this is a unique opportunity for a close-up view	This is the first result in a survey of 20 faraway quasars whose light passes
of our galaxy's own fireworks.	through gas inside or just outside the Fermi Bubbles - like a needle piercing a
"When you look at the centers of other galaxies, the outflows appear much	balloon. An analysis of the full spectrum of the light sample will yield the amount
smaller because the galaxies are farther away," said Andrew Fox of the Space	of mass being ejected. The astronomers can then compare the outflow mass with
Telescope Science Institute in Baltimore, Maryland, lead researcher of the study.	the velocities at various locations in the bubbles to determine the amount of
"But the outflowing clouds we're seeing are only 25,000 light-years away in our	energy needed to drive the outburst and possibly the origin of the explosive event.
galaxy. We have a front-row seat. We can study the details of these structures. We	One possible cause for the outflows is a star-making frenzy near the galactic
can look at how big the bubbles are and can measure how much of the sky they	center that produces supernovas which blow out gas. Another scenario is a star or
are covering."	a group of stars falling onto the Milky Way's super-massive black hole. When that
Fox's results will be published in the Astrophysical Journal Letters and will be	happens, gas superheated by the black hole is ejected deep into space.
presented at the American Astronomical Society meeting in Seattle, Washington.	Because the bubbles are young compared to the age of our galaxy, and believed to
The giant lobes, dubbed Fermi Bubbles, initially were spotted using NASA's	be a short-lived phenomenon, the bubbles may be evidence for a repeating event in the Milky Way's history. Whatever the trigger is, it likely occurs episodically,
Fermi Gamma-ray Space Telescope. The detection of high-energy gamma rays	perhaps only when the black hole gobbles up a concentration of material.
suggested that a violent event in the galaxy's core violently launched energized	"It looks like the outflows are a hiccup," Fox said. "There may have been repeated
gas into space.	ejections of material that have blown up, and we're catching the latest one. By
To provide more information about the outflows, Fox used Hubble's Cosmic	studying the light from the other quasars in our program, we may be able to detect
Origins Spectrograph (COS) to study the ultraviolet light from a distant quasar, a	the ancient remnants of previous outflows."
galaxy with a bright active nucleus, that lies behind the base of the northern bubble. Imprinted on that light as it travels through the lobe is unique information	Galactic winds are common in star-forming galaxies, such as M82, which is
about the velocity, composition, and temperature of the expanding gas inside the	furiously making stars in its core. "It looks like there's a link between the amount
bubble.	of star formation and whether or not these outflows happen," Fox said. "Although

11	1/12/15	Name	Student nu	mber
		l currently produces a moderate or		cancer. But we never knew why. Now that we have that link, we're a step closer to
	•	ration of star formation close to the	e <i>i</i>	shutting down this cycle," Rehemtulla says.
<u>h</u>	<u>ttp://www.eurek</u>	<u>alert.org/pub_releases/2015-01/u</u>	<u>iomh-ruk010515.php</u>	Additional authors: Shyam Nyati, Katrina Schinske-Sebolt, Sethuramasundaram Pitchiaya,
	Research	ers uncover key cancer-pro	moting gene	Katerina Chekhovskiy, Areeb Chator, Nauman Chaudhry, Joseph Dosch, Marcian E. Van
		helps explain major paradox of c		Dort, Sooryanarayana Varambally, Chandan Kumar-Sinha, Mukesh Kumar Nyati, Dipankar Ray, Nils G. Walter, Hongtao Yu, Brian Dale Ross
ANN A		ne of the mysteries in cancer biolo		Funding: National Cancer Institute grants P01 CA85878, P50 CA093990, R01 CA136892,
TGF-ł	beta, can both sto	op cancer from forming and encou	rage its aggressive growth.	P50 CA093990-11, and National Science Foundation grants MRI-R2-ID, DBI-0959823
		e University of Michigan Compre		Reference: Science Signaling, Vol. 8, Issue 358, Jan. 6, 2015
have u	incovered a key	gene that may explain this parado	x and provide a potential	http://www.eurekalert.org/pub_releases/2015-01/ehs-noi010615.php
target	for treatment.			Nearly one in five women who undergo hysterectomy may not
		a tumor suppressor, meaning it's i	• •	need the procedure
		rmally. But at some point, its func	-	Hysterectomies are declining overall but alternatives to hysterectomy are still
	-	ring aggressive growth and spread		being underutilized, say researchers in the American Journal of Obstetrics &
		Bub1 as a key gene involved in re	gulating TGF-beta	Gynecology
-	• •	published in Science Signaling.		Philadelphia, PA - It is estimated that one in three women in the United States will
		involved at the receptor level is c		have had a hysterectomy by the age of 60. Although the numbers of
•	•	nawaz Rehemtulla, Ph.D., Ruth Tu		hysterectomies are decreasing, a new study of more than three thousand women in
		oncology and radiology and co-di		Michigan who underwent hysterectomy for benign indications reveals that
		the University of Michigan Medic		alternatives to hysterectomy are being underused and that treatment guidelines are
		for its role in cell division. But thi	5	often not followed. Post-surgical pathology showed that nearly one in five (18%)
		Ve think this may explain the para	dox of TGF-beta as a	of hysterectomies that were done for benign indications were unnecessary, and
	*	tumor suppressor," he adds.		that nearly two in five (37.8%) of women under 40 had unsupportive pathology,
		rs at the University of Michigan, i		reports the American Journal of Obstetrics & Gynecology.
		oss, Ph.D., developed a way to scr	-	Over 400,000 hysterectomies are performed in the US each year. About 68% of
-		receptor. When 720 genes from the	-	surgeries for benign conditions are done because of abnormal uterine bleeding,
		cancer and breast cancer cells, Bu	bl emerged as playing a	uterine fibroids, and endometriosis. The American Congress of Obstetricians and
•	role in TGF-bet	e e	11	Gynecologists recommends alternatives to hysterectomy, including hormonal and
		nd to the TGF-beta receptor and a		other forms of medical management, operative hysteroscopy, endometrial ablation,
	-	When the researchers blocked B		and use of the levonorgestrel intrauterine device as primary management of these
	· ·	npletely. TGF-beta is known to pl	•	conditions in many cases.
		tics of aggressive cancer cells. Re		"Over the past decade, there has been a substantial decline in the number of
		ghly expressed in many different t		hysterectomies performed annually in the United States," observes senior
		d in many types of cancer, develop		investigator Daniel M. Morgan, MD, Associate Professor of Obstetrics and
		ct multiple cancers. A compound eady for testing in patients. Initial		Gynecology at the University of Michigan. "An earlier study found a 36.4%
		y specifically target Bub1 withou		decrease in number of hysterectomies performed in the U.S. in 2010 compared to
	of the cell.	y specifically target Dub1 withou	t causing uamage to other	2002. However, despite the decrease in numbers of hysterectomies in the U.S.,
-		ne expression in cancer, Bub1 is in	n the ton five. In addition	appropriateness of hysterectomy is still an area of concern and it continues to be a
		s correlate with outcome in patien		target for quality improvement."
Dubi	capiession levels	s correlate with outcome in patien	is with fung and bicast	l

12	1/12/15	Name	Student number	
Investig	ators set out to assess how	often alternatives to hysterectomy are b	being	http://l.usa.gov/lwKBbpJ

Investigators set out to assess how often alternatives to hysterectomy are being recommended to women with benign gynecologic disease before performing hysterectomy and how often the pathologic findings from the hysterectomy supported an indication for surgery. They examined the medical records of 3,397 women who underwent hysterectomies for benign conditions in Michigan with these goals in mind. Data were collected over a ten-month period in 2013 from 52 hospitals participating in the Michigan Surgery Quality Collaborative (MSQC). Indications for surgery included uterine fibroids, abnormal uterine bleeding, endometriosis, or pelvic pain.

Nearly 40% of women did not have documentation of alternative treatment before their hysterectomy. Fewer than 30% received medical therapy, while 24% underwent other minor surgical procedures before the hysterectomy. Alternative treatment was more likely to be considered among women under 40 years old and among women with larger uteri. About 68% of women under 40 received alternative treatment compared with 62% of those aged 40-50 and 56% of those aged 50 or above.

Nearly one in five women (18.3%) had postsurgical pathologic findings that did not support having undergone a hysterectomy. The rate of unsupportive pathology was highest among women under 40 years. Nearly two in five women under 40 (37.8%) had pathologic findings that did not support undergoing a hysterectomy versus those aged 40-50 (12%) and over 50 years (7.5%). The frequency of unsupportive pathology was highest among women with a pre-operative diagnosis of endometriosis or chronic pain.

"This study provides evidence that alternatives to hysterectomy are underutilized in women undergoing hysterectomy for abnormal uterine bleeding, uterine fibroids, endometriosis, or pelvic pain," says Dr. Morgan.

"Although quality in gynecologic surgery has focused on care after a procedure, these findings suggest that appropriateness of surgery could serve as an important quality metric in gynecology," comments noted expert Jason D. Wright, MD, Chief of the Division of Gynecologic Oncology and Sol Goldman Associate Professor of Obstetrics and Gynecology at Columbia University College of Physicians and Surgeons and New York Presbyterian Hospital, New York. Dr. Wright adds: "Reducing the number of procedures performed in women who may not necessarily require the procedure in the first place has the potential to have an even more meaningful impact in reducing adverse outcomes and cost than To determine whether a planet is made of rock, water or gas, scientists must know optimization of postoperative care. As reimbursement policies shift, appropriateness of surgery will likely become an even greater imperative from patients and payers."

NASA's Kepler Marks 1,000th Exoplanet Discovery, Uncovers More Small Worlds in Habitable Zones

How many stars like our sun host planets like our Earth?

NASA's Kepler Space Telescope continuously monitored more than 150,000 stars beyond our solar system, and to date has offered scientists an assortment of more than 4,000 candidate planets for further study - the 1,000th of which was recently verified.

Using Kepler data, scientists reached this millenary milestone after validating that eight more candidates spotted by the planet-hunting telescope are, in fact, planets. The Kepler team also has added another 554 candidates to the roll of potential

planets, six of which are near-Earth-size and orbit in the habitable zone of stars similar to our sun Three of the newly-validated planets are located in their distant suns' habitable zone. the range of distances from the host star where liquid water might exist on the surface of an orbiting planet. Of the three, two are likely made of rock. like Earth.



NASA Kepler's Hall of Fame: Of the more than 1,000 verified planets found by NASA's Kepler Space Telescope, eight are less than twice Earth-size and in their stars' habitable zone. All eight orbit stars cooler and smaller than our sun. The search continues for Earth-size habitable zone worlds around sun-like stars.

"Each result from the planet-hunting Kepler mission's treasure trove of data takes us another step closer to answering the question of whether we are alone in the Universe," said John Grunsfeld, associate administrator of NASA's Science Mission Directorate at the agency's headquarters in Washington. "The Kepler team and its science community continue to produce impressive results with the data from this venerable explorer."

its size and mass. When its mass can't be directly determined, scientists can infer what the planet is made of based on its size. Two of the newly validated planets, Kepler-438b and Kepler-442b, are less than 1.5 times the diameter of Earth. Kepler-438b, 475 light-years away, is 12 percent bigger than Earth and orbits its

13	1/12/15	Name	Student nu	mber
star on	ce every 35.2 da	ays. Kepler-442b, 1,100 light	-years away, is 33 percent	<u>http://bit.ly/11CfRIC</u>
		orbits its star once every 112	•	Years-long 'silent quake' unleashed Fukushima tsunami
		Kepler-442b orbit stars smal		Earthquake that set off the tsunami was unleashed by a stealthy nine-year
_		cone closer to their parent star		buildup of pressure on a plate boundary
	•		s finding has been accepted for	The earthquake that set off the tsunami which caused the Fukushima nuclear plant
*		rophysical Journal.		disaster was unleashed by a stealthy nine-year buildup of pressure on a plate
		very of these small, possibly 1	-	boundary, scientists said Tuesday.
-		-	cy of planets like Earth," said	Part of a fault where two mighty plates on the Earth's crust collide east of Japan
	-	ell, SETI Institute Kepler sci		was being quietly crushed and twisted for nearly a decade, they said. It was this
		offett Field, California. "The o	-	hard to detect activity which caused the fault eventually to rip open on March 11,
		non temperate, rocky planets		2011 and cause the catastrophe.
		554 more planet candidates fr	-	The deformation "increased the stress in the source region and finally triggered
	•	o April 2013, the Kepler tean		the earthquake," said study co-author Kazuki Koketsu of the University of Tokyo.
	-	of these new candidates are be		"It had an impact on the occurrence time of the earthquake," Koketsu told AFP by
			Of these eight, six orbit stars	email. "It advanced the time (of the quake) by about one year."
		-	All candidates require follow-	The earthquake, occurring below the Pacific floor about 200 kilometres (120
-		alysis to verify they are actuated for four vegeta	-	miles) east of the east coast city of Sendai, was one of the biggest ever recorded,
-		n one Earth-year orbits", said	that we can now tease out the	measuring 9.0 on the moment magnitude scale.
		-	sis of a new candidate catalog.	The sea bottom shifted by about 27 metres (88 feet), causing a massive tsunami
	-	've ever been to finding Earth		that sparked the Fukushima disaster and left 18,000 people dead or missing.
		inets we're looking for". The		The fault lies on the Japan Trench, where the Pacific plate dives beneath the North American plate on which the Japanese archipelago lies. Subduction faults like
	-	ion in The Astrophysical Jour	0	these have been responsible for some of the world's most devastating quakes.
	-		ries into estimates of how often	But they are also notoriously difficult to monitor, given that events are as rare as
	•		like our sun, a key step toward	they are massive. Centuries may elapse between occurrences, which means the
		standing our place in the univ		danger could be undocumented.
	-		use of Kepler's four-year data	Koketsu and colleague Yusuke Yokota looked at data supplied by the GeoNet
			a collected by the mission and	network of Global Positioning System (GPS) stations dotted across Japan.
also wi	Il be conducted	using sophisticated software	that is more sensitive to the	They used the data to build a map of ground movement in the Tohoku and Kanto
tiny tel	ltale signatures	of small Earth-size planets th	an software used in the past.	districts from March 21, 1996 to March 8, 2011 - a day before a 7.3-magnitude
			d system development and science	foreshock. The team had to strip out seismic noise from relatively smaller
		Propulsion Laboratory in Pasad		earthquakes nearby in order to expose the background signals - the long,
			p. in Boulder, Colorado, developed with the Laboratory for Atmospheric	agonising deformation on the Japan Trench.
		University of Colorado in Boulde		The research builds on previous initiatives to harness GeoNet data, which has
		hives, hosts and distributes Keple		millimetric accuracy of land motion. "Our paper proved that a network of GPS
		nd was funded by the agency's Sc		stations can monitor a slow event which may lead to a great subduction
Washing	gton.For more info	ormation about the Kepler missio	n, visit: <u>http://www.nasa.gov/kepler</u>	earthquake," said Koketsu. But, he cautioned: "It has not yet been proven that a
				slow event always occurs prior to every great subduction earthquake."
				The paper appears in the journal Nature Communications.

<u>http://phys.org/news/2015-01-sun-lifespan-birth.html</u>

Sun may determine lifespan at birth, study finds

Could the Sun be your lucky - or unlucky - star?

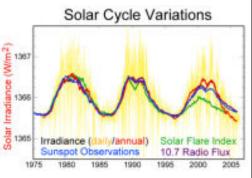
In an unusual study published Wednesday, Norwegian scientists said people born during periods of solar calm may live longer, as much as five years on average, than those who enter the world when the Sun is feisty.

The team overlaid demographic data of Norwegians born between 1676 and 1878 with observations of the Sun. The lifespan of those born in periods of solar maximum - interludes marked by powerful flares and geomagnetic storms - was "5.2 years shorter" on average than those born during a solar minimum, they found. "Solar activity at birth decreased the probability of survival to adulthood," thus truncating average lifespan, according to the paper published in the journal Proceedings of the Royal Society B. There was a stronger effect on girls than boys, it said.

The Sun has cycles that last 11 years, give or take, from one period of greatest activity or solar maximum, to the next. Solar maxima are marked by an increase

in sunspots, solar flares and coronal mass ejections that can disrupt radio communications and electrical power on Earth, damage satellites and disturb navigational equipment.

Solar activity is also linked to levels of ultraviolet radiation - an environmental stressor known to affect survival and reproductive performance, possibly by causing cell and DNA damage, according to the study authors.



Sun may determine lifespan at birth, study finds Robert A. Rohde/GNU General Publi Licens

Fertility reduced

The team, from the Norwegian University of Science and Technology, based their study on demographic data from church records of some 8,600 individuals from two different mid-Norwegian populations, one poor and one wealthy.

This was matched to maps of historical solar cycles. On top of lifespan, being born in a solar maximum period also "significantly reduced" fertility for women born into the poor category, but not for wealthier women or for men, said the authors.

"We show for the first time that not only infant survival and thus lifespan but also fertility is statistically associated with solar activity at birth," they wrote.

It was not clear whether the same would necessarily hold true for people born in the modern era. One explanation could be ultraviolet-induced degradation of the B vitamin folate, a shortage of which before birth has been linked to higher rates of illness and death, the team theorised.

"Our findings suggest that maternal exposure to solar activity during gestation can affect the fitness of female children," the authors wrote. "The effect of socioeconomic status on the relationship between solar activity and fertility suggests that high-status pregnant women were better able to avoid the adverse effects of high solar activity" - possibly by staying out of the Sun or because a healthier diet curbed the harm.

The team did not have data about how early or late into a solar maximum event the children were born - a limitation of the study. And they could not fully distinguish between pre- or post-natal exposure to ultraviolet light.

Further investigation is needed, they said, to test whether the results were repeated in people of different skin colours, and those living at different latitudes. "This study is the first to emphasise the importance of UVR (ultraviolet radiation)

in early life," the authors said. "UVR is a global stressor with potential ecological impacts and the future levels of UVR are expected to increase due to climate change and variation in atmospheric ozone."

http://phys.org/news/2015-01-mind-selfish-gene-ribosomes-link.html

Never mind the selfish gene – ribosomes are the missing link If a cellular component is "selfish" it must be ribosomes

by Robert Root-Bernstein And Meredith Root-Bernstein, The Conversation Since the discovery that DNA encodes genetic information, research on the evolution of life has focused on its genetic origins. Following this "genes-first" approach, Oxford University evolutionary biologist Richard Dawkins has argued in his book The Selfish Gene that cells and organisms evolved simply as packages to ever-more efficiently protect and transmit genes.

But this genes-first point of view ignores much. All cells share three organelles, or internal structures, besides gene-containing chromosomes: ribosomes which contain the machinery for translating genetic information into the proteins that perform the cell's work; a cell membrane that selectively permits materials in and out; and acidocalcisomes, which store and regulate the ions that drive the chemical reactions of life.

We challenge the "selfish gene" concept, proposing instead that if a cellular component is "selfish" it must be ribosomes. Cells – and DNA itself – evolved, we argue, to optimise the functioning of ribosomes. That upends everything we think we know about the evolution of cellular life and ribosomes themselves.

15 1/12/15	Name Student nu	mber
What does DNA wan	t?	"machine". Finally, it had to encode the tRNAs necessary to translate the mRNAs
We came to this idea the	hrough a father-daughter collaboration that began when	into proteins.
	ng Robert's 1989 book Discovering. Half-way through,	In a recent paper in the Journal of Theoretical Biology, we have shown that rRNA
Meredith looked up an	d asked: "What does DNA want?"	does contain vestiges of the mRNAs, tRNAs and "genes" that encode its own
	strange to anthropomorphise a molecule, in fact this is a	protein structure and function. Ribosomes are not simply the passive translators of
	gested in Robert's book. What's more, scientists often	genes as described in textbooks. We believe they are the missing link between
express the selfish gen	e theory in scientific short-hand as: "DNA wants to	simple pre-biotic molecules and the single-celled LUCA, the Last Universal
replicate itself."		Common Ancestor, considered to be the first living thing on Earth.
	nt metaphor when they anthropomorphise molecules. They	DNA evolved to conserve and protect the information originally encoded in rRNA.
•	ant to be in their lowest energy conformation". This means	Cells and organisms have evolved to optimise the replication of ribosomes, and
	etic molecules move through many positions, but they	ribosomes are almost the same across all species. Maybe the selfish ribosome puts
always return to a resti	• •	a new spin on feeling kinship with other creatures. We are all just different kinds
	DNA is very tightly curled up with its genes inaccessible.	of homes to ribosomes.
	ble that it can protect its genes for 10,000 years or more,	Explore further: Evolution of life's operating system revealed in detail
-	ecover DNA from frozen mammoths. This is not a	More information: Meredith Root-Bernstein, Robert Root-Bernstein, "The ribosome as a missing link in the evolution of life," Journal of Theoretical Biology, Volume 367, 21
	lisperse its genes, but one that wants to conserve them by	<i>February 2015, Pages 130-158, ISSN 0022-5193, dx.doi.org/10.1016/j.jtbi.2014.11.025.</i>
remaining curled up in		http://phys.org/news/2015-01-adding-year-internet-problems.html
	ellular structure that wants to copy genes and turn them	Adding leap second this year expected to cause Internet problems
_	hake up functioning cells is ribosomes. The resting state of a	Announcement of leap second has made many Internet sites nervous
•	y to translate DNA into proteins." Ribosomes "want" to	Jan 07, 2015 by Bob Yirka report
convert genes into wor	-	Phys.org - Officials at the International Earth Rotation Service have announced that
What do ribosomes w		a leap second will be added to the year this summer to allow for syncing up
• •	nalogy to the "selfish gene" theory, then became: Might	atomic clock time with the Earth's rotational time. The announcement has made
	hake copies of themselves? If ribosomes wanted to copy	many Internet sites nervous, as adding leap seconds in the past has caused
· · ·	would harbour the means to do so.	problems with services such as Foursquare, Reddit, Linkedln and Yelp - all
	ould be required for ribosomes to copy themselves, a bit of	reported incidents due to the sudden time discrepancy the last time a leap second
	some structure and function is necessary. Ribosomes are	was added back in 2012.
	and RNA, which is structurally similar to DNA and exists	The advent of computers and the Internet has caused a need for ever more precise
	One is ribosomal RNA, or rRNA, which forms a structural	time measurement and scientists have responded - atomic clocks are the standard
1 1	roteins arrange themselves to form a functional ribosome hine" uses the other two types of RNA to make proteins.	now with accuracy up to quadrillionths of a second. Unfortunately, the spin of the
	RNA, transcribes the genetic information from DNA and	Earth on its axis, which of course is the original source for recording the passage
•	ne. Transfer RNA, or tRNA, translates the mRNA message	of time - one spin equals one day - is slowing down, losing approximately two
	h are strung together on the ribosome to make a protein.	thousandths of a second every day. That means that atomic clocks and true Earth
· · · · · · · · · · · · · · · · · · ·	to makes copies of itself, the rRNA forming the structure at	time must be reconciled every so often - it has happened 25 times since it became
	ne machine would have to be functional. For this to be true,	necessary back in 1975. But back then, adding leap seconds went virtually
	n three things. First, it must contain the "genes" encoding its	unnoticed by all but the most interested. Nowadays, however, adding a leap
	s so as to be able to form a working "machine". Second, it	second - which is scheduled to occur at 23:59:59 on June 30 (the halfway point of
	As needed to carry its own genetic information to the	the year) - can cause computer systems to become confused when their clock
	Le neere to carry his own generic information to the	1

16 1/12/15	Name Student	number
	her than rolling over after 59 - and we all know what that	Basu, MD, PhD, professor of pathology and of medical oncology at the OSUCCC
e :	ages. Other computers will show the 59th second for two	- James. "Furthermore, dopamine can prevent the low-neutrophil count that is
-	ch can also cause problems.	often induced by a very common anti-cancer drug used for the treatment of
-	st notably, Google, have created a work-around - they call in	• • • •
	t forces servers to use extra time in making updates over the	
2	ich prevents them from ever noticing that a leap second has	
	ch apparently worked well enough as Google has already	Earlier studies by Basu and others have shown that dopamine blocks the growth
	Id use the same technique this year. Whether other sites will	
be doing the same is s		growth factor-A (VEGF-A).
	ptions, some in the technology sector have called for an end	
-	g away with time based on the Earth's movement altogether	
	much of a difference in the near term, but at some point,	currently used in the clinics have anti-VEGF-A actions," Basu says. "Our study
	ir clocks completely mismatched with days and nights,	will help to rapidly translate the use of this inexpensive but effective anti-
	the need for a leap minute, or hour which would seem to be	
*	Another possibility is of course, to maintain a dual system,	Basu and his colleagues conducted this study using an animal model of human
	the other for everybody else.	colon tumors transplanted into mice and a mouse model of lung cancer. The
	national Earth Rotation Service:	technical findings included:
www.iers.org/IERS/EN/H		Dopamine did not cause hypertension or affect liver functions (i.e., levels of alanine
	kalert.org/pub_releases/2015-01/osuw-sst010615.php	aminotransferase and aspartate aminotransferase were not elevated, as can happen
Study suggests	that dopamine is a safe anti-angiogenic drug in	with currently available anti-VEGF drugs);
	cancer treatment	Renal function was unaffected by dopamine treatment; serum blood urea nitrogen (BUN) levels remained normal in both animal models and in normal animals, while
Dopamine can be sa	ıfely used in cancer treatment to curb the growth of blood	animals treated with the anti-angiogenic inhibitor sunitinib showed increased levels;
	vessels in tumors	Dopamine administration did not affect platelet or neutrophil counts, although both
	new study led by scientists at The Ohio State University	were decreased by treatment with sunitinib.
	er Center - Arthur G. James Cancer Hospital and Richard J.	Dopamine prevented neutropenia (low neutrophil count) induced by 5-FU, an anti-
	tute (OSUCCC - James) suggests that dopamine - an	cancer drug commonly used to treat gastrointestinal cancers.
	ently used to treat heart, vascular and kidney disorders - can	Funding from the National Cancer Institute (grant CA124763) supported this research.
2	er treatment to curb the growth of blood vessels in tumors.	Other researchers involved in this study were Chandrani Sarkar and Debanjan Chakroborty
	national Journal of Cancer, the researchers show that	of The Ohio State University; and Partha Sarathi Dasgupta, Chittaranjan National Cancer Institute, Kolkata, India.
1 1	he growth of blood vessels in two animal models without	http://www.aurakalant.org/pub_valaasas/2015_01/afps_cal010715_php
e	erious side effects of the far-more expensive anti-angiogeni	Expressing anger linked with better health in some cultures
drugs currently used in	1.0	1 0 0
	t prevented the drop in the number of neutrophils (i.e.,	Anger may actually be linked with better, not worse, health in certain cultures In the US and many Western countries, people are urged to manage feelings of
	the blood that is typically caused by 5-fluorouracil, a	
	ommonly used in the treatment of gastrointestinal and other	Japan suggests that anger may actually be linked with better, not worse, health in
	, stomach, pancreas and breast cancers.	certain cultures. The findings are published in Psychological Science, a journal of
	nonstrate for the first time that the inexpensive drug	the Association for Psychological Science.
	rious side toxicities commonly seen with the anti-	
angiogenesis drugs pro	esently used in the clinic," says principal investigator Sujit	

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"Many of us in Western societies naively believe that anger is bad for health beliefs like these appear to be bolstered by recent scientific findings," says psychological scientist Shinobu Kitayama of the University of Michigan. "B	, and emotions more generally. "The association between greater anger and compromised biological health, taken for granted in the current (Western) ut our literature, was completely reversed so that greater anger was associated with
study suggests that the truism linking anger to ill health may be valid only w the cultural boundary of the 'West,' where anger functions as an index of	The researchers did not find a link between other facets of anger, such as chronic
frustration, poverty, low status and everything else that potentially comprom health." "These findings show how socio-cultural factors go under the skin to influence vital biological processes," explains Kitayama.	
In other words, it's the circumstances that elicit anger, and not anger itself, the seem to be bad for health. In previous work, Kitayama and colleagues found	reflects different experiences across cultural contexts. In the US, expressing anger
anger can function as a signal of high status and privilege in Asia drawing this, they hypothesized that greater expression of anger might be associated	on Japan it may reflect the degree to which people feel empowered and entitled.
better health among Asian participants. A recent incident on a Korean Air flight bound for Seoul illustrates this poin	· · · · · · · · · · · · · · · · · · ·
says Kitayama. Heather Cho, former vice president of Korean Air and daugh Korean Air Chairman Cho Yang-ho, apparently flew into a rage when she w improperly served a bag of macadamia nuts by the chief flight attendant. In a	as Kitayama and colleagues hope that future longitudinal research that follows
angry outburst, Ms. Cho ordered the pilot to take the plane back to the gate s the flight attendant could be kicked off the flight.	
This expression of anger, which may seem disproportionate to the circumstatis a typical display of privilege and power, says Kitayama, and may, therefore	
linked with better rather than worse health. To explore the link, the researchers examined data from American participar drawn from the Midlife in the United States (MIDUS) survey and data from	of Northwestern University; Hazel Rose Markus of the University of Michigan; Mayumi Karasawa of Tokyo Woman's Christian University; and Norito Kawakami of the University of
Japanese participants drawn from the Midlife in Japan (MIDJA) survey. To measure health, the researchers looked at biomarkers for inflammation ar	Tokyo.This research was supported by a grant from the National Institute on Aging(5R37AG027343) to conduct the Midlife in Japan survey for comparative analysis with the
cardiovascular functioning, both of which have been linked to anger express previous research. The combination of these two factors served as a measure	
overall biological health risk. The researchers also looked at measures that gauged various aspects of angeincluding how often participants expressed angry feelings through verbally of	http://pss.sagepub.com/content/early/2015/01/06/0956797614561268.abstract
physically aggressive behaviors (e.g., "I slam doors," "I say nasty things").	Study of ancient dogs in the Americas yields insights into human,
The data revealed that greater anger expression was associated with increase biological health risk among American participants, as previous studies have shown.	
But greater anger expression was associated with reduced biological health r among Japanese participants. And the association was not explained by othe	migrated to the Americas only about 10,000 years ago, thousands of years after
potentially related factors such as age, gender, chronic health conditions, smoking and alcohol consumption, social status, and experience of negative	the first human migrants crossed a land bridge from Siberia to North America.

18 1/12/15	Name	Student nu	
	e genetic characteristics of 84 ir		Dozens of dogs were ceremonially buried at Janey B. Goode, suggesting that
	orth and South America, and is		people there had a special reverence for dogs. While most of the dogs were buried
-	ericas. The findings appear in t	he Journal of Human	individually, some were placed back-to-back in pairs.
Evolution.			In Cahokia, dog remains, sometimes burned, are occasionally found with food
	predecessors, ancient dogs lear		debris, suggesting that dogs were present and sometimes were consumed. Dog
	benefited from the association		burials during this time period are uncommon.
	the safety of human encampment		As previous studies had done, the Illinois team analyzed genetic signals of
	o-legged masters. Dogs also we		diversity and relatedness in a special region (the hypervariable region) of the
beasts of burden, and se	ometimes were served as food,	particularly on special	mitochondrial genome of ancient dogs from the Americas. University of Iowa
occasions.			anthropology professor Andrew Kitchen contributed significantly to this analysis.
	0-year association with humans		The researchers found four never-before-seen genetic signatures in the new
	fancient human behavior, inclu-		samples, suggesting greater ancient dog diversity in the Americas than previously
2	ois graduate student Kelsey Wi	tt, who led the new analysis	thought.
with anthropology prof	essor Ripan Malhi.		They also found unusually low genetic diversity in some dog populations,
	arliest organisms to have migrat		suggesting that humans in those regions may have engaged in dog breeding.
	hat says a lot about the relations		In some samples, the team found significant genetic similarities with American
	hey can be a powerful tool whe	en you're looking at how	wolves, indicating that some of the dogs interbred with or were domesticated
	e moved around over time."		anew from American wolves.
	t always available for study "be		But the most surprising finding had to do with the dogs' arrival in the Americas,
	d to their ancestors in some case		Witt said.
	enetic analysis," Witt said. Anal		"Dog genetic diversity in the Americas may date back to only about 10,000 years
1	n analysis of human remains is	-	ago," she said.
	eient dogs in the Americas focus		"This also is about the same time as the oldest dog burial found in the Americas,"
	which is easier to obtain from an		Malhi said. "This may not be a coincidence."
-	ear DNA, is inherited only from		The current study, of only a small part of the mitochondrial genome, likely
	fers researchers "an unbroken li	ine of inheritance back to	provides an incomplete picture of ancient dog diversity in the Americas, Malhi
the past," Witt said.			said.
	cused on mitochondrial DNA, b		"The region of the mitochondrial genome sequenced may mask the true genetic
1 0	d been analyzed before. See int	1	diversity of indigenous dogs in the Americas, resulting in the younger date for
	ist Brian Kemp of Washington		dogs when compared with humans," he said.
1	m ancient dog remains found in		More studies of ancient dogs are in the works, the researchers said. Witt has
	iois State Archaeological Surve		already sequenced the full mitochondrial genomes of 20 ancient dogs, and more
1	southern Illinois known as Jane	· · ·	are planned to test this possibility, the researchers said.
	ey B. Goode site is located near		The Illinois State Archaeological Survey, a division of the Prairie Research Institute at the U.
	own metropolitan area in North		of I., supported this research. The paper, "DNA analysis of ancient dogs of the Americas: Identifying possible founding
	curred between 1,400 and 1,000		haplotypes and reconstructing population histories," is available online or from the U. of I.
said, while Cahokia wa	as active from about 1,000 to 70	00 years ago.	News Bureau.

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<u>http://www.eurekalert.org/pub_releases/2015-01/jhm-sti010515.php</u> Scientists train immune system to spot and destroy cure-defying

mutant HIV

Strategy that could form a blueprint for a therapeutic vaccine to eradicate lingering virus from the body

Luring dormant HIV out of hiding and destroying its last cure-defying holdouts has become the holy grail of HIV eradication, but several recent attempts to do so have failed. Now the findings of a Johns Hopkins-led study reveal why that is and offer a strategy that could form a blueprint for a therapeutic vaccine to eradicate lingering virus from the body.

The findings, published online Jan. 7 in the journal Nature, show HIV eradication efforts have been stymied by the virus' ability to mutate beyond recognition, rendering it impervious to immune system destruction even when lured out of hiding. Going a step further, the scientific team successfully trained the immune system to recognize, attack and subdue such mutant HIV once coaxed out of its dormancy.

In a description of their "proof of principle" research, the team says they tamed mutant HIV by training a class of immune sentinel cells known as killer T cells to spot and eliminate HIV-infected cells capable of evading immune surveillance and impervious to immune system destruction.

The strategy addresses one of HIV's most challenging behaviors -- its ability to hijack a class of immune cells known as memory CD4+ T cells, where it goes into hiding soon after infection, lying quietly under the immune system's radar and unreachable by antiviral drugs. The killing of those last infected cells has become the focus of numerous recent efforts to lure the virus out of dormancy and finish it off permanently. However, the new findings show much of the latent virus is not merely out of reach, but also genetically altered to evade recognition by the immune system even once latency is reversed.

"Our results suggest that luring HIV out of hiding is winning only half the battle," says senior investigator Robert Siliciano, M.D., Ph.D., professor of medicine, molecular biology and genetics at the Johns Hopkins University School of Medicine. "We found that these pools of dormant virus carry mutations that render HIV invisible to the very immune cells capable of disarming it, so even when the virus comes out of hiding, it continues to evade immune detection." Using a technique known as deep sequencing to reveal HIV's genetic features down to a single infected cell, scientists analyzed blood samples from 25 HIV-infected patients, 10 of whom had started therapy early -- within three months of

infection -- while the rest had begun treatment after the three-month mark, when HIV infection enters its chronic stage.

Strikingly, the researchers report, they discovered that patients who began antiviral therapy within a few weeks or months of infection harbored largely nonaltered HIV. Those who had started treatment later had viral reservoirs composed almost entirely of HIV that carried so-called escape mutations, which occur when key sections of the viral protein shape-shift beyond recognition. All viruses and bacteria carry such key protein identifiers. Intact, these identifiers are spotted by the immune system as "foreign," triggering an immune attack. However, soon after infection HIV quickly alters these "marker" regions, making them unrecognizable to the immune system. In the study, people who started therapy early appeared to have halted the mutation process in its tracks, freezing the virus more or less in its original state, the researchers found. By contrast, more than 98 percent of the virus in the latent reservoirs of late-treated patients was broadly altered. The good news, Siliciano and his colleagues report, is that each HIVinfected cell retains a tiny portion of its original viral protein intact -- a feature the researchers exploited to test a possible solution to the "recognition" problem. "We hypothesized that if these killer T cells were somehow nudged to spot the tiny segments of unaltered virus, they would kill the entire HIV-infected cell," says Kai Deng, Ph.D., lead author of the study and a postdoctoral research fellow at the Johns Hopkins University School of Medicine.

Just like unmasking a tiny portion of a camouflaged target allows a sniper to suddenly discern the hidden mark, researchers exposed killer T cells to the unaltered portions of the viral protein.

To do so, scientists first isolated killer T cells from patients and mixed them either with mutant forms of HIV or with a cocktail that contained both mutated and nonmutated lab-made chunks of HIV protein. After a few days, each group of killer T cells was exposed to cells infected with HIV obtained from patients carrying escape mutations. Killer T cells primed with the mixture of mutated and nonmutated HIV mounted a vigorous response against the patients' HIV-infected cells, killing 61 percent of them. By contrast, killer T cells primed only with mutant HIV showed a weak response and low kill rate, destroying only 23 percent of HIV-infected cells.

"It's as if the immune system had lost its ability to spot and destroy the virus, but priming killer T cells that recognize a different, nonmutated portion of HIV's protein reawakened that natural killer instinct," Siliciano says.

To see whether the primed killer T cells could perform outside the lab dish, the investigators injected them in a handful of so-called humanized mice, animals engineered to be physiologically closer to humans than standard lab mice. Each

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mouse received bone marrow from an HIV-infected patient, giving rise to a humanized immune system, and each mouse was then infected with HIV derived from the corresponding patient whose immune system the animal now harbored. All animals developed full-blown HIV infections. When investigators injected mice with patient-derived killer T cells primed solely by mutated viral proteins, the animals succumbed to the infection. In contrast, mice injected with retrained killer T cells those primed with a mixture of mutant and nonmutant HIV were able to control the infection and experienced a sharp thousand-fold drop in the amount of circulating virus. Some of the animals treated that way suppressed HIV below detectable levels. "Our results shows that any curative strategy designed to eradicate HIV infection would need to include the use of killer T cells primed to recognize nonmutant forms of HIV," Deng says. <i>The mouse work was conducted at Yale University by investigators Liang Shan and Richard Flavell. Other investigators included Mihaela Pertea, Anthony Rongvaux, Leyao Wang, Christine Durand, Gabriel Ghiaur, Jun Lai, Holly L. McHugh, Haiping Hao, Hao Zhang, Joseph Margolick, Cagan Gurer, Andrew Murphy, David M. Valenzuela, George D. Yancopoulos, Steven G. Deeks, Till Strowig, Priti Kumar, Janet Siliciano and Steven Salzberg. Other institutions involved in the research include the University of California, San Francisco and Yale University. The work was funded by the National Institutes of Health under grant numbers AI43222, AI 096109 and T32 AI07019; amfAR, The Foundation for AIDS Research; the Howard Hughes Medical Institute; and the Bill and Melinda Gates Foundation.</i>	"I would call this an unexpected and somewhat stunning finding," said Xue of CU-Boulder's Department of Molecular, Cellular and Developmental Biology. "This is the first time a molecule involved in apoptosis has been found to have the ability to repair severed axons, and we believe it has great therapeutic potential." Xue is the lead author on a paper being published Jan. 7 in Nature Communications that details how PSR-1 recognizes and removes cells that are pre-programmed to die or damaged. He also is co-author of the companion paper being published in Jan. 7 in Nature led by Associate Professor Massimo Hilliard of the UQ's Queensland Brain Institute that shows the major role played by PSR-1 in the regeneration of nerve axons, a holy grail of sorts for neurologists involved with patients who have suffered central nervous system damage from accidents or diseases. Both studies relied on a popular lab organism known as C. elegans, a nearly microscopic nematode that is fast growing, translucent and has a sequenced genome showing that nearly half its genes are closely related to corresponding human genes. "This will open new avenues to try and exploit this knowledge in other systems closer to human physiology and hopefully move toward solving injuries," said Hilliard. In the future, neurosurgery may be combined with molecular biology to deliver positive clinical outcomes and perhaps treat conditions like spinal cord or nerve injuries, he said. During programmed cell death, apoptotic cells flag themselves for elimination by moving a specific cell membrane component known as phosphatidylserine (PS)
<u>http://www.eurekalert.org/pub_releases/2015-01/uoca-rfh010515.php</u> Research findings have implications for regenerating damaged	from the inner membrane to the cell surface, setting them up to be engulfed.
nerve cells	"These are what we call 'eat me' signals," said Xue. In contrast, broken axons in nerve cells send PSR-1 molecules an SOS alert. "The
Unique molecule not only gobbles up bad cells and repairs damaged nerve cells Two new studies involving the University of Colorado Boulder and the University of Queensland (UQ) in Brisbane, Australia have identified a unique molecule that not only gobbles up bad cells, but also has the ability to repair damaged nerve cells. Known as the phosphatidylserine receptor, or PSR-1, the molecule can locate and clear out apoptotic cells that are pre-programmed to die as well as necrotic cells that have been injured and are causing inflammation, said CU-Boulder Professor Ding Xue, who led one study and co-authored the other. Programmed cell death, or apoptosis, is a natural process that kills billions of cells in a typical human body each day. But it is the finding that the PSR-1 molecule also can help reconnect and knit together broken nerve fibers, called axons, that has caught the attention of both science teams.	moment there is a cut to the nerve cell we see a change in the cell membrane PS composition, which acts as a signal to PSR-1 molecules in the other part of the nerve that essentially says "I am in danger, come and save me," said Xue. One of the most encouraging finding is that PSR-1 plays an early role in the axonal fusion process required for neuroregeneration, said Xue. "Whether human PSR has the capacity to repair injured axons is still unknown," he said. "But I think our new research findings will spur a number of research groups to chase this question." While biomedical researchers have had some successes in repairing peripheral nerves and nerve clusters outside the brain and spinal cord in humans, there currently is no effective way to regenerate broken nerve cells in the central nervous system, said Xue. Such nerve damage can cause partial or total paralysis.

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Xue, w	ho first identifie	ed the PSR-1 receptor in 2003,	said the collaboration	participants in the study knew whether or not they were getting the drug, we saw
		nd UQ has pushed scientific di	2	improvement in movement and motor skills in people with Huntington's after one
		w PSR-1 removes cells throug	· ·	month of therapy."
and the	ey are trying to u	inderstand if molecules involve	ed in apoptosis also play a	For the study, researchers used MRI brain scans to analyze the energy profile
role in	the neuroregene	ration process," said Xue.		before, during and after the brain was visually stimulated in nine people in the
CU-Bo	ulder postdoctor	ral researcher Yu-Zen Chen, a	Nature Communications	early stages of Huntington's disease and 13 people without the disease. The
paper c	o-author, said th	ne team currently is trying to fi	nd ways to raise the level of	average age of the participants was 46. The test was then repeated one month later.
		cells, which likely would pror		In the people without the disease, the brain's metabolism increased during the
axons.	"We think the h	igher the PSR-1 level, the high	er the repair capacity of the	stimulation, then returned to the normal level. In people with Huntington's disease,
	lle," said Chen.			there was no change in metabolism.
	-	an ideal organism to use in the	-	For the second part of the study, only people with Huntington's disease received
	•	ause of its relatively small, we		triheptanoin, a compound made up of special fatty acids that can provide
		ys. "This makes drug screenin		alternative energy to glucose in the brain. The 10 participants, which included five
	L	ng a mouse model, for instance		of the participants in the first part of the study, had the flavorless, odorless oil
		t we have a single receptor that		during meals three or four times a day for a month. Then they had the visual
		we a solution yet for treating pe		stimulation test again. The brain metabolism was now normal.
		ngs offer promise in seeking ne	w and effective	"If confirmed in other studies, the findings may be hopeful for people who have
therape				the family gene for Huntington's and will eventually develop the disease," Mochel
		lature Communications paper are f		said.
		rsity in Beijing, China; Xiamen Uni ne State University of New Jersey.	versity in Alamen, China,	The study was supported by Ipsen and the French National Institute of Health and
		efforts were funded primarily by the	e Burroughs Wellcome Fund	Research. Ultragenyx Pharmaceutical Inc. provided the investigational drug
		of Health (NIH). The Queensland		triheptanoin for the study.
		ical Research Council and the Aust		http://phys.org/news/2015-01-japan-akatsuki-spacecraft-orbit-venus.html
<u>ht</u>	ttp://www.eurek	alert.org/pub_releases/2015-0	<u>1/aaon-sod010715.php</u>	Japan's Akatsuki spacecraft to make second attempt to enter
Syn	thetic oil dru	g may bring promise for	Huntington's disease	orbit of Venus in Jan 07, 2015
An ea	rly study sugges	sts that a synthetic triglyceride	oil called triheptanoin may	Would be the first time that Japan deployed a satellite around a planet other
		hope for people with Hunting		than Earth
		idy is published in the January		by Matt Williams, Universe Today
		cal journal of the American Ac		Back in 2010, the Japanese Aerospace Exploration Agency (JAXA) launched the
	•	inherited and causes nerve cel	-	Venus Climate Orbiter "Akatsuki" with the intention of learning more about the
-	•	ed in the control of movements		planet's weather and surface conditions. Unfortunately, due to engine trouble, the
		and behavior. A child of a pare		probe failed to make it into the planet's orbit.
	*	e of developing the disease. Sy	mptoms usually appear	Since that time, it has remained in a heliocentric orbit, some 134 million kilometers from Venus, conducting scientific studies on the solar wind. However,
	n the ages of 30			JAXA is going to make one more attempt to slip the probe into Venus' orbit
		at this drug in the form of oil m	· ·	before its fuel runs out.
	1	in early stages of the disease,"	5 5	Since 2010, JAXA has been working to keep Akatsuki functioning so that they
		h Pitié-Salpêtrière University l	-	could give the spacecraft another try at entering Venus' orbit.
Althou	ugn the results s	hould be taken with great cauti	on because researchers and	coura five the spaceorart another ity at entering venus oron.

22 1/12/15 Nama Student nu	mbor
22 1/12/15 NameStudent nu After a thorough examination of all the possibilities for the failure, JAXA determined that the probe's main engine burned out as it attempted to decelerate on approach to the planet. They claim this was likely due to a malfunctioning valve in the spacecraft's fuel pressure system caused by salt deposits jamming the valve between the helium pressurization tank and the fuel tank. This resulted in high temperatures that damaged the engine's combustion chamber throat and nozzle. JAXA adjusted the spacecraft's orbit so that it would establish a heliocentric orbit, with the hopes that it would be able to swing by Venus again in the future. Initially, the plan was to make another orbit insertion attempt by the end 2016 when the spacecraft's orbit would bring it back to Venus. But because the spacecraft's speed has slowed more than expected, JAXA determined if they slowly decelerated Akatsuki even more, Venus would "catch up with it" even sooner. A quicker return to Venus would also be advantageous in terms of the lifespan of the spacecraft and its equipment. But this second chance will likely be the final chance, depending on how much damage there is to the engines and other systems. The reasons for making this final attempt are quite obvious. In addition to providing vital information on Venus' meteorological phenomena and surface conditions, the successful orbital insertion of Akatsuki would also be the first time that Japan deployed a satellite around a planet other than Earth. If all goes well, Akatsuki will enter orbit around Venus at a distance of roughly 300,000 to 400,000 km from the surface, using the probe's 12 smaller engines since the main engine remains non-functional. The original mission called for the probe to establish an elliptical orbit that would place it 300 to 80,000 km away from Venus's surface. This wide variation in distance was intended to provide the chance to study the planet's meteorological phenomena and its surface in detai	first detected by the ESA's Venus Express spacecraft. One of the original aims of Akatsuki was to compliment the Venus Express mission. But Venus Express has now completed its mission, running out of gas and plunging into the planet's atmosphere. But most of all, it is hoped that Akatsuki can provide observational data on the greatest mystery of Venus, which has to do with its surface storms. Previous observations of the planet have shown that winds that can reach up to 100 m/s (360 km/h or ~225 mph) circle the planet every four to five Earth days. This means that Venus experiences winds that are up to 60 times faster than the speed at which the planet turns, a phenomena known as "Super-rotation". Here on Earth, the fastest winds are only capable of reaching between 10 and 20 percent of the planet's rotation. As such, our current meteorological understanding does not account for these super-high speed winds, and it is hoped that more information on the atmosphere will provide some clues as to how this can happen. Between the extremely thick clouds, sulfuric rain storms, lightning and high-speed winds, Venus' atmosphere is certainly very interesting! Add to the fact that the volcanic, pockmarked surface cannot be surveyed without the help of sophisticated radar or IR imaging, and you begin to understand why JAXA is eager to get their probe into orbit while they still can. <u>http://bit.ly/llhezVb</u> Drug-Resistant Bacteria Tests in mice show that the new drug works against numerous nasty diseases and should stay viable for decades By Brian Handwerk smithsonian.com Antibiotics are trusted weapons against many types of bacterial disease, but growing resistance to the drugs is a major problem. "Pathogens are acquiring resistance faster than we can introduce new antibiotics, and this is causing a human health crisis," says biochemist Kim Lewis of Northeastern University. Lewis is part of a team that recently unveiled a promising antibiotic, born from a
This wide variation in distance was intended to provide the chance to study the planet's meteorological phenomena and its surface in detail, while still being able	resistance faster than we can introduce new antibiotics, and this is causing a human health crisis," says biochemist Kim Lewis of Northeastern University.
 At a distance of 400,000 km, the image quality and opportunities to capture them are expected to be diminished. However, JAXA is still confident that it will be able to accomplish most of the mission's scientific goals. In its original form, these goals included obtaining meteorological information on Venus using four cameras that capture images in the ultraviolet and infrared wavelengths. These would be responsible for globally mapping clouds and peering beneath the veil of the planet's thick atmosphere. Lighting would be detected with a high-speed imager, and radio-science monitors would observe the vertical structure of the atmosphere. In so doing, JAXA hopes 	Lewis is part of a team that recently unveiled a promising antibiotic, born from a new way to tap the powers of soil microorganisms. In animal tests, teixobactin proved effective at killing off a wide variety of disease-causing bacteria - even those that have developed immunity to other drugs. The scientists' best efforts to create mutant bacteria with resistance to the drug failed, meaning teixobactin could function effectively for decades before pathogens naturally evolve resistance to it. The 20th century's "antibiotic era" introduced a widely successful, targeted effort against disease-causing bacteria. Drugs like penicillin and streptomycin became household names, and millions of people benefited from them.
to confirm the existence of surface volcanoes and lighting, both of which were	1

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But wi	idespread use - a	nd misuse, such as patients not	taking the drugs properly -	Today teixobactin can cure mice of infection, which is a good start, and the drug
meant	that bacteria beg	gan working overtime to develo	p resistance to antibiotics.	is perhaps two years away from beginning the clinical tests that could eventually
Now s	ome pathogens,	including some strains of tuber	culosis, are resistant to all	lead to approval for human treatment. And promising as it may be, teixobactin
availal	ble antibiotics. B	Because resistance can evolve qu	ickly, the high costs of drug	represents just the tip of the iceberg, Lewis says. Who knows what may be found
develo	pment aren't see	n as having long-term value, an	d fewer new antibiotics are	among the many millions of uncultured soil bacteria species?
reaching	ng the market.			"It's a tremendous source of new antibiotic compounds," Lewis says. "You could
Part of	f the problem has	s been trouble growing the mos	t promising candidates in	imagine all kinds of compounds that could be there and could do all kinds of
the lab	. Natural microb	bial substances from soil bacteri	a and fungi have been at the	things. Even apart from antibiotics the compounds you get from soil
root of	f most antibiotic	drug development during the pa	ast century. But only about	microorganisms have also been used to develop anti-cancer drugs,
one pe	ercent of these or	ganisms can be grown in a lab.	The rest, in staggering	immunosuppressants and anti-inflammatories. So really, these bacteria are very
numbe	ers, have remaine	ed uncultured and of limited use	to medical science, until	good at making antibiotics, but there are definitely many other therapeutics that
now.				they can make as well."
Lewis	and his team dee	cided on a different approach. "	Instead of trying to figure	http://bit.ly/1yXwxdM
		s for each and every one of the		Green Comet Lovejoy Now Visible in 'Heavenly River' of Stars:
		nt, to allow them to grow in the		Where to Look
		ment where they already have		<i>Currently passing through the boundaries of Eridanus is a celestial interloper,</i>
	n," he says.	5 5	5	Currently passing inrough the boundaries of Eridanus is a celesual interioper, Comet Lovejoy.
•		signed a gadget that sandwiche	s a soil sample between two	by Joe Rao, SPACE.com Skywatching Columnist
		prated with pores that allow mo		Two heavenly sights are shining in the night sky for stargazers this month:
		n't allow the passage of cells. "		Eridanus, the long, winding Heavenly River constellation, and Comet Lovejoy,
		hat they are in their natural env		the bright green comet that is now streaking through the star pattern
		00 strains of uncultured soil ba		Located due south around 8 p.m. your local time this week, Eridanus, is actually
		e tested against nasty pathogen	1 1	fun to trace out. Begin at Orion, where the star Cursa is located to the north and
		romising drug. Mice infected w		west (upper right) of the brilliant blue star Rigel in Orion.
		ions (including S. aureus or Stre		After passing two stars to the west note the close pair of stars, which have the
		bactin, and the drug knocked o		catchy names Beid and Keid (words derived from the Arabic for egg and eggshell,
	able toxic effects	e		respectively.) At Zaurak begins a reverse curve, then four stars extend directly to
		s effective because of the way in	t targets disease: The drug	the west.
		cell walls by attacking the lipid		Among these is Epsilon Eridani, one of our closest stellar neighbors at a mere
		any other antibiotics target the b		10.7 light-years away. To the ancients, the River ended at Acamar, but in reality,
		e proteins can mutate to produc		it is the bluish first magnitude star Achernar that glows at the end of the river. It's
•		k isn't always effective, so some		the ninth brightest star in the sky, yet positioned so far south that only those who
		d a resistant strain.	5	live near or along the Gulf Coast get a glimpse of it. <i>[How to Spot Comet Lovejoy</i>]
	v 1	that also targets lipid cell-wall	precursors, vancomycin,	in Eridanus: A Guide]
		nearly 40 years before bacteria		Comet Lovejoy sails the Eridanus
		iderably better protected from 1	-	Currently passing through the boundaries of Eridanus is a celestial interloper,
		ong run of effectiveness, the tea		Comet Lovejoy.
	1 Nature.	<i>c i i i i i i i i i i</i>	1	The comet, discovered last August by Australian amateur astronomer Terry
5	· · · · · · · ·			Lovejoy (his fifth comet to date), is putting on a show for those equipped with
				Love joy (ins intil contet to date), is putting on a snow for mose equipped with

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Student number

little more than good binoculars or a small telescope. Officially catalogued as C/2014 Q2, this object is now reaching the pinnacle of its brightness; it will be making its closest approach to Earth tonight (Jan. 7) at a distance of 43.6 million miles (70.2 million km).

Name

Until now, the bright early winter moon has been a real nuisance, lighting up the sky and hindering comet observations. Nonetheless, the comet has held its own in the moonlight. On Jan. 3, Lovejoy was shining at magnitude 4.6, a bit brighter than Eta Ursae Minoris, the faintest of the four stars in the bowl of the Little Dipper.



about 8 p.m. local time. Looking to the upper right of constellation Orion will assist in locating Comet Lovejoy. Credit: Sky & Telescope View full size image

As such, the comet is now dimly visible to the unaided eye. The coma, or head of the comet, appears 18 arc minutes wide, or three-fifths the apparent diameter of the moon, corresponding to 238,600 miles (383,900 km).

Alan MacRobert, senior editor of Sky & Telescope magazine, says that before the bright moon became too objectionable, his 10x50 binoculars revealed Lovejoy to be a "biggish puffball, moderately concentrated toward its center." He was also able to perceive the comet's greenish tint. "And this was through moderate suburban light pollution."

There is no question that the comet would have appeared much more impressive were it not for the moon.

http://www.eurekalert.org/pub releases/2015-01/jhm-sht010715.php Surprise: High-dose testosterone therapy helps some men with advanced prostate cancer

Paradoxically, testosterone is found to suppress some advanced prostate cancers and may reverse resistance to testosterone-blocking drugs.

In a surprising paradox, the male hormone testosterone, generally thought to be a feeder of prostate cancer, has been found to suppress some advanced prostate cancers and also may reverse resistance to testosterone-blocking drugs used to treat prostate cancer.

The finding, by scientists at the Johns Hopkins Kimmel Cancer Center, is reported in the Jan. 7 issue of Science Translational Medicine.

Medical oncologist Samuel Denmeade, M.D., who led the small study of 16 patients with metastatic prostate cancer, warns that the timing of testosterone treatment used in his research is critical and difficult to determine, and says men should not try to self-medicate their cancers with testosterone supplements available over the counter.

Previous studies, he adds, have shown that taking testosterone at the wrong time -particularly by men with symptoms of active cancer progression who have not yet received testosterone-blocking therapy -- can make the disease worse. In men whose prostate cancer spreads, doctors typically prescribe drugs that block testosterone production, but cancer cells eventually become resistant to this means of reducing the hormone, says Denmeade, a professor of oncology at the Johns Hopkins University School of Medicine. At that point, physicians switch to other drugs, such as enzalutamide, which block testosterone's ability to bind to receptors within prostate cancer cells.

This chart shows how to spot Comet Lovejoy in mid-January 2015, looking southeast at Denmeade says the combination of drugs that block testosterone production and receptors, called androgen deprivation therapy, may make prostate cancer more aggressive over time by enabling prostate cancer cells to subvert attempts to block testosterone receptors. And many men on these drugs experience harsh side effects, including impotence, weight gain, muscle loss and intense fatigue.

"This really is the most lethal form of prostate cancer," says Michael Schweizer, M.D., researcher at Fred Hutchinson Cancer Research Center and contributor to the study during his recent fellowship at Johns Hopkins. "It's the one that's the most resistant, and typically once people progress to this stage it's when we start to worry that they're at a much higher risk for dying from prostate cancer." With this context, the new study tested an approach based on the idea that if prostate cancer cells were flooded with testosterone, the cells might be killed by the hormone shock. The cells also might react by making fewer receptors, which

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	ells vulnerable once more to androgen deprivation	Other scientists at Johns Hopkins who contributed to the study include Michael Schweizer
therapy.		(now at the Fred Hutchinson Cancer Research Center and the University of Washington), Emmanuel Antonarakis, Hao Wang, Atinuke Ajiboye, Avery Spitz, Harry Cao, Jun Luo,
	his colleagues enrolled 16 men who had been	Michael Haffner, Vasan Yegnasubramanian, Michael Carducci, Mario Eisenbergery and
	g treatment for metastatic prostate cancer at Johns	John Isaacs.
-	previously with at least one type of androgen	http://www.eurekalert.org/pub_releases/2015-01/dc-abc010515.php
	sing levels of prostate specific antigen (PSA), a	Algae blooms create their own favorable conditions, new study
-	er, and radiographic evidence their cancers were	finds
becoming resistant.		Multi-institution study shows algae can drive nitrogen and phosphorus cycling
-	day cycles of an intramuscular injection of	HANOVER, N.H Fertilizers are known to promote the growth of toxic
	a chemotherapy drug called etoposide. Men who	cyanobacterial blooms in freshwater and oceans worldwide, but a new multi-
	Is after three cycles were continued on testosterone	institution study shows the aquatic microbes themselves can drive nitrogen and
injections alone.	e the study: One died of pneumonia and sepsis due	a hearth and some line in a semiliar dense tone month in tales.
	experienced prolonged erection, a side effect of the	\hat{T} \hat{C} 1 \hat{L} 1 L
testosterone.	experienced protonged election, a side effect of the	green algae that get a toe-hold in low-to-moderate nutrient lakes can set up
	l, seven experienced a dip in their PSA levels of	positive feedback loops that amplify the effects of pollutants and climate change
	indication their cancers were stable or lessening in	and make conditions even more favorable for blooms, which threaten water
severity. Seven of the men sho		resources and public health worldwide. The findings shed new light on what
	nen stayed on testosterone therapy for 12 to 24	makes cyanobacteria so successful and may lead to new methods of prevention
-	A levels. Of 10 men whose metastatic cancers	and control.
could be measured with imagir	ng scans, five experienced tumor shrinkage by more	e The study appears in the journal Ecosphere. A PDF is available on request.
	hose cancer completely disappeared.	"We usually think of cyanobacteria as responders to human manipulations of
"Surprisingly, we saw PSA red	luctions in all of 10 men, including four whose PSA	watersheds that increase nutrient loading, but our findings show they can also be
didn't change during the trial, w	who were given testosterone-blocking drugs after	drivers of nitrogen and phosphorus cycling in lakes," says Dartmouth Professor
the testosterone treatment," say	s Denmeade. The scientists say these results	Kathryn Cottingham, one of the study's lead authors. "This is important because
suggest that testosterone therap	by has the potential to reverse the resistance that	cyanobacteria are on the increase in response to global change both warming
eventually develops to testoste	rone-blocking drugs like enzalutamide.	temperatures and land use and may be driving nutrient cycling in more lakes in
• • •	have died since the study began in 2010; the rest	the future, especially the clear-water, low-nutrient lakes that are so important for
are still alive.		drinking water, fisheries and recreation."
	, many of the men experienced the usual side	Biogeochemical cycling is the natural recycling of nutrients between living organisms and the atmosphere, land and water. The researchers found that
	ding nausea, fatigue, hair loss, swelling and low	cyanobacterial blooms can influence lake nutrient cycling and the ability of a lake
	, only the testosterone injection, however, side	to maintain its current conditions by tapping into pools of nitrogen and
effects were rare among the me		phosphorus not usually accessible to phytoplankton. The ability of many
	ies are being planned at Johns Hopkins and other	cyanobacterial organisms to fix dissolved nitrogen gas is a well-known potential
hospitals.	fintement in the idea of the initial states of	source of nitrogen, but some organisms can also access pools of phosphorus in
	of interest in the idea of reversing resistance to	
	We have plenty of anecdotes and some evidence in ant to test it in larger groups of patients," he adds.	to the water column via leakage or decomposing organisms, thereby increasing
J i	rovided by the One-in-Six Foundation in Akron, Ohio.	nutrient availability for other phytoplankton and microbes.
1 anaing jor ine cinicai iriai was p	oraca by the One-th-SM Foundation in AMON, Onto.	

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The study was funded by the ecologist Kathryn Cotting mathematician Meredith Cand biogeochemist Kathled research included literatur and phosphorus cycling. <u>http://phys.org/</u> Short words provide The smallest, most forg how students will perfor University of Texas at a Common sense suggest complicated words - succ provide a better yardsti The new study used 50 students, enabling the r performance. It turned	he National Science Foundation and c ham at Dartmouth, ecosystem ecologis Greer at Bates, freshwater ecologist C en Weathers at the Cary Institute of E re review and original mathematical n (news/2015-01-short-words-acaa rt words predict academic de a better yardstick than long w person's potential gettable words in admissions essa orm in college, a new study by res Austin reveals. Its that academic potential is show e new research shows, on the cor th as the, a, to, I and they - matter ck than long words for measuring ,000 admissions essays written by essearchers to connect language u out that how students use small w	<i>co-authored by freshwater</i> <i>st Holly Ewing and</i> <i>ayelan Carey at Virginia Tech</i> <i>cosystem Studies. The</i> <i>nodeling of coupled nitrogen</i> <i>lemic-success.html</i> success <i>yords for measuring a</i> <i>ays can tell us in advance</i> <i>searchers at The</i> <i>yn by use of long</i> <i>ntrary, that common, easily</i> <i>r. These short words</i> <i>g a person's potential.</i> <i>y prospective college</i> <i>yords is related to</i>	mber
worse in class, and stud "Function words allow are thinking about," sai University of Texas at a big data, we can now b individuals, groups and records." The UT Austin team us performance is tied to a Index (CDI). This meas frequencies of common into kinds and connecti thinking is reflected by of. The new research show	equent GPA. For example, students who heavily use the word I tend to do e in class, and students who heavily use of the words the and a do better. action words allow us to assess how people are thinking more than what they hinking about," said James Pennebaker, a psychology professor at The rersity of Texas at Austin and co-author of the paper. "In the growing age of lata, we can now begin to identify the potential thinking patterns of viduals, groups and perhaps even cultures for whom there exist language	 Transhydrogenase, a critical mitochondrial enzyme works in a process that is key to maintaining healthy cells LA JOLLA, CA - A team led by structural biologists at The Scripps Research Institute (TSRI) has taken a big step toward understanding the intricate molecular mechanism of a metabolic enzyme produced in most forms of life on Earth. The finding, published in the January 9 issue of Science, concerns nicotinamide nucleotide transhydrogenase (TH), an ancient evolutionary enzyme found throughout the animal kingdom as well as in plants and many simpler species. The enzyme is part of a process key to maintaining healthy cells and has also recently been linked to diseases such as diabetes and cancer. "Despite its importance, TH has been one of the least-studied of mitochondrial enzymes," said TSRI Associate Professor C. David Stout. "Our new study helps clear up some mysteriessuggesting how the enzyme structure might harness protons and indicating that its two sides are able to alternate functions, always staying in balance." Powering the Cell 	

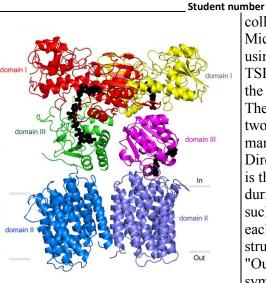
of narratives, typically personal and subjective. Dynamic thinkers use more

In humans and other higher organisms, TH enzymes work within mitochondria, the tiny, double-hulled oxygen reactors that help power most cellular processes.

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As a mitochondrion burns oxygen, it pumps protons (hydrogen atoms denuded of their electrons) out of its inner compartment ("matrix"), creating an excess of these charged particles just outside its inner membrane. TH enzymes, which are fixed at one end within this membrane, allow a one-by-one flow of protons back through the membrane within the matrix. This process--which is similar to that which makes ATP, the cell's universal source of energy--has also been linked to the production of a compound called NADPH, which is crucial for defusing oxygen free radicals to maintain cell health.



The new study provides insight into how a critical mitochondrial enzyme, transhydrogenase (TH), works in a process that is key to maintaining healthy cells Image by Josephine Leung, courtesy of the Stout lab, The Scripps Research Institute. Stout's laboratory and others have previously described portions of the TH enzyme that protrude from the membrane into the mitochondrial matrix. But a precise understanding of TH's mechanism has been elusive. In its entirety, the enzyme has an exceptionally loose structure that makes it hard to evaluate using X-ray crystallography, the standard tool for determining the structures of large proteins at atomic-level resolution.

"Key details we've been lacking include the structure of TH's transmembrane portion, and the way in which the parts assemble into the whole enzyme," said Josephine H. Leung, a graduate student in the Stout laboratory who was lead author of the study.

New Clues to a Dynamic Structure

In the new study, thanks to technology developed by Professor Vadim Cherezov, now of University of Southern California, Leung and her colleagues were able for the first time to form crystals (neatly lined-up groupings) of the TH transmembrane portion and use X-ray crystallography to determine its structure-to an atomic-level resolution of 2.8 angstroms (280 trillionths of a meter). The team also was able to grow crystals of the whole TH enzyme. These yielded a much lower-resolution structural image, but the researchers were able to enhance the resolution to 6.9 angstroms by plugging in data from crystallography of individual TH portions. In a further study, Professor Bridget Carragher and

colleagues at the TSRI-based National Resource for Automated Molecular Microscopy (NRAMM) imaged individual copies of the enzyme to 18 angstroms using electron microscopy. Stout emphasized that such seamless collaborations at TSRI made this work possible: "Only an environment as at Scripps would enable the study of transhydrogenase."

The electron microscopy data confirmed that TH naturally exists as a "dimer"-two identical copies bound together--and provided major clues to how TH manages to work in this conformation.

Directly above TH's transmembrane structure, just inside the mitochondrial matrix, is the "domain III" structure that binds NADPH's precursor molecule, NADP+, during conversion to NADPH. Structural biologists haven't understood how two such structures could work side by side in the TH dimer and not interfere with each other's activity. The new structural data suggest that these side-by-side structures are highly flexible and always have different orientations.

"Our most striking finding was that the two domain III structures are not symmetric--one of them faces up while the other faces down," said Leung. In particular, one of structures is oriented apparently to catalyze the production of

NADPH, while the other is turned towards the membrane, perhaps to facilitate transit of a proton. The new structural model suggests that with each proton transit, the two domain III structures flip and switch their functions. "We suspect that the passage of the proton is what somehow causes this flipping of the domain III structures," said Leung.

But much work remains to be done to determine TH's precise structure and mechanism. For example, the new structural data provide evidence of a likely proton channel in the TH transmembrane region, but show only a closed conformation of that structure. "We suspect that this channel can have another, open conformation that lets the proton pass through, so that's one of the details we want to study further," said Leung.

"There are many experiments to follow," Stout said.

Other co-authors of the study, "Division of labor in transhydrogenase by alternating proton translocation and hydride transfer," were Robert B. Gennis, professor of biochemistry and biophysics at the University of Illinois at Urbana-Champaign, and a research associate in his laboratory, Lici A. Schurig-Briccio, who produced whole TH proteins for analysis and characterized the activity of TH when mutated at key structural sites; Jeffrey A. Speir of NRAAM; former NRAAM member Arne Moeller, now at Aarhus University; and Mutsuo Yamaguchi, staff scientist in the Stout laboratory at TSRI.

Support for the study was provided by the National Institutes of Health (5R01GM061545) and by the National Institute of General Medical Sciences (1R01GM103838, GM095600, GM073197 and P41GM103310).

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<u>http://www.eurekalert.org/pub_releases/2015-01/epfd-nfp010515.php</u> Neuroprosthetics for paralysis: Biocompatible, flexible implant slips into the spinal cord

New therapies are on the horizon for individuals paralyzed following spinal cord injury -- the e-Dura implant developed by EPFL scientists can be applied

directly to the spinal cord without causing damage and inflammation EPFL scientists have managed to get rats walking on their own again using a combination of electrical and chemical stimulation. But applying this method to humans would require multifunctional implants that could be installed for long periods of time on the spinal cord without causing any tissue damage. This is precisely what the teams of professors Stéphanie Lacour and Grégoire Courtine have developed. Their e-Dura implant is designed specifically for implantation on the surface of the brain or spinal cord. The small device closely imitates the mechanical properties of living tissue, and can simultaneously deliver electric impulses and pharmacological substances. The risks of rejection and/or damage to the spinal cord have been drastically reduced. An article about the implant will appear in early January in Science Magazine.

So-called "surface implants" have reached a roadblock; they cannot be applied long term to the spinal cord or brain, beneath the nervous system's protective envelope, otherwise known as the "dura mater," because when nerve tissues move or stretch, they rub against these rigid devices. After a while, this repeated friction causes inflammation, scar tissue buildup, and rejection.

An easy-does-it implant

Flexible and stretchy, the implant developed at EPFL is placed beneath the dura mater, directly onto the spinal cord. Its elasticity and its potential for deformation are almost identical to the living tissue surrounding it. This reduces friction and inflammation to a minimum. When implanted into rats, the e-Dura prototype caused neither damage nor rejection, even after two months. More rigid traditional implants would have caused significant nerve tissue damage during this period of time.

The researchers tested the device prototype by applying their rehabilitation protocol -- which combines electrical and chemical stimulation - to paralyzed rats. Not only did the implant prove its biocompatibility, but it also did its job perfectly, allowing the rats to regain the ability to walk on their own again after a few weeks of training.

"Our e-Dura implant can remain for a long period of time on the spinal cord or the cortex, precisely because it has the same mechanical properties as the dura mater itself. This opens up new therapeutic possibilities for patients suffering from

neurological trauma or disorders, particularly individuals who have become paralyzed following spinal cord injury," explains Lacour, co-author of the paper, and holder of EPFL's Bertarelli Chair in Neuroprosthetic Technology. Flexibility of tissue, efficiency of electronics

Developing the e-Dura implant was quite a feat of engineering. As flexible and stretchable as living tissue, it nonetheless includes electronic elements that stimulate the spinal cord at the point of injury. The silicon substrate is covered with cracked gold electric conducting tracks that can be pulled and stretched. The electrodes are made of an innovative composite of silicon and platinum microbeads. They can be deformed in any direction, while still ensuring optimal electrical conductivity. Finally, a fluidic microchannel enables the delivery of pharmacological substances - neurotransmitters in this case - that will reanimate the nerve cells beneath the injured tissue.

The implant can also be used to monitor electrical impulses from the brain in real time. When they did this, the scientists were able to extract with precision the animal's motor intention before it was translated into movement.

"It's the first neuronal surface implant designed from the start for long-term application. In order to build it, we had to combine expertise from a considerable number of areas," explains Courtine, co-author and holder of EPFL's IRP Chair in Spinal Cord Repair. "These include materials science, electronics, neuroscience, medicine, and algorithm programming. I don't think there are many places in the world where one finds the level of interdisciplinary cooperation that exists in our Center for Neuroprosthetics."

For the time being, the e-Dura implant has been primarily tested in cases of spinal cord injury in paralyzed rats. But the potential for applying these surface implants is huge - for example in epilepsy, Parkinson's disease and pain management. The scientists are planning to move towards clinical trials in humans, and to develop their prototype in preparation for commercialization.

http://bit.ly/11hNqBw

"The Flu Has Been Making People Sick for At Least 500 Years The 1918 flu pandemic gets all the headlines, but the malady is thought to have first appeared in the 16th century - and possibly earlier By Laura Clark smithsonian.com

There's no doubt about it - flu season is here. The <u>CDC reported</u> in late December that over half of America is experiencing a high rate of flu, and the numbers are expected to climb.

The offending strain this year - to blame for about <u>95 percent of cases</u> - is H3N2, which is bad news for anyone hoping that the flu shot might guarantee an infection-free winter. Thanks to a virus mutation that occurred after the shot was

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manufa preven pregna protect It is ha panden 1919 " that the the wo Scienti <u>China,</u> the viru The fir have af States. later, th caused it's beli Seven peak of	ictured, this year's vaccine ing the flu. (Though <u>exper</u> nt women, the disabled and ion is still better than none of to talk about the flu with nics - and the most deadly Spanish flu." The pandemi disease originated in Spai disease orig	e is believed to be <u>only 33 percent effective</u> at <u>rts</u> recommend that people - especially childred d the elderly - still get the vaccine, since some e at all.) hout mentioning the most deadly of all flu of <u>all disease outbreaks in history</u> - the 1918- ic got its name from the erroneous assumption in, but it killed up to <u>50 million</u> people around may actually have <u>first emerged in</u> ent on that. What we're surer of, however, is to f it - has been around for hundreds of years. to have begun <u>in the summer of 1510</u> and to d Europe before moving east through the Balt a particularly high mortality rate, but fifty yea gnificantly more deadly. This round, the flu ike symptoms in people from China to Europe more than two years. lus a rash of smaller epidemics confined to sir hought to have occured prior to 1918, too. The <u>in 1781</u> saw two-thirds of Rome's population	http://bit.ly/1C6gnfK Orangutan Figures Out How to Communicate Like a Person Tilda, a female orangutan at the Cologne Zoo in Germany, appears to have figured out that if she communicates like a person, she can better grab the attention of zookeepers. Jan 8, 2015 02:00 PM ET // by Jennifer Viegas She is the first wild-born Bornean orangutan known to produce novel human-like vocalizations, according to a paper published in PLOS ONE. She is also the only wild born orangutan that can whistle tunes, just as humans do. Tilda's background is somewhat of a mystery, but it's suspected that as a youngster, she was a circus a nimal. Apes laugh similar to humans, according to new research exploring the evolution of laughter. "It is our belief that Tilda learned to produce these calls from humans while she was in the entertainment business, putatively by copying a human trainer," lead author Adriano Lameira of the University of Amsterdam's Institute for Biodiversity and Ecosystem Dynamics, told Discovery News. Tilda is now producing the calls all on her own without prompting, and with a specific goal in mind. Lameira and his team came to these conclusions after making video and audio recordings of Tilda and then analyzing her communications. Two of her calls are unknown among other orangutans and show human-like characteristics, the
the work Scienti <u>China.</u> the viru The fir have at States. later, th caused it's beli Seven cities, th peak of falling make 1 Some th Some the loth ce mention unhear believe historia lacking All in a epidem mutate preven hey, at	Id. sts believe the Spanish flu but there's not full agreem is - or at least variations of st flu pandemic is thought fected people in Africa an This first flu didn't inflict are outbreak of 1557 was si <u>pleurisy</u> and pneumonia-lif eved to have persisted for other major pandemics - ple gions or countries - are th one pandemic that began ill and over 30,000 new ca ast season's 53,470 confirm nedical historians say that ntury and into antiquity. T ned in writings dating as fa d of cough" spreading thro flu pandemics have been ans strongly caution that a c.) Ill, over the past 500 years ic has occurred <u>approxima</u> s, creating new strains and ion efforts. How bad will least you have the advanta	may actually have <u>first emerged in</u> ent on that. What we're surer of, however, is to f it - has been around for hundreds of years. to have begun <u>in the summer of 1510</u> and to d Europe before moving east through the Balt a particularly high mortality rate, but fifty yea gnificantly more deadly. This round, the flu ike symptoms in people from China to Europe more than two years. lus a rash of smaller epidemics confined to sir hought to have occured prior to 1918, too. The	 wild born orangutan that can whistle tunes, just as humans do. Tilda's background is somewhat of a mystery, but it's suspected that as a youngster, she was a circus animal. Apes laugh similar to humans, according to new research exploring the evolution of laughter. "It is our belief that Tilda learned to produce these calls from humans while she was in the entertainment business, putatively by copying a human trainer," lead author Adriano Lameira of the University of Amsterdam's Institute for Biodiversity and Ecosystem Dynamics, told Discovery News. Tilda is now producing the calls all on her own without prompting, and with a specific goal in mind. Lameira and his team came to these conclusions after making video and audio recordings of Tilda and then analyzing her communications. Two of her calls are unknown among other orangutans and show human-like characteristics, the researchers conclude. For one call, Tilda clicks her tongue to produce different tones, just as a human producing voiceless consonants, such as saying the letters "p," "k" and "t." For the other call, Tilda grumbles in a way that's comparable to humans producing vowel sounds. Both calls require that she rapidly open and close her mouth in rhythms similar to those of human speech. The meaning of her calls is clear, because she often claps or extends her index finger towards food in the caretakers' hands as she vocalizes. "They are what we would call attention gathering or come-hither calls, which indeed are mostly used when the human caretakers are handling food," Lameira said. "I would translate them into, 'Come here and give that food Aside from revealing Tilda's cleverness, the findings suggest that the common ancestor of
comfor	t them.		Chimpanzees, for example, engage in novel call production. Koko, a human- raised gorilla, sometimes babbles on her toy phone.

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Lameira said that in the wild, orangutans create their own "call cultures," where	It doesn't have to be that way. There is evidence that volunteers can be brought on
different populations produce their own unique vocalizations.	board and kept there by making more of an effort to inform them and help them to
"The notion that great ape calls are hard-wired and inflexible is likely an artifact	choose which trial they would like to enter.
of our very poor understanding of the call communication of these species, rather	We report (" <u>Radical therapies that could beat my brain tumour</u> ") how such
than that their calls are factually hard-wired or inflexible," Lameira added.	knowledge can be empowering. Former doctor Stuart Farrimond is weighing up
Tilda might meet her match in another adult orangutan, Bonnie.	experimental treatment options for his brain tumour – to his benefit and that of the
"Bonnie, a female orangutan at the National Zoo in DC, taught herself to whistle	companies behind the treatments. He is unusually well-informed, but his story
for what seems simply to be the pleasure of it, though there's no whistling known	hints at what an empowered, informed patient group might look like.
to be part of the call system of any wild apes," Mark Sicoli of Georgetown	The problems with volunteer recruitment were identified a decade ago but haven't
University's Department of Linguistics told Discovery News.	been eradicated. It is high time they were. Drug development costs – and delays –
"What Bonnie shows is that anatomically, whistling would have been in the rang	are ultimately passed onto the consumer. It is in everyone's interests to get rid of
of potential sound making behavior of Archaic Homo sapiens, including	this unnecessary waste.
Neanderthal and earlier hominins like Homo erectus and Australopithecines," he	http://phys.org/news/2015-01-burkina-faso-field.html
added.	Beating back the desert in Burkina Faso, field by field
Some of the earliest human languages were also produced by making clicking	In Burkina Faso, what was once stony semi-wasteland is now covered in
sounds, such as the "click language" of the Bushmen of the Kalahari Desert.	verdant crop fields, rescued from relentless desertification.
Orangutan vocalizations, as Sicoli and Lameira indicate, could therefore help us	January 9th, 2015 by Romaric Ollo Hien in Earth / Environment
to understand the emergence and evolution of human speech to me!"	Using simple agricultural techniques largely spread by word-of-mouth, this tiny
More information: "Speech-Like Rhythm in a Voiced and Voiceless Orangutan Call" <u>PLOS</u>	West African state has rejuvenated vast stretches of scrubby soil over the past 30
ONE, DOI: 10.1371/journal.pone.0116136	years, proving they are not doomed and giving hope to other vulnerable areas in
<u>http://bit.ly/1BSrtXC</u>	the region. One success story is Rim, a peaceful hamlet of about 3,000 people in
It's time to take drug trial participation seriously	the country's north, close to the border with Mali.
A high drop-out rate in drug trials means lots of wasted time, effort and mone	Below the village as far as the eye can see, tall stalks groan under the weight of fat
Empowering patients to choose the right trial for them could change that	cobs of "baniga", a white sorghum grown in this part of the country.
2014 was a landmark year for drug development. The US Food and Drug	"This place was a desert. But the people succeeded in regreening the region," said
Administration approved 41 new pharmaceuticals, the most since 1996. Each of	Amanda Lenhardt, a researcher with Britain's Overseas Development Institute
these will (hopefully) make the world a slightly better place, alleviating distress	(ODI), who authored a report on farming developments in Burkina Faso.
and preventing premature deaths.	Called "zai" or "stone contour", the low-cost techniques were devised from some
But developing drugs is excruciatingly expensive – and increasingly so. The cost	of the region's traditional farming techniques, nudged along with some outside
of bringing a new compound to the market is now around <u>\$2.5 billion</u> , twice as	help.
much in real terms as it was a decade ago.	They have gained favour in different parts of the Sahel region - a semi-arid band
One of the costliest parts is recruiting and retaining volunteers to test the drug in	a that spans the continent with the Sahara Desert to the north and African savannah
clinical trial. Around three-quarters of trials are delayed by problems with this	lands to the south - but have seen particular success in Burkina Faso.
process. Most trials over-recruit by up to 50 per cent to compensate, but the drop	In Rim, as in other parts of the country's north, farmers now swear by "zai" after
out rate is still so high that only 1 in 20 volunteers end up generating useful data.	again producing food on land considered lost to agriculture - the occupation of at
The result: wasted time, effort and money.	least 80 percent of the population.
That is not for lack of patient willingness. In 2013, the UK's House of Commons	The technique consists of building little stone barriers to trap runoff water and
found that people want to volunteer but don't know how. Only about 7 per cent o	f ensure it seeps into the ground, preventing erosion, agronomist Paulin Drabo
people with cancer who are eligible to participate in a trial do so, for example.	explained. Holes for planting are then dug next to the stones and packed with

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fertilise	er, which togethe	er with the improved hydration, helps	crops sprout up	<u>http://bit.ly/1xfdeWp</u>
quickly				Scientists help avert a nuclear medicine meltdown
"Before	e, when we plant	ted on bare ground, we harvested not	hing. Now, with the	University of British Columbia scientists have shown that small cyclotrons –
techniq	ue they showed	us, the meal grows well," Sita Rouar	nba, a female farmer,	particle accelerators the size of an SUV – can replace hulking nuclear power
said ha	ppily.			plants as the country's main source of medical isotopes, the radioactive atoms
The shi	ft to sustainable	techniques has also expanded the su	pply of arable land.	used for thousands of diagnostic scan across Canada each day.
In the p	ast, farmers scra	ambled for plots on the banks of rive	rs, where the soil is	The demonstration last month points the way to a safer, cleaner, more reliable and
most fe	rtile. Now they	can grow food "on any kind of soil, r	o matter how	cheaper source of medical isotopes, not just in Canada, but globally. The
degrade	ed", said 38-year	r-old Souleymane Porgo, a hoe slung	over his shoulder.	cyclotron produced enough isotopes in six hours to enable about 500 scans -
Farm y	ields are also va	stly improved.		beating the previous record almost four-fold. The quantity would be enough to
'Store 1	full of grain'			meet the daily needs of all of British Columbia's hospitals.
"At the	moment, my sto	ore is full of grain I haven't touched.	l also have plenty of	"With this solution, we'll be able to make completely locally-grown isotopes,
beans,"	Souleymane's f	ather, Saidou, who heads a family of	11 children and	without any long-term radioactive waste," said Dr. Francois Benard, a professor
several	grandchildren, s	said. His yields have made him a ma	n of means, with goats	of radiology and scientific director of functional imaging at the BC Cancer
a motor	bike and cattle,	which can be sold to pay for food if	a harvest fails.	Agency.
"All of	this helps me pr	roperly care for my family," Saidou s	aid with pride.	The breakthrough creates a viable alternative to the soon-to-be-retired National
Around	l 30 producers ir	n Rim have converted to "zai" farmin	g, out of around	Research Universal Reactor near Chalk River, Ont., which has been the country's
		id Joel Ouedraogo, director of the Fe		main source of medical isotopes. The plant, beset by leaks, high maintenance
Groupe	ments Naam, a	non-governmental organisation that v	vorks with farmers.	costs and the challenge of disposing of radioactive waste, will stop making
		300,000 hectares (500,000 and 740,00		medical isotopes in 2016.
		he size of Luxembourg - have been r		The cyclotron is housed at <u>TRIUMF</u> , Canada's national laboratory for particle and
estimat	ed. In a region the	hreatened by the advancing Sahara sa	inds, the results are	nuclear physics located adjacent to UBC's Vancouver campus. The machine
-	sive, the ODI's L			accelerates ions in a spiral, causing them to accumulate energy before channeling
		is "possible" to combat climate chang		them into a beam. The beam is aimed at a plate of molybdenum-100, a naturally
	-	doption of the new techniques to wor	d-of-mouth.	occurring isotope, and the resulting collisions create technetium-99m, an artificial
		change is dramatic.		isotope that emits gamma rays used for imaging bones, blood flow and cancers.
-		oured stretches are the areas where "		Members of UBC's Department of Radiology have been working for five years to
	•	icts in between are the newly fertile z		overcome various technical hurdles, including designing targets that can withstand
	-	oncern in Burkina Faso but the bid to	beat back the desert	very high levels of energy deposition, securely removing the irradiated material
0	yond food secu	5		from the cyclotron, and developing efficient methods of purification. The five-
	• • •	countries the impoverished former F	-	year process of trial-and-error involved many re-thinks and adjustments.
		exodus, which is straining resources i		Canada has about 24 cyclotrons suitable for making these isotopes, with several
		s from farming the lesser the lure of o		more expected to be put into operation in the next couple of years. Canada
		or 60 per cent of the population of 17		currently ships its isotopes from the Chalk River plant to the U.S. for packaging,
	• 1	resents a new generation of young vil	lager, who sees his	then buys back the finished product.
	on the land.			BACKGROUND: New source of medical isotopes
		o seek his fortune in neighbouring Ive		A revealing isotope: About 4 per cent of Canadians need a diagnostic
U	5	ng wooed back by the "zai" revolution	n, the father of four is	examination with technetium-99m each year. The isotopes, which only last for six
home to	o stay.			hours, are typically attached to a carrier molecule and then tracked by the gamma

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rays the	ey emit. The re	esulting images can reveal whether a cancer has	spread to	Afghanistan, Nigeria, Pakistan, Somalia and Yemen. South Sudan may also be
bones, o	or how well bl	lood is flowing to the heart or brain.		included when the collected data has been analysed closely.
Atomic	uncertainty:	Until recently, nuclear plants were able to mee	t the global	A war is defined as an armed conflict where at least 1,000 people have died in
		sotopes, and despite the cost of running reactors		fighting in one year. Minor armed conflicts are those with 25–999 deaths per year.
resultin	g <u>radioactive</u> v	waste, alternative methods were barely explored	1. Canada's	Some of the less intense conflicts have seen increased activity in 2014, for
effort, f	funded by the I	Natural Sciences and Engineering Research Co	uncil, Natural	instance the conflict between Armenia and Azerbaijan. However, it is still too
		d the Canadian Institutes of Health Research, w		early to pin down the precise number of conflicts since this requires more work by
		wn of the Chalk River plant in 2009 and the sub	osequent	the researchers at the UCDP.
	n to close it pe			"These data should give the international community stronger incentives to make
		apan have all expressed interest in what we're d	-	sure the conflicts in the Middle East don't escalate further and to find peaceful
	-	arly interested, because they don't have nuclear	-	solutions. Also, the developments in Afghanistan should be followed closely since
-	-	ons that could be used for this," said Thomas Ru		NATO's military operation has ended", says Project Manager Therése Pettersson.
-		's department of medicine and a senior research		The researchers also point to a few positive events during the year. A peace
		F-affiliated company, Applied Physics Solution	s Inc., is	agreement has been signed in the long-lived conflict in Mindanao in the
	-	bgy for the global market.		Phillipines.
		rd is finalizing details of a clinical trial in Vanc		"This is an agreement that bridges conflicts between Christians and Muslims. It is
	-	the cyclotron-produced medical isotopes behav		also the first where a female chief negotiator is the first name on the document.
		actors. The trial, expected to begin this summer		Also, the peace process in Colombia has moved forward, since the president was
		vill involve 50 to 60 patients. If the trial is a suc		given a renewed mandate in the election earlier in the year and a general has been
-		F would likely be dedicated to medical isotope r	production in	released by the gerilla", says Peter Wallensteen.
	as soon as 201			http://www.eurekalert.org/pub_releases/2015-01/uops-cha123014.php
		ability of producing <u>medical isotopes</u> on cyclotr		Coupling head and neck cancer screening and lung cancer scans
		stant professor of radiology and TRIUMF's hea		could improve survival
medicin		v working with Health Canada to put the solution	ons in place.	People most at risk for lung cancer are also most at risk for head and neck
		//phys.org/news/2015-01-sudden-wars.html		cancer
		udden rise in the number of wars		PITTSBURGH - Adding head and neck cancer screenings to recommended lung
Th	•	on-going wars exceeded ten during 2014, whic	•	cancer screenings would likely improve early detection and survival, according to
T1 ·	-	ed to previous years since the new millennium		a multidisciplinary team led by scientists affiliated with the University of
		ven wars in 2013 is also the most significant inc		Pittsburgh Cancer Institute (UPCI), a partner with UPMC CancerCenter.
-		searchers at the Uppsala Conflict Data Program	· · ·	In an analysis published in the journal Cancer and funded by the National
-	-	nt of the global conflict situation at the end of 2		Institutes of Health (NIH), the team provides a rationale for a national clinical trial
	s in Syria and	ng wars also have very high numbers of deaths,	primarily the	to assess the effectiveness of adding examination of the head and neck to lung
		pends partly on entirely new wars that have flar	rad up such	cancer screening programs. People most at risk for lung cancer are also those most
		e where the UCDP differentiates between the tw		at risk for head and neck cancer.
		also seen an escalation of previously low-inten	-	"When caught early, the five-year survival rate for head and neck cancer is over
		Gaza war is the deadliest confrontation betwee		83 percent," said senior author Brenda Diergaarde, Ph.D., assistant professor of epidemiology at Pitt's Graduate School of Public Health and member of the UPCI.
	U	two decades. Drawn-out conflicts are also ongo		"However, the majority of cases are diagnosed later when survival rates generally
i ulostili	nun Broups III	the accures. Drawn out connets are also onge		1 nowever, the majority of cases are tragnosed rater when survival fates generally

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shrink	below 50 percent	nt. There is a strong need to develop strategies that will	<u>http://bit.ly/1xfGLzq</u>
result	in identification	of the cancer when it can still be successfully treated."	Brothers Who Are Murderers: Why So Many?
Head a	and neck cancer i	is the world's sixth-most common type of cancer.	From genetics to life at home, there appear to be a number of factors that
World	wide every year,	, 600,000 people are diagnosed with it and about 350,000	predispose some brothers to violent behavior.
die. To	bacco use and a	lcohol consumption are the major risk factors for	by Jennifer Viegas
develo	ping the cancer.		So it may not be a coincidence that two sets of brothers have been identified as
The ea	rly symptoms ar	re typically a lump or sore in the mouth or throat, trouble	terrorist suspects Dzhokhar Tsarnaev and his slain brother, Tamerlan Tsarnaev,
swallo	wing or a voice of	change, which are often brushed off as a cold or somethin	in the Boston Marathon bombing and, now, brothers Saïd Kouachi and Cherif
that wi	ill heal. Treatmen	nt, particularly in later stages, can be disfiguring and can	Kouachi for the killing of 12 people at the offices of the Charlie Hebdo newspaper
change	e the way a perso	on talks or eats.	in Paris. The Kouachi brothers were killed by police today as the pair held a
Dr. Di	ergaarde and her	t team analyzed the records of 3,587 people enrolled in the	hostage outside of Paris.
Pittsbu	irgh Lung Screer	ning Study (PLuSS), which consists of current and ex-	"There are numerous factors" that contribute to terror-related murders, "including
smoke	rs aged 50 and o	lder, to see if they had a higher chance of developing head	neurobiological, personality, social and cultural," neuropsychologist Robert
and ne	ck cancer.		Hanlon of the Northwestern University Feinberg School of Medicine told
In the	general U.S. pop	oulation, fewer than 43 per 100,000 people would be	Discovery News.
		ad and neck cancer annually among those 50 and older.	He added, "One brother is usually a stronger character and the leader of the two.
		ticipants, the rate was 71.4 cases annually per 100,000	The other brother is a follower and is influenced by the leader-brother. The
people			follower wants to please the leader and obtain the respect of the leader."
		ventive Services Task Force, as well as the American	Hanlon added that such siblings tend to be male, with men committing 90 percent
		veral other organizations, recommended annual screening	of murders annually in the United States alone. "Due to biological, psychological
		w-dose computed tomography in people 55 to 74 years of	
with a	smoking history	v averaging at least a pack a day for a total of 30 years. The	· · ·
		after a national clinical trial showed that such screening	In addition to terrorist duos, there are also a number of serial killers who are
	s lung cancer mo	•	brothers, such as Pete and Pat Bondurant, Larry and Danny Ranes and Reginald
	-	r is relatively rare, and screening the general population	and Jonathan Carr, just to name a few. Terrorism is a subtype of violence that, as
		said co-author David O. Wilson, M.D., M.P.H., associate	Hanlon indicates, can have multiple driving influences. Neuroscientist Jeremy
		ing Cancer Center. "However, the patients at risk for lung	Richman of The Avielle Foundation added, "All of our behavior has both a
		d refer for the newly recommended annual screening are	genetic and environmental component they cannot be separated."
		our study shows also likely would benefit from regular hea	
	-	nings. If such screening reduces mortality in these at-risk	increase a person's risk for violent behavior 13-fold: MAOA and CDH13. The
		a convenient way to increase early detection and save	research was led by Jari Tiihonen, a professor in the Department of Clinical
lives."	,	5	Neuroscience at the Karolinska Institute in Sweden. He points out that men are
	ergaarde's team i	is collaborating with otolaryngologists to design a nationa	
	-	ine if regular head and neck cancer screenings for people	"Since MAOA is located in the X-chromosome, men have only one copy of the
		r screenings would indeed reduce mortality.	gene and women have two copies," Tiihonen said, explaining that women have
		this study are Ronak Dixit, Joel L. Weissfeld, M.D., M.P.H., Paul	
Balogh,	D.N.P., F.N.P., P.	amela Sufka and Jennifer R. Grandis, M.D., F.A.C.S., all of Pitt;	(alternative form of a gene that arises by mutation) and one high- activity allele,
		D., of the University of Minnesota.	but if males have a low activity allele, they cannot have another allele functioning
This res	search was funded	by NIH grants P50 CA097190, P50 CA090440 and P30 CA04790	^{4.} more efficiently because they have only one copy of the gene."

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It's the	en possible that	the genes are passed down in families, mostly affecting	at the time that this was the remnants of one of the largest meteoroids to have
males.	A forthcoming	study on twins, which will be published in the journal	entered Earth's atmosphere during the decade (Nature, 10.1038/nature03881).
Biolog	gical Psychology	y, found that some males, even as children, have a	Second, in 2007, another team used global infrasound (low-frequency sound) data
measu	rable "state of le	ow arousal in the brain" that may require riskier, more	to triangulate the location of a big bang that was picked up by remote sensors on
impuls	sive and higher	excitement activities "to achieve the arousal levels that a	that same date (Earth, Moon and Planets, 10.1007/s11038-007-9205-z. They
norma	lly aroused brai	in typically experiences."	pinpointed the Antarctic ice shelf, very close to where Müller spotted his ice
On the	e "nurture" side	of nature/nurture, several studies have found that the	crater and speculated the bang had been made by a meteoroid the size of a house.
enviro	nment in which	children are raised can have a profound impact on the way	Müller and his colleagues say their theory still needs to be carefully checked out,
	rains process in		and will be conducting further studies.
		la Chraid, of the University of Bucharest's Faculty of	http://www.eurekalert.org/pub_releases/2015-01/icl-eag010815.php
		ational Sciences, found that children who are raised in	eLearning as good as traditional training for health professionals
		luding with abusive individuals, can become desensitized to	Electronic learning could enable millions more students to train as doctors and
		cious level. They often are unaffected emotionally when	nurses worldwide, according to research.
	-	ts, such as beheadings, which otherwise disturb children	A review commissioned by the World Health Organisation (WHO) and carried
	mpathize with the		out by Imperial College London researchers concludes that eLearning is likely to
		eliefs, although often mentioned in the media as playing a	be as effective as traditional methods for training health professionals.
	-	t acts, have been falsely implicated, Hanlon said.	eLearning, the use of electronic media and devices in education, is already used
-		I murderers are predisposed to violence as a result of their	by some universities to support traditional campus-based teaching or enable
		ocial psychopaths). Because of their antisocial personalities,	distance learning.
•		rganizations with which they can identify. Then, their	Wider use of eLearning might help to address the need to train more health
		tendencies are reinforced by the leaders of terror	workers across the globe. According to a recent WHO report, the world is short of
-	zations and they	y are motivated to kill for the cause of the organization," he	7.2 million healthcare professionals, and the figure is growing.
said.			The Imperial team, led by Dr Josip Car, carried out a systematic review of the
	-	ion and religious beliefs, in my opinion, play a very small	scientific literature to evaluate the effectiveness of eLearning for undergraduate
role in	terror-related n	nurders. Religion is used as an excuse by murderers to kill."	health professional education.
		http://bit.ly/1BSVeaS	They conducted separate analyses looking at online learning, requiring an internet
	0	e in Antarctic ice hints at meteorite impact	connection, and offline learning, delivered using CD-ROMs or USB sticks, for
	•	ight over the Antarctic ice shelf on 20 December last year,	example.
geop	hysicist Christia	an Müller spotted something strange: a huge, 2-kilometre-	The findings, drawn from a total of 108 studies, showed that students acquire
		wide circle on the ice.	knowledge and skills through online and offline eLearning as well as or better
N / ·· 11		18:08 09 January 2015 by Catherine Brahic	than they do through traditional teaching.
		with research consultants Fielax from Bremerhaven,	The authors suggest that combining eLearning with traditional teaching might be
		arctica as part of a polar survey conducted by the German	more suitable for healthcare training than courses that rely fully on eLearning
		tute. Six days after spotting the weird ice-ring, he and his	because of the need to acquire practical skills.
	•	nd flew over the site at two different altitudes, to photograph	Dr Josip Car, from the School of Public Health at Imperial College London said:
		king theory is that the ring marks an ice crater left by a large	
		ed into Antarctica in 2004.	workers by enabling greater access to education, especially in the developing
		seem to back up this theory. First, a trail of dust was seen 30	
KHOIM	and above And	arctica on 3 September 2004. An Australian team speculated	I

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"There	are still barriers	s that need to be overcome, such as access to computers		The Cancer Drugs Fund is about to introduce price-caps on the drugs it will fund.
interne	et connections, a	and learning resources, and this could be helped by		The pharmaceutical industry has already been told some of their drugs - including
facilita	ting investment	ts in ICT. Universities should encourage the development	t of	Jevtana, Zaltrap and Halaven - are being pulled as a result.
eLearn	ing curricula an	nd use online resources to reach out to students		Profit problems
interna	tionally."			There will inevitably be outrage in some quarters when the announcement -
		duate health professional education: A systematic review inform	ng a	expected Monday or Tuesday - is made.
		fhealth workforce development" will be published at		The Association of the British Pharmaceutical Industry has already said it would
http://w		elines.org/ on Monday 12 January 2015.		"deplore any decision to restrict or remove patient access to cancer medicines".
		p://www.bbc.com/news/health-30731875		Yet there is a much more fundamental conundrum that needs addressing.
		s: How do we pay for innovative drugs?		The Cancer Drugs Fund is a sticking plaster - it exists because the old system no
A pot	of money to giv	e cancer patients access to expensive, life-extending d	ugs	longer works. So how does the industry make a profit (out of drugs that are often
		is about to get controversial.		taken for just a few months) while the NHS gets a price it can afford?
		mes Gallagher Health editor, BBC News website	1	Breakthrough Breast Cancer describes the Cancer Drugs Fund as "a short-term fix
		ind in England is certainly popular with patients - too pop	ular,	for a long-term problem" adding that "the long-term solution is now long
		ill be culling some of the drugs it funds because it is		overdue". All eyes are on the government's "Innovative Medicines and Medical
	<u>g towards a £10</u>	· · · · · · · · · · · · · · · · · · ·	_	Technology Review" which is expected to report before the Autumn.
	-	angered some, raised questions about how the NHS pay	S	http://s.nikkei.com/1BYf6ao
		ags and led to calls for the fund to be scrapped entirely.	for	Takeda to grow licorice for medicine in Japan
		for Health and Care Excellence (NICE) approves drugs		Takeda Pharmaceutical will start growing licorice in Japan, marking the first
		NHS. It is prepared to fork out up to £30,000 for a cours a year (adjusted to take account of the quality of life	e or	time that the key herbal-medicine ingredient is produced in quantity here.
		around double that for "end-of-life" drugs including the	•	TOKYO - Takeda recently registered a new licorice breed that has a higher yield
for car	/ 1 /	around double that for end-of-file drugs including those	e	per plant than conventional domestic licorice. Active ingredients for reducing
		cancer medicines are coming with hefty price tags, som		swelling and other effects have met the requirements set by the health ministry.
		quality-adjusted life year (to use the technical jargon).	5	The Japanese drugmaker has been trying to develop a suitable breed at a Kyoto
	'dilemma'	quanty-adjusted me year (to use the technical jargon).		facility since 1996. Having tried volume production in Hokkaido since 2012, it
		on campaigning in 2010, the now Prime Minister David		now has prospects for harvesting enough to make and sell drugs.
		Cancer Drugs Fund, a £200m-a-year pot of money to pay	for	The aim is to release an over-the-counter drug using the new licorice breed within
	uper-expensive		101	five years. Takeda already sells OTC herbal medicine, having grown rhubarb a
	1	d to expire last year, but has been extended until 2016.		key ingredient of laxatives domestically since 1972. Licorice is also a key
		ligible patients. Around 55,000 have used the scheme; so	me	ingredient of laxatives.
	•	hs or even years of life through drugs which the NHS or		Domestic drugmakers have so far relied on licorice from China, where growing
	normally afford.		ulu	demand has caused prices to spike and fueled concerns over the stability of the
	•	s, as Dr Mangesh Thorat, a cancer doctor at Queen Mary		supply.
		has argued: "This issue presents me with a dilemma - a		"We hope to increase the planted acreage [of licorice] in Japan to continue
		happy that this Cancer Drugs Fund prevents my patients		supplying products even if we can no longer import from China," says Masashi
		atments towards the end of their life. "However, on the c		Sugimoto, president of Takeda's consumer health care unit.
	•	not only undermines NICE but also discriminates against		The domestic market for herbal medicine, including prescription drugs, totaled
		ations who have diseases other than cancer."	•	about 141 billion yen (\$1.16 billion at current rates) in 2012 by production value,
runom	S III SIIIII SILU	when some have abouted only than earlier.		

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up about 20% from 2008. Demand for herbal medicine, which is said to have	The findings, interpretations, and conclusions expressed in the study are entirely
fewer side effects than conventional pharmaceuticals, is projected to grow as the	those of the authors and do not necessarily represent the views of the U.S.
nation's population grays.	Department of the Treasury.
Takeda sees OTC drugs as a key business in its domestic operations amid a slump	http://www.bbc.com/news/health-29458635
in its prescription drug business following the expiration of patents on mainstay	Plasters for the mind - the rise in mental health first aid
products.	Mental health first aid training, which teaches to recognise signs and symptoms
http://www.eurekalert.org/pub_releases/2015-01/yu-cef010915.php	of mental health problems and respond appropriately, is growing in force.
Children eligible for expanded Medicaid contribute more in taxes	By Helen Briggs BBC News
as adults	Tony Jorm and Betty Kitchener were out for a stroll in their home town in
A new study finds that children who received expanded Medicaid benefits in the	Australia when the idea came to them.
1980s and 1990s contributed more to the U.S. tax system as adults.	Prof Jorm, a researcher at the University of Melbourne, was discussing a recent
New Haven, Conn They also were more likely to attend college and less likely to	mental health conference with his wife, a registered nurse.
die prematurely in adulthood.	He recalled that someone had remarked: "What we need is first aid for
The study is based on an analysis of tax returns for nearly all children born in the	depression."
United States from 1981 to 1984. It compared children from similar backgrounds	The couple took the comment literally and were inspired to develop a training
who were eligible for Medicaid for different lengths of time, depending on where	course in mental health first aid.
and when they were born.	"We do come up with the best ideas while walking the dog," says Betty, a
Medicaid, which began in 1965, is a public health insurance program for low-	registered nurse. "Once the USA took it on, I thought, 'Wow this is amazing'."
income people. It expanded dramatically in the 1980s and again in the 1990s, with	Mental health first aid training - which teaches participants how to recognise the
the establishment of the State Children's Health Insurance Program. Historically,	signs and symptoms of mental health problems and to respond appropriately - is
states have set different eligibility thresholds for Medicaid.	growing in force.
Yale University economist Amanda Kowalski, one of the study's co-authors, said	Since it was founded in Australia more than a decade ago, mental health first aid
the research has implications for today's Medicaid landscape, as well. "Although	training has spread around the world, to New Zealand, the US, Canada, Hong
it will take years to know the long-term impact of current expansions of Medicaid	Kong, Singapore, Denmark, Sweden, Finland and the UK. Betty speaks to me
undertaken as part of the Affordable Care Act, this study shows that the	from Ireland, where she is advising on the rollout of a national programme next
investments that the government made in Medicaid in the 1980s and 1990s are	year. "The aim is to increase mental health literacy of members of the community
paying off in the form of higher tax payments now," Kowalski said.	including reducing stigmatisation of the illness and people learning simple first
According to the study, the federal government recouped 14 cents for each dollar	aid skills to be able to see mental illness as like any other illness," she explains.
spent on childhood Medicaid by the time the children reached age 28. Assuming	In England the training is run by a social enterprise company, MHFA England. It
these higher tax payments persist, the federal government would recoup 56 cents	would like to see mental health training given equal prominence to physical first
on each dollar by the time these children reach age 60.	aid training and says this is already starting to happen.
Children eligible for more years of Medicaid made higher combined income and	Glenn Scott was already a qualified first aider when he was offered the course by
payroll tax payments as adults, the study found. They also collected less from the	his company. And he was soon putting it into practice. He was at an event at
Earned Income Tax Credit, and females had higher cumulative wages.	Twickenham Rugby Stadium when he saw a woman having a panic attack. A first
In addition to Kowalski, who also is affiliated with the National Bureau of	aider was by her side, but did not seem to know what to do. The 56-year-old
Economic Research (NBER), the study's co-authors are David Brown and Ithai	catering worker intervened and encouraged her to bring her breathing under
Lurie, from the Office of Tax Analysis at the U.S. Department of the Treasury.	control.
The study was released Jan. 12 as an NBER Working Paper.	

"I stepped in and calmed the lady down following my mental first aid training," he says. "I was really impressed that I was able to put my training into practice and actually see it work."

He says the training has improved his understanding of mental health issues, and how to deal with stressful situations at work. "It's really taught me how to speak to people who are vulnerable," he says.

Chris Morgan from Kent is a mental health first aid trainer who knows this from personal experience. He is open about his own struggles with mental health issues during his 40s, while he was running a faltering family business.

"I had to close the company down and make everybody redundant, including myself," he says. "And during that process I got depressed."

He says that over a period of months he got "lower and lower" and "couldn't see any way out of it". "I had suicidal thoughts for months and it came to a crisis for me when I left home one day and determined never to go back and to take my own life."

But he couldn't go through with it and asked his wife and GP for help. He was put in touch with a psychiatrist and eventually made a full recovery. The experience also led to a new career - first in the NHS on suicide prevention work, then as a mental health first aid instructor and trainer.

Chris says people go away from the course with a different perspective on mental health issues and more willingness to listen to other people and to offer help.

"I think one particularly rewarding thing is seeing people realise that everybody has mental health in the same way that everybody has physical health and we should look after our own mental health," he says. "And if we don't we're at risk of developing some kind of mental illness."