http://www.eurekalert.org/pub_releases/2014-09/si-sda091914.php

Scientists discover an on-off switch for aging cells

Scientists at the Salk Institute have discovered an on-and-off "switch" in cells that may hold the key to healthy aging.

La Jolla - This switch points to a way to encourage healthy cells to keep dividing and generating, for example, new lung or liver tissue, even in old age.

In our bodies, newly divided cells constantly replenish lungs, skin, liver and other organs. However, most human cells cannot divide indefinitely–with each division, a cellular timekeeper at the ends of chromosomes shortens. When this timekeeper, called a telomere, becomes too short, cells can no longer divide, causing organs and tissues to degenerate, as often happens in old age. But there is a way around this countdown: some cells produce an enzyme called telomerase, which rebuilds telomeres and allows cells to divide indefinitely.

In a new study published September 19th in the journal Genes and Development, scientists at the Salk Institute have discovered that telomerase, even when present, can be turned off.

"Previous studies had suggested that once assembled, telomerase is available whenever it is needed," says senior author Vicki Lundblad, professor and holder of Salk's Ralph S. and Becky O'Connor Chair. "We were surprised to discover instead that telomerase has what is in essence an 'off' switch, whereby it disassembles."

Understanding how this "off" switch can be manipulated–thereby slowing down the telomere shortening process–could lead to treatments for diseases of aging (for example, regenerating vital organs later in life).

Lundblad and first author and graduate student Timothy Tucey conducted their studies in the yeast Saccharomyces cerevisiae, the same yeast used to make wine and bread. Previously, Lundblad's group used this simple single-celled organism to reveal numerous insights about telomerase and lay the groundwork for guiding similar findings in human cells.

"We wanted to be able to study each component of the telomerase complex but that turned out to not be a simple task," Tucey said. Tucey developed a strategy that allowed him to observe each component during cell growth and division at very high resolution, leading to an unanticipated set of discoveries into how–and when–this telomere-dedicated machine puts itself together.

Every time a cell divides, its entire genome must be duplicated. While this duplication is going on, Tucey discovered that telomerase sits poised as a "preassembly" complex, missing a critical molecular subunit. But when the genome has been fully duplicated, the missing subunit joins its companions to form a complete, fully active telomerase complex, at which point telomerase can replenish the ends of eroding chromosomes and ensure robust cell division.

Surprisingly, however, Tucey and Lundblad showed that immediately after the full telomerase complex has been assembled, it rapidly disassembles to form an inactive "disassembly" complex - essentially flipping the switch into the "off" position. They speculate that this disassembly pathway may provide a means of keeping telomerase at exceptionally low levels inside the cell. Although eroding telomeres in normal cells can contribute to the aging process, cancer cells, in contrast, rely on elevated telomerase levels to ensure unregulated cell growth. The "off" switch discovered by Tucey and Lundblad may help keep telomerase activity below this threshold.

This research was supported by the National Institutes of Health, the Fritz B. Burns Foundation and a Rose Hills Foundation Fellowship.

http://www.eurekalert.org/pub_releases/2014-09/uosd-asi092214.php

Arctic sea ice helps remove CO2 from the atmosphere

Due to global warming, larger and larger areas of sea ice melt in the summer and when sea ice freezes over in the winter it is thinner and more reduced.

As the Arctic summers are getting warmer we may see an acceleration of global warming, because reduced sea ice in the Arctic will remove less CO2 from the atmosphere, Danish scientists report.

"If our results are representative, then sea ice plays a greater role than expected, and we should take this into account in future global CO2 budgets", says Dorte Haubjerg Søgaard, PhD Fellow, Nordic Center for Earth Evolution, University of Southern Denmark and the Greenland Institute of Natural Resources, Nuuk.

Only recently scientists have realized that sea ice has an impact on the planet's CO2 balance.

"We have long known that the Earth's oceans are able to absorb huge amounts of CO2. But we also thought that this did not apply to ocean areas covered by ice, because the ice was considered impenetrable. However, this is not true: New research shows that sea ice in the Arctic draws large amounts of CO2 from the atmosphere into the ocean", says Dorte Haubjerg Søgaard.

Dorte Haubjerg Søgaard has just completed her studies of sea ice in Greenland. The studies show that sea ice may have a major impact on the global carbon cycle, and that chemical processes have a much greater impact on the sea ice's ability to remove CO2 than biological processes. The research is published as a series of articles in scientific journals.

"The chemical removal of CO2 in sea ice occurs in two phases. First crystals of calcium carbonate are formed in sea ice in winter. During this formation CO2 splits off and is dissolved in a heavy cold brine, which gets squeezed out of the ice

and sinks into the deeper parts of the ocean. Calcium carbonate cannot move as freely as CO2 and therefore it stays in the sea ice. In summer, when the sea ice melts, calcium carbonate dissolves, and CO2 is needed for this process. Thus, CO2 gets drawn from the atmosphere into the ocean - and therefore CO2 gets removed from the atmosphere", explains Dorte Haubjerg Søgaard.

The biological removal of CO2 is done by algae binding of carbon in organic material.

Another important discovery is that every winter flower-like ice formations are formed on the surface of newly formed sea ice. They are called frost flowers. Dorte Haubjerg Søgaard has discovered that these frost flowers hold extremely high concentrations of calcium carbonate, which can have a further significant impact on the potential CO2 uptake in the Arctic.

The relative contributions of biological and abiotic processes to carbon dynamics in subarctic sea ice, Polar Biology: Dorte Haubjerg Søgaard, David N. Thomas, Søren Rysgaard, Ronnie Nøhr Glud, Louiza Norman, Hermanni Kaartokallio, Thomas Juul-Pedersen, Nicolas-Xavier Geilfus. doi 10.1007/s00300-013-1396-3.

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Autotrophic and heterotrophic activity in Arctic first-year sea ice: seasonal study from Malene Bight, SW Greenland, Marine Ecology: Dorte Haubjerg Søgaard, Morten Kristensen, Søren Rysgaard, Ronnie Nøhr Glud, Per Juel Hansen, Karen Marie Hilligsøe. doi:10.3354/meps08845.

http://bit.ly/1uCGcjG

New Model Demonstrates That Stars Can Absorb Gravitational Ripples

Energetic events are thought to create gravitational waves that cause ripples in space and time.

A newly published study contradicts previous assumptions about the behavior of gravitational waves, demonstrating that stars can absorb the energy of gravitational waves.

Scientists have shown how gravitational waves - invisible ripples in the fabric of space and time that propagate through the universe - might be "seen" by looking at the stars. The new model proposes that a star that oscillates at the same frequency as a gravitational wave will absorb energy from that wave and brighten, an overlooked prediction of Einstein's 1916 theory of general relativity. The study, which was published today in the Monthly Notices of the Royal Astronomical Society: Letters, contradicts previous assumptions about the behavior of gravitational waves.

"It's pretty cool that a hundred years after Einstein proposed this theory, we're still finding hidden gems," said Barry McKernan, a research associate in the Museum's Department of Astrophysics, who is also a professor at CUNY's Borough of Manhattan Community College; a faculty member at CUNY's Graduate Center; and a Kavli Scholar at the Kavli Institute for Theoretical Physics. Gravitational waves can be thought of like the sound waves emitted after an earthquake, but the source of the "tremors" in space are energetic events like supernovae (exploding stars), binary neutron stars (pairs of burned-out cores left behind when stars explode), or the mergers of black holes and neutron stars. Although scientists have long known about the existence of gravitational waves, they've never made direct observations but are attempting to do so through experiments on the ground and in space. Part of the reason why detection is difficult is because the waves interact so weakly with matter. But McKernan and his colleagues from CUNY, the Harvard-Smithsonian Center for Astrophysics, the Institute for Advanced Study, and Columbia University, suggest that gravitational waves could have more of an effect on matter than previously thought. The new model shows that stars with oscillations - vibrations - that match the frequency of gravitational waves passing through them can resonate and absorb a large amount of energy from the ripples.

"It's like if you have a spring that's vibrating at a particular frequency and you hit it at the same frequency, you'll make the oscillation stronger," McKernan said. "The same thing applies with gravitational waves."

If these stars absorb a large pulse of energy, they can be "pumped up" temporarily and made brighter than normal while they discharge the energy over time. This could provide scientists with another way to detect gravitational waves indirectly.

"You can think of stars as bars on a xylophone - they all have a different natural oscillation frequency," said co-author Saavik Ford, who is a research associate in the Museum's Department of Astrophysics as well as a professor at the Borough of Manhattan Community College, CUNY; a faculty member at CUNY's Graduate Center; and a Kavli Scholar at the Kavli Institute for Theoretical Physics. "If you have two black holes merging with each other and emitting gravitational waves at a certain frequency, you're only going to hit one of the bars on the xylophone at a time. But because the black holes decay as they come closer together, the frequency of the gravitational waves changes and you'll hit a

sequence of notes. So you'll likely see the big stars lighting up first followed by smaller and smaller ones."

The work also presents a different way to indirectly detect gravitational waves. From the perspective of a gravitational wave detector on Earth or in space, when a star at the right frequency passes in front of an energetic source such as merging black holes, the detector will see a drop in the intensity of gravitational waves measured. In other words, stars - including our own Sun - can eclipse background sources of gravitational waves. "You usually think of stars as being eclipsed by something, not the other way around," McKernan said.

The researchers will continue to study these predictions and try to determine how long it would take to observe these effects from a telescope or detector.

Other authors include Bence Kocsis, from the Harvard-Smithsonian Center for Astrophysics and the Institute for Advanced Study, and Zoltan Haiman from Columbia University.

Support for this work was provided by NASA grant #APRA 08-0117, #NNX11AE05G, and #NNX11AF29G, National Science Foundation grant #PAARE AST-1153335 and #PHY 11-25915, a Borough of Manhattan Community College Faculty Development Grant, a CUNY Chancellor's Research Fellowship, the W.M. Keck Foundation Fund of the Institute for Advanced Study, and the Kavli Institute for Theoretical Physics.

Publication: B. McKernan, et al., "Stars as resonant absorbers of gravitational waves," MNRAS (November 21, 2014) 445 (1): L74-L78. doi: 10.1093/mnrasl/slu136

http://phys.org/news/2014-09-woolly-mammoth-genome-sequencer-uwa.html

Woolly mammoth genome sequencer at UWA

How can a giant woolly mammoth which lived at least 200,000 years ago help to save the Tasmanian Devil from extinction? The answer lies in DNA, the carrier of genetic information.

Stephan Schuster, a Professor of Genetics at Nanyang Technical University, Singapore, became famous around the world when he completed the genome of the prehistoric mammal thousands of years after it had walked the Earth.

As a Raine visiting professor whose visit is supported by the Raine Foundation, Professor Schuster will be at The University of Western Australia next week to give the Raine Lecture and will be available to talk to the media. He is a guest of Nobel Laureate Professor Barry Marshall who will also be available to talk to the media.

Professor Schuster, a world leader in DNA sequencing, was able to recreate the woolly mammoth's DNA from a ball of hair that had been buried under ice in Siberia. He hopes to apply the knowledge to at least seven species living at the brink of extinction, as the woolly mammoth itself was once.

He has also sequenced the genomes of the polar bear and the zebrafish, and is helping with work on the face cancer that is driving the Tasmanian Devil to extinction. In other work, Professor Schuster analysed Archbishop Desmond Tutu's genome and has worked on the genome of the extinct New Zealand flightless moa bird.

The Raine Visiting Professor is hosted by the Marshall Centre for Infectious Diseases. Professor Schuster has worked with UWA's Nobel Laureate Professor Barry Marshall, on helicobacter pylori, for many years.

Assistant Professor Tim Perkins, a geneticist in the Marshall Centre, is co-ordinating Professor Schuster's visit.

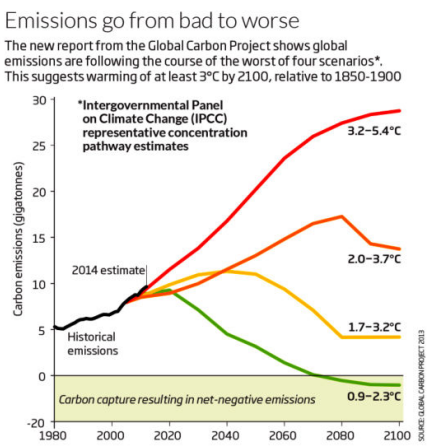
"We are now in the post-genomic era," Professor Perkins said. "Medical scientists are now starting to use the information from DNA sequencing in research. The human genome is an important part of our research."

http://bit.ly/1r3Kwup

World on track for worst-case warming scenario

We are on a clear course to extreme global warming

12:45 22 September 2014 by Catherine Brahic, New York City



Presidents, prime ministers and ministers flying into New York City on Tuesday for a one-day United Nations summit on climate change have their work cut out for them. And this is why. As the graph above shows, despite everything they have done so far, we are on a clear course to extreme global warming.

Since the ignominious 2009 United Nations Climate Change Conference in Copenhagen, Denmark, over a hundred nations have pledged action on emissions. The world has seen a major shift away from coal in favour of gas, which emits fewer greenhouse gases.

Solar panels have become much, much cheaper and are being deployed in regions around the world, as are other renewable sources of energy. But the latest number-crunching – published on Sunday in Nature Climate Change – shows that none of this is enough.

"Our study shows no progress in curbing global carbon emissions," says Corinne Le Quéré at the University of East Anglia in the UK. Global carbon emissions from fossil fuel burning and cement production grew 2.3 per cent in 2013. They are expected to increase a further 2.5 per cent this year. "And they are projected to

be around that for the next five years," says Le Quéré. "There is no progress in spite of all the talk."

Perfectly bad

The bleak image is brought home when emissions over the last few decades are plotted against projections for the future. Models predict how much the world will warm depending on how much we emit in future. Scientists typically look at four different possible futures, ranging from an uber-green society to a worst-case scenario, in which no action is taken to combat global warming. Le Quéré and her colleagues show how today's emissions are near-perfectly in line with the worst-case scenario. This means that, according to scientists' best estimates, the world will be as much as 5.4 °C warmer in 2100 than it was before the industrial revolution.

Le Quéré says it is still possible to stay below the internationally agreed target of 2 °C, but that this will require drastic emissions cuts across the world, and very soon. Bringing certain technologies online – such as carbon capture and storage – would be instrumental in achieving this, she says.

And that is the scale of the action needed from the New York meeting tomorrow, when world leaders will gather for one day at the UN headquarters. The UN secretary general, Ban Ki Moon, is hosting the event and has been pleading with governments for months now to come to the summit prepared to show the world that they are taking the situation seriously and are prepared to grow their ambitions on tackling the problem.

The UN Climate Summit 2014 follows the launch of New York City's climate week today, and demonstrations around the world on Sunday.

Journal reference: Nature Climate Change DOI: 10.1038/nclimate2384

http://bit.ly/1rl39sH

The Risks of Fire Around Chernobyl

Radioactive forest litter that has accumulated for the past 28 years could fuel massive blazes in the future

By Rachel Nuwer

For 28 years now, the forest in the Exclusion Zone - the 19-mile radius around the Chernobyl Nuclear Plant - has been piling up dead wood and leaf litter: decomposition in the irradiated zone seems to work at a much slower pace. And all of that leaf litter, from plants and trees that have taken up radiation from the contaminated soil, makes for a massive pile of kindling for a future wildfire, new research published in the journal Environment International shows.

The entire Exclusion Zone is at risk of catching fire, the authors warn, which could redistribute radiation across Europe and Russia.

The meltdown at the Chernobyl Nuclear Power Plant in 1986 released more than 10 EBq (1018 Becquerels) of radiation. Approximately one-fifth of that radiation settled around the power plant; the rest was picked up by the wind and dispersed across Europe and beyond.

In 2010, the authors of the new study point out, more than 54 fires - some of them purposefully started by people - broke out in the Exclusion Zone, and more than 300 others burned nearby. To understand the impacts of a major fire in the Exclusion Zone, the team built a computer model of Chernobyl's potential fire risk based on the data from the real-world fires from 2010. Another computer model calculated health risk to humans and animals.

The researchers ran several possible scenarios: fires that consume 10, 50 and 100 percent of the area. Depending on the intensity of the fire, they found that from 20 to 240 people would likely develop cancer, of which 10 to 170 cases may be fatal - figures comparable to those projected for Fukushima.

While many uncertainties exist in the models, perfectly predicting future disasters wasn't the authors' intention. Their paper, instead, serves as a warning. As they write: "We aim to sensitize the scientific community and the European authorities for the foreseen risks from radioactivity redistribution over Europe."

http://scitechdaily.com/yale-study-shows-estrogen-helps-calm-stressed-cells/

Yale Study Shows Estrogen Helps Calm Stressed Cells

Estrogen helps cells survive stress and may help kill cancer cells

New research from Yale University shows that the hormone estrogen helps cells survive stress, fueling speculation that anti-estrogen therapy may help kill cancer cells and prolong the survival of patients.

Stress is as bad for cells as it is for people, but scientists have had a hard time devising ways to study its effects on cells without killing them. Yale researchers have developed a system that solved the experimental problem and in the process made a surprising discovery: the hormone estrogen seems to help cells weather stress.

In the September 21 issue of the journal Nature Chemical Biology, the Yale team led by Craig Crews found that the estrogen pathway is activated when cells are subjected to stress. Following up on this study, the team has also discovered that introduction of the hormone can help cells negotiate certain stressful environments. The findings have interesting implications - beyond fueling speculation that estrogen helps women live longer than men, Crews said. For instance, anti-estrogen therapy could help kill cancer cells and prolong survival of patients, he said.

Publication: Kanak Raina, et al., "Targeted protein destabilization reveals an estrogen-mediated ER stress response," Nature Chemical Biology (2014); doi:10.1038/nchembio.1638

http://bit.ly/ZbU0bC

Tiny Implants Could Give Humans Self-Healing Superpowers

Wolverine, Ghost Rider, the Incredible Hulk - all of these characters have at least one awesome trait in common: the ability to heal themselves.

Sep 22, 2014 11:50 AM ET // by Elizabeth Palermo, LiveScience

And now, the Pentagon wants to give ordinary people this superhuman capability.

A new military-sponsored program aims to develop a tiny device that can be implanted in the body, where it will use electrical impulses to monitor the body's organs, healing these crucial parts when they become infected or injured.

Known as Electrical Prescriptions, or ElectRx, the program could reduce dependence on pharmaceutical drugs and offer a new way to treat illnesses, according to the Defense Advanced Research Projects Agency (DARPA), the branch of the U.S. Department of Defense responsible for developing the program.

"The technology DARPA plans to develop through the ElectRx program could fundamentally change the manner in which doctors diagnose, monitor and treat injury and illness," Doug Weber, program manager for DARPA's biological technologies office, said in a statement.

The implant that DARPA hopes to develop is something akin to a tiny, intelligent pacemaker, Weber said. The device would be implanted into the body, where it would continually assess a person's condition and provide any necessary stimulus to the nerves to help maintain healthy organ function, he added.

The idea for the technology is based on a biological process known as neuromodulation, in which the peripheral nervous system (the nerves that connect every other part of the body to the brain and spinal cord) monitors the status of internal organs and regulate the body's responses to infection and disease. When a person is sick or injured, this natural process can sometimes be thrown off, according to DARPA. Instead of making a person feel better, neuromodulation can actually exacerbate a condition, causing pain, inflammation and a weakened immune system.

But with the help of an electrically charged implant, DARPA says it can keep neuromodulation under control. Electric impulses from the device will stimulate the nerve patterns that help the body heal itself and keep the out-of-whack nerve stimulus patterns that cause a sick person even greater harm from doing damage.

DARPA hopes to develop a device so tinythat it can be implanted using only a needle. Such a small implant would be a huge improvement over similar neuromodulation devices already in use today, most of which are about the size of a deck of cards and require invasive surgery to implant, according to DARPA.

And the miniature size of the device has another advantage: It can be placed exactly where it is needed at nerve endings. An implant as small as a nerve fiber could minimize the side effects caused by implants whose electric impulses aren't sent directly into nerve channels, DARPA officials said.

The device could help treat a host of painful, inflammatory conditions, such as rheumatoid arthritis, systemic inflammatory response syndrome (a condition that causes inflammation throughout the body) and inflammatory bowel disease. And if the ElectRx program is a success, it could also lead to the development of implants that help treat brain and mental-health disorders, such as epilepsy, traumatic brain injury, post-traumatic stress disorder (PTSD) and depression, according to DARPA.

http://www.eurekalert.org/pub_releases/2014-09/mu-odm092214.php

Old drug may be key to new antibiotics

Lamotrigine stopped ribosomes from being created

Hamilton, ON - McMaster scientists have found that an anticonvulsant drug may help in developing a new class of antibiotics. Although dozens of antibiotics target what bacteria do, their study has looked at how a certain part of bacteria are created, and they found there is a way of stopping it. The discovery is important as there is growing concern worldwide about how antibiotic resistance is making the cures for infections ineffective. The World Health Organization has declared that antibiotic resistance is a major threat to global health security.

The McMaster study found that an anticonvulsant drug called lamotrigine is the first chemical inhibitor of the assembly of ribosomes in bacteria. Ribosomes are the molecular machines in cells that create all proteins. Many antibiotics attack what ribosomes do. However, the McMaster team found that lamotrigine stopped ribosomes from being created in the first place.

The paper has been published by the open-access journal eLife.

"Ribosome-inhibiting antibiotics have been routinely used for more than 50 years to treat bacterial infections, but inhibitors of bacterial ribosome assembly have waited to be discovered," said Eric Brown, principal investigator of the study and a professor of biochemistry and biomedical sciences at McMaster's Michael G. DeGroote Institute for Infectious Disease Research.

"Such molecules would be an entirely new class of antibiotics, which would get around antibiotic resistance of many bacteria. We found lamotrigine works."

Jonathan Stokes, a PhD student who worked on the paper, added that the team was able to identify the precise target for the lamotrigine within the bacteria, allowing the researchers to be clear in their understanding of ribosome assembly and the therapeutic applications of these types of chemicals.

The team used high throughput screening technologies of the Centre for Microbial Chemical Biology at McMaster to make the discovery. The study was funded by the Canadian Institutes

of Health Research, the Michael G. DeGroote Institute for Infectious Disease Research, and the Natural Sciences and Engineering Research Council.

http://www.eurekalert.org/pub_releases/2014-09/tjnj-saw091914.php

Statins associated with better outcomes in hospitalization for brain hemorrhage

Patients receiving statins after a stroke caused by an intracerebral hemorrhage (ICH, bleeding in the brain) appeared to have better 30-day survival

Bottom Line: Hospitalized patients who took statins after a stroke caused by an intracerebral hemorrhage (ICH, bleeding in the brain) appeared to have better 30-day survival and were more likely to be discharged to their home or an acute rehabilitation facility than patients who did not use statins or whose statin use was discontinued in the hospital.

Author: Alexander C. Flint, M.D., Ph.D., of Kaiser Permanente Northern California, Redwood City, Calif., and colleagues.

Background: Statins are known to reduce the risk of ischemic stroke among patients with a history of ischemic stroke. Ischemic stroke and hemorrhagic stroke (ICH) have different primary causes but share many molecular causes for the secondary brain injury that may be influenced by statins.

How the Study Was Conducted: The authors examined the effect of inpatient statin use and the stopping of statin use in a group of 3,481 patients with ICH admitted to 20 hospitals in a large health care system over a 10-year period. They analyzed electronic medical and pharmacy records.

Results: Of the 2,321 patients not using a statin as an outpatient before ICH, 425 (18.3 percent) received a statin as an inpatient. And, of the 1,160 patients who used a statin as an outpatient, 391 (33.7 percent) did not receive statins as an inpatient. Inpatient statin users had a 30-day unadjusted mortality rate of 18.4 percent compared with 38.7 percent for patients not treated with statins. Patients treated with a statin during hospitalization for ICH were discharged to home or a rehabilitation facility 51.1 percent of the time compared with 35 percent of the time for patients not treated with statins. Patients whose statin therapy was discontinued as an inpatient had an unadjusted mortality rate of 57.8 percent compared with 18.9 percent for patients using a statin before and during hospitalization. Patients whose statin therapy was discontinued were discharged to home or inpatient rehabilitation 22.3 percent of the time compared with 49.8 percent of the time for patients who used a statin before and during hospitalization.

Discussion: "Statin use is associated with improved outcomes after ICH, and the cessation of statin use is associated with worsened outcomes after ICH. … The particular association between cessation of statin use and worsened outcomes merits careful consideration of the risk-benefit balance of discontinuing statin therapy in the acute setting of ICH."

(JAMA Neurol. Published online September 22, 2014. doi:10.1001/.jamaneurol.2014.2124. Available pre-embargo to the media at http://media.jamanetwork.com.)

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Editorial: Statin Use and Brain Hemorrhage

In a related editorial, Marco A. Gonzalez-Castellon, M.D., and Randolph S. Marshall, M.D., M.S., of Columbia University Medical Center, New York, write: "Despite physiological and clinical evidence on both sides of the argument, the idea that statins should be avoided whenever brain hemorrhage is involved has permeated stroke practice."

"New evidence on the positive effects of statins in spontaneous ICH appears in this issue of JAMA Neurology. Flint and colleagues demonstrate that statin use during the acute period after ICH was not associated with increased hemorrhage risk but was strongly associated with improved outcomes at 30 days," they continue.

"The controversy regarding statin use and ICH is far from settled. … Their study thus requires validation in a prospective cohort. For now, however, it provides sufficient evidence to recommend at least the continuation of statin therapy after nonamyloid ICH for at least 30 days after the initial event. Further study of this important management question is warranted," they conclude.

(JAMA Neurol. Published online September 22, 2014. doi:10.1001/.jamaneurol.2014.2463. Available pre-embargo to the media at http://media.jamanetwork.com.)

http://www.eurekalert.org/pub_releases/2014-09/uou-fto091814.php

Firelight talk of the Kalahari Bushmen

Did tales told over fires aid our social and cultural evolution?

SALT LAKE CITY - After human ancestors controlled fire 400,000 to 1 million years ago, flames not only let them cook food and fend off predators, but also extended their day.

A University of Utah study of Africa's Kalahari Bushmen suggests that stories told over firelight helped human culture and thought evolve by reinforcing social traditions, promoting harmony and equality, and sparking the imagination to envision a broad sense of community, both with distant people and the spirit world.

Researchers previously studied how cooking affected diets and anatomy, but "little is known about how important the extended day was for igniting the embers of culture and society," anthropology professor Polly Wiessner writes in a study published online today in the journal Proceedings of the National Academy of Sciences.

"There is something about fire in the middle of the darkness that bonds, mellows and also excites people. It's intimate," says Wiessner, who has studied the Bushmen for 40 years. "Nighttime around a fire is universally time for bonding, for telling social information, for entertaining, for a lot of shared emotions."

Wiessner's study, which she calls "exploratory," analyzed scores of daytime and firelight conversations among !Kung Bushmen – also known as Ju/'hoansi Bushmen – some 4,000 of which now live in the Kalahari Desert of northeast Namibia and northwest Botswana. (The exclamation, slash and apostrophe symbols represent click sounds in their language.) They are among several groups of Kalahari Bushmen.

Why study the campfire tales of Bushmen?

"We can't tell about the past from the Bushmen," Wiessner says. "But these people live from hunting and gathering. For 99 percent of our evolution, this is how our ancestors lived. What transpires during the firelit night hours by hunter-gatherers? It helps answer the question of what firelit space contributes to human life."

She writes: "Stories are told in virtually all hunter-gatherer societies; together with gifts, they were the original social media."

From the Workaday World to Nights of Bonding and Wonder

In her study, "Embers of Society: Firelight Talk among the Ju/'hoansi Bushmen," Wiessner says archaeological evidence indicates human ancestors had sporadic control of fire 1 million or more years ago, and regularly used it after 400,000 years ago.

"Fire altered our circadian rhythms, the light allowed us to stay awake, and the question is what happened in the fire-lit space? What did it do for human development?" asks Wiessner, who earlier this year was among three University of Utah researchers elected to the National Academy of Sciences.

Wiessner says !Kung Bushmen hold firelight gatherings most nights in groups of up to 15 people. A camp has hearths for each family, but at night people often converge at a single hearth. She analyzed only conversations involving five or more people.

Firelight stories deal with topics such as past hunts, fights over meat, marriage, premarital customs, murder, bush fires, birth, getting lost, interactions with other groups, truck breakdowns, being chased by animals, disputes and extramarital affairs. And there also are traditional myths.

For her study, Wiessner analyzed two sets of data:

Notes she took in 1974 (initially for another purpose) of 174 daytime and nighttime conversations at two !Kung camps in northwest Botswana. Each conversation lasted more than 20 to 30 minutes and involved five to 15 people.

Digital recordings, transcribed by educated Bushmen, of 68 firelight stories Wiessner originally heard in the 1970s but came back to have retold and recorded during three visits in 2011-2013 to !Kung villages in Botswana and Namibia.

Wiessner found daytime conversations differed much from firelight discussions. Of daytime conversations, 34 percent were complaints, criticism and gossip to regulate social relationships; 31 percent were economic matters, such as hunting for dinner; 16 percent were jokes; only 6 percent were stories and the rest were other topics

But at night, 81 percent of the conversations involved stories, and only 7 percent were complaints, criticism and gossip and 4 percent were economic.

Bonding with People Near and Far – and with the Supernatural

Wiessner found how conversations reinforced major !Kung social institutions and values: arranged marriages, the kinship system, a social structure based on equality, the sharing of food during times of hardship, land rights, trance healing and xaro, a system of exchange that involved pledges of mutual assistance, including housing and food, in troubled times.

"What I found was a big difference between day and night conversation, the kinds of information transmitted and the use of imaginary thought," Wiessner says. "Day conversation has a lot to do with economic activities – working, getting food, what resources are where," she says. "It has a lot to do with social issues and controls: criticism, complaints and gripes."

"At night, people really let go, mellow out and seek entertainment. If there have been conflicts in the day, they overcome those and bond. Night conversation has more to do with stories, talking about the characteristics of people who are not present and who are in your broader networks, and thoughts about the spirit world and how it influences the human world. You have singing and dancing, too, which bonds groups."

Healers dance and go into trances, "travel to god's village and communicate with the spirits of deceased loved ones who are trying to take sick people away," Wiessner says.

She says nonhuman primates don't maintain mutually supportive ties outside their group: "We are really unique. We create far-flung ties outside our groups."

Such extended communities allowed humans "to colonize our planet because they had networks of mutual support, which you see expressed today in our capacity for social networking" she adds. "Humans form communities that are not together in space, but are in our heads – virtual communities. They are communities in our heads. For the Bushmen, they may be up to 120 miles away."

Wiessner suggests that firelight stories, conversations, ceremonies and celebrations sparked human imagination and "cognitive capacities to form these

imagined communities, whether it's our social networks, all of our relatives on Earth or communities that link us to the spirit world." She says they also bolstered the human ability to "read" what others are thinking – not just their thoughts or intentions, but their views toward other people.

What Has Electricity Done to Us?

Examining how firelight extended the day prompted Wiessner to wonder about modern society, asking, "What happens when economically unproductive firelit time is turned to productive time by artificial lighting?"

Parents read stories or show videos to their children, but now, "work spills into the night. We now sit on laptops in our homes. When you are able to work at night, you suddenly have a conflict: 'I have only 15 minutes to tell my kids a bedtime story. I don't have time to sit around and talk.' Artificial light turned potential social time into potential work time. What happens to social relations?" Her research raises that question, but doesn't answer it.

http://www.eurekalert.org/pub_releases/2014-09/osu-cfh092214.php

Compound from hops aids cognitive function in young animals

Xanthohumol, a type of flavonoid found in hops and beer, has been shown in a new study to improve cognitive function in young mice, but not in older animals.

CORVALLIS, Ore. –The research was just published in Behavioral Brain Research by scientists from the Linus Pauling Institute and College of Veterinary Medicine at Oregon State University. It's another step toward understanding, and ultimately reducing the degradation of memory that happens with age in many mammalian species, including humans.

Flavonoids are compounds found in plants that often give them their color. The study of them – whether in blueberries, dark chocolate or red wine - has increased in recent years due to their apparent nutritional benefits, on issues ranging from cancer to inflammation or cardiovascular disease. Several have also been shown to be important in cognition.

Xanthohumol has been of particular interest because of possible value in treating metabolic syndrome, a condition associated with obesity, high blood pressure and other concerns, including age-related deficits in memory. The compound has been used successfully to lower body weight and blood sugar in a rat model of obesity.

The new research studied use of xanthohumol in high dosages, far beyond what could be obtained just by diet. At least in young animals, it appeared to enhance their ability to adapt to changes in the environment. This cognitive flexibility was tested with a special type of maze designed for that purpose.

"Our goal was to determine whether xanthohumol could affect a process we call palmitoylation, which is a normal biological process but in older animals may become harmful," said Daniel Zamzow, a former OSU doctoral student and now a lecturer at the University of Wisconsin/Rock County.

"Xanthohumol can speed the metabolism, reduce fatty acids in the liver and, at least with young mice, appeared to improve their cognitive flexibility, or higher level thinking," Zamzow said. "Unfortunately it did not reduce palmitoylation in older mice, or improve their learning or cognitive performance, at least in the amounts of the compound we gave them."

Kathy Magnusson, a professor in the OSU Department of Biomedical Sciences, principal investigator with the Linus Pauling Institute and corresponding author on this study, said that xanthohumol continues to be of significant interest for its biological properties, as are many other flavonoids.

"This flavonoid and others may have a function in the optimal ability to form memories," Magnusson said. "Part of what this study seems to be suggesting is that it's important to begin early in life to gain the full benefits of healthy nutrition."

It's also important to note, Magnusson said, that the levels of xanthohumol used in this study were only possible with supplements. As a fairly rare micronutrient, the only normal dietary source of it would be through the hops used in making beer, and "a human would have to drink 2000 liters of beer a day to reach the xanthohumol levels we used in this research."

In this and other research, Magnusson's research has primarily focused on two subunits of the NMDA receptor, called GluN1 and GluN2B. Their decline with age appears to be related to the decreased ability to form and quickly recall memories. In humans, many adults start to experience deficits in memory around the age of 50, and some aspects of cognition begin to decline around age 40, the researchers noted in their report.

This research was supported by the National Institutes of Health.

http://phys.org/news/2014-09-modern-humans-migrated-austria-years.html

Modern humans may have migrated into Austria 43,500 years ago

Oldest well-documented occurrence of behaviorally modern humans in Europe

A multinational team analysed stone tools recovered during a recent re-excavation of the find site of the Venus of Willendorf in Austria. The authors identified the stone tools as belonging to the Aurignacian culture, generally accepted as indicative of modern human presence. Chronostratigraphic information suggests the tools date to around 43,500 years ago, pre-dating other known Aurignacian artifacts. Based on the type of soil and its mollusk assemblage, climatic conditions during that time were likely cool, with a steppe-like environment and some conifer trees along river valleys. The date of the artifacts represents the oldest well-documented occurrence of behaviorally modern humans in Europe and

suggests contemporaneity with Neanderthals in other parts of Europe, showing that behaviorally modern humans and Neanderthals shared this region longer than previously thought. Additionally, the results suggest that the early modern human settlers, who may have come from the warmer environments in southern Europe, were well-adapted to a variety of climates, according to the authors.

Modern humans dispersed into Europe and replaced Neanderthals at least 40 thousand years ago, but potentially much earlier. "The problem is that we have practically no human remains associated with the early Upper Palaeolithic in Europe, so we have to use archaeological proxies to figure out when the first modern humans appeared. We have some clearly modern human remains associated with the Aurignacian culture, so we think it is a good indicator for modern human presence," explains Bence Viola. "At Willendorf, we could date the early Aurignacian to 43,500 years, quite a bit earlier than elsewhere and overlapping with directly dated Neanderthal remains," says Philip Nigst.

Neanderthals' capabilities are still hotly debated. Some argue that before modern humans replaced them, Neanderthals showed cultural capabilities similar to those of modern humans, while others make a case that these similarities only appear once Neanderthals came in contact with modern humans. "The new data from Willendorf clearly shows that modern humans were present in what is now Austria while Neanderthals still occupied other regions of Europe suggesting that the two species met, and may have exchanged mates and ideas", explains Philip Nigst. "This means the changes in the material culture of some of the last Neanderthal groups are most probably related to direct or indirect contact with modern humans," says Jean-Jacques Hublin, director of the Department of Human Evolution at the Max Planck Institute for Evolutionary Anthropology.

The stone tools were discovered in a sequence of sediments that were deposited during different colder and warmer phases within the last glacial. Based on the type of soil and its mollusk assemblage, climatic conditions during the time of modern human occupation were likely cool, with a steppe-like climate and some conifer trees along river valleys. "Mollusks are great for environmental reconstruction because they are so sensitive to changes in temperature and moisture – meaning that the species you find vary with every little change in climate," explains Bence Viola. "What is particularly interesting is that the Aurignacian at Willendorf occurs in a relatively cold period, which shows that these earliest settlers were already adapted to different climates requiring different subsistence strategies," says Philip Nigst.

More information: Philip R. Nigst, Paul Haesaerts, Freddy Damblon, Christa Frank-Fellner, Carolina Mallol, Bence Viola, Michael Götzinger, Laura Niven, Gerhard Trnka, and Jean-Jacques Hublin. "Early modern human settlement of Europe north of the Alps occurred 43,500 years ago in a cold steppe-type environment." PNAS 2014 ; published ahead of print September 22, 2014, DOI: 10.1073/pnas.1412201111

http://bit.ly/1sYXmWt

Thousands of Strange Green Balls Appeared Overnight on a Beach in Australia

Scientists believe that the balls are actually extremely rare algae congregations called marimo

By Rachel Nuwer

Last weekend, beachgoers at Dee Why Beach near Sydeny were met with a peculiar sight: thousands of bright green balls scattered all over the sand. The squishy spheres were about the size of golf balls and seemed to be made of some sort of algae or seaweed. Many joked that they were “alien eggs” or UFOs (“unidentified floating objects”), the Manly Daily reports.

Scientists, however, have another hunch. As the Viral Spell writes, certain types of algae sometimes roll around on the seafloor, forming into ball shapes. But, as one researcher noted, “that’s made of dead material and these look to be living.”

Still, there is an answer. Although extremely rare, 7News Sydney continues, there have been some past cases of multitudes of living balls of algae turning up on beaches, including in Japan, where they are referred to as marimo. The named was coined back in 1898 and is a combination of the words for “bouncy play ball” and “plant that grows in water.” In Iceland, on the other hand, the balls are referred to as kúluskítur or “ball muck.”

Most likely, plentiful sunshine combined with rough currents created the perfect conditions for forming the balls and depositing them on the beach in Sydney. While the seaweed that formed the balls normally secures itself to rocks, one scientist explained to 7News Sydney that “occasionally they get knocked off and rolled around in the ocean forming these beautiful little balls.”

For now, the balls are providing quirky entertainment for curious locals on Dee Why beach, but as scientists warn, after a few days spent under the spring sun they’ll be nothing but a smelly mess.

http://www.bbc.com/news/world-africa-29327741

Ebola death rates 70% - WHO study

New figures suggest 70% of those infected with Ebola in West Africa have died, higher than previously reported, says the World Health Organization.

By Helen Briggs Health editor, BBC News website

Ebola infections will treble to 20,000 by November if efforts to tackle the outbreak are not stepped up, the UN agency has warned. In the worst case scenario, cases in two nations could reach 1.4 million in January, according to a US estimate. Experts said the US numbers were "somewhat pessimistic".

The world's largest outbreak of Ebola has caused 2,800 deaths so far, mainly in Guinea, Liberia and Sierra Leone.

Outbreaks in Senegal and Nigeria were "pretty much contained", said the WHO.

In other developments:

More than 160 NHS staff have volunteered for UK efforts to help in the outbreak.

Chief medical officer for England, Prof Dame Sally Davies, confirmed that the British nurse who survived Ebola, William Pooley, has volunteered to give blood that could help treat patients.

The Sierra Leone army has closed the country's border with Guinea and Liberia to vehicle traffic in a bid to control the spread of Ebola.

British military and humanitarian staff have arrived in Freetown to oversee the construction of the UK's medical facility and assist with the response to the outbreak.

Scientists have warned that swift action is needed to curb the exponential climb in the Ebola outbreak. Two new estimates suggest that cases of Ebola could soar dramatically in the three countries with the majority of cases.

Projections published in The New England Journal of Medicine predict that by early November there will have been nearly 20,000 cases.

The analysis of confirmed cases also suggests death rates are higher than previously reported at about 70% of all cases, rather than 50%.

Dr Christopher Dye, Director of Strategy for WHO, said unless control measures improved quickly "these three countries will soon be reporting thousands of cases and deaths each week, projections that are similar to those of the Centers for Disease Control and Prevention (CDC)".

The CDC said that there could be up to 21,000 reported and unreported cases in Liberia and Sierra Leone alone by the end of this month.

In predictions released on Tuesday, the US health agency said cases could reach as many as 1.4 million by mid-January, if efforts to control the outbreak are not scaled up.

But experts cautioned that the numbers seemed "somewhat pessimistic" and did not account for infection control efforts already under way.

Drug trials

Meanwhile, The Wellcome Trust charity has announced that experimental drugs will be tested in West Africa for the first time. They include the drug ZMapp, which has been given to a handful of infected health workers.

Dr Peter Horby, of the Centre for Tropical Medicine and Global Health at the University of Oxford, said the first trials could begin in West Africa as early as November. "We want to evaluate these carefully, properly, in affected countries in West Africa," he told the BBC.

"For the next one or two weeks we'll be doing site assessments and we'll be working with the WHO on identifying which drugs to prioritise, and then there'll be a number of steps in setting up the systems - getting ethical approval through the countries and getting community participation and agreement to run the trials."

http://www.eurekalert.org/pub_releases/2014-09/acs-wt092414.php

'Fracking' wastewater that is treated for drinking produces potentially harmful compounds

Discharge of fracking wastewaters to rivers, even after passage through treatment plants, could be putting the drinking water supplies at risk

Concerns that fluids from hydraulic fracturing, or "fracking," are contaminating drinking water abound. Now, scientists are bringing to light another angle that adds to the controversy. A new study, appearing in the ACS journal Environmental Science & Technology, has found that discharge of fracking wastewaters to rivers, even after passage through wastewater treatment plants, could be putting the drinking water supplies of downstream cities at risk.

William A. Mitch, Avner Vengosh and colleagues point out that the disposal of fracking wastewater poses a major challenge for the companies that use the technique, which involves injecting millions of gallons of fluids into shale rock formations to release oil and gas.

The resulting wastewater is highly radioactive and contains high levels of heavy metals and salts called halides (bromide, chloride and iodide). One approach to dealing with this wastewater is to treat it in municipal or commercial treatment plants and then release it into rivers and other surface waters. The problem is these plants don't do a good job at removing halides. Researchers have raised concern that halide-contaminated surface water subsequently treated for drinking purposes with conventional methods, such as chlorination or ozonation, could lead to the formation of toxic byproducts. Mitch's team set out to see if that was indeed the case.

The researchers diluted river-water samples of fracking wastewater discharged from operations in Pennsylvania and Arkansas, simulating real-world conditions when wastewater gets into the environment. In the lab, they then used current drinking-water disinfection methods on the samples. They found that even at concentrations as low as 0.01 percent up to 0.1 percent by volume of fracking wastewater, an array of toxic compounds formed. Based on their findings, the researchers recommend either that fracking wastewater should not be discharged at all into surface waters or that future water treatment include specific halide-removal techniques.

http://bit.ly/1u0G5R1

Brain Wave Could Prove What People Have Seen

What if a brain wave test could prove whether you'd walked down the street carrying a yellow umbrella?

Sep 23, 2014 11:29 AM ET // by Sheila M. Eldred

New research suggests it could: Scientists have pinpointed a specific brain wave that responds to details it has encountered. That could have big implications for courtrooms (if a criminal had been carrying a pink umbrella, for example, a brain scan could help exonerate the suspect carrying the yellow umbrella).

Electroencephalography (EEG) recordings show that the brain wave, known as P300, lights up when a person recognizes something meaningful among a list of random items.

"Perhaps the most surprising finding was the extent to which we could detect very trivial details from a subject's day, such as the color of umbrella that the participant had used," lead researcher John B. Meixner of Northwestern University said in a press release. "This precision is exciting for the future because it indicates that relatively peripheral crime details, such as physical features of the crime scene, might be usable in a real-world [investigation.]"

In order to mimic how P300 could be used in investigations, 24 college students agreed to wear clip-on video cameras for four hours, and then look at a series of descriptions in a lab the next day.

Half of the students were given descriptions that contained some details of scenarios they had encountered the previous day, whereas the others were given descriptions that they had no knowledge of. As expected, the authors wrote in Psychological Science, the P300 brain wave was larger only for the details that someone had actually seen. Next up: The researchers hope to show that using images instead of descriptions make an even greater impact on the P300.

http://www.eurekalert.org/pub_releases/2014-09/uoih-apc092414.php

Alzheimer's patients can still feel the emotion long after the memories have vanished

Caregivers have a profound influence on the emotional state of individuals with Alzheimer's disease

University of Iowa study offers good news for care givers, health care providers

A new University of Iowa study further supports an inescapable message: caregivers have a profound influence - good or bad - on the emotional state of individuals with Alzheimer's disease. Patients may not remember a recent visit by a loved one or having been neglected by staff at a nursing home, but those actions can have a lasting impact on how they feel.

The findings of this study are published in the September 2014 issue of the journal Cognitive and Behavioral Neurology, and can be viewed online for free here.

UI researchers showed individuals with Alzheimer's disease clips of sad and happy movies. The patients experienced sustained states of sadness and happiness despite not being able to remember the movies. "This confirms that the emotional life of an Alzheimer's patient is alive and well," says lead author Edmarie Guzmán-Vélez, a doctoral student in clinical psychology, a Dean's Graduate Research Fellow, and a National Science Foundation Graduate Research Fellow. Guzmán-Vélez conducted the study with Daniel Tranel, UI professor of neurology and psychology, and Justin Feinstein, assistant professor at the University of Tulsa and the Laureate Institute for Brain Research.

Tranel and Feinstein published a paper in 2010 that predicted the importance of attending to the emotional needs of people with Alzheimer's, which is expected to affect as many as 16 million people in the United States by 2050 and cost an estimated $1.2 trillion. "It's extremely important to see data that support our previous prediction," Tranel says. "Edmarie's research has immediate implications for how we treat patients and how we teach caregivers."

Despite the considerable amount of research aimed at finding new treatments for Alzheimer's, no drug has succeeded at either preventing or substantially influencing the disease's progression. Against this foreboding backdrop, the results of this study highlight the need to develop new caregiving techniques aimed at improving the well-being and minimizing the suffering for the millions of individuals afflicted with Alzheimer's.

For this behavioral study, Guzmán-Vélez and her colleagues invited 17 patients with Alzheimer's disease and 17 healthy comparison participants to view 20 minutes of sad and then happy movies. These movie clips triggered the expected emotion: sorrow and tears during the sad films and laughter during the happy ones. About five minutes after watching the movies, the researchers gave participants a memory test to see if they could recall what they had just seen. As expected, the patients with Alzheimer's disease retained significantly less information about both the sad and happy films than the healthy people. In fact, four patients were unable to recall any factual information about the films, and one patient didn't even remember watching any movies.

Before and after seeing the films, participants answered questions to gauge their feelings. Patients with Alzheimer's disease reported elevated levels of either sadness or happiness for up to 30 minutes after viewing the films despite having little or no recollection of the movies. Quite strikingly, the less the patients remembered about the films, the longer their sadness lasted. While sadness tended

to last a little longer than happiness, both emotions far outlasted the memory of the films.

The fact that forgotten events can continue to exert a profound influence on a patient's emotional life highlights the need for caregivers to avoid causing negative feelings and to try to induce positive feelings.

"Our findings should empower caregivers by showing them that their actions toward patients really do matter," Guzmán-Vélez says. "Frequent visits and social interactions, exercise, music, dance, jokes, and serving patients their favorite foods are all simple things that can have a lasting emotional impact on a patient's quality of life and subjective well-being."

The study was funded by the National Institute of Neurological Disorders and Stroke (grant number: P01 NS19632), a National Science Foundation Graduate Research Fellowship awarded to Guzmán-Vélez, Kiwanis International, the Fraternal Order of Eagles, an American Psychological Association of Graduate Students Basic Psychological Research Grant, and the William K. Warren Foundation.

http://www.eurekalert.org/pub_releases/2014-09/acs-tsc_1092414.php

Tonsil stem cells could someday help repair liver damage without surgery

The liver provides critical functions, such as ridding the body of toxins.

Its failure can be deadly, and there are few options for fixing it. But scientists now report in the journal ACS Applied Materials & Interfaces a way to potentially inject stem cells from tonsils, a body part we don't need, to repair damaged livers - all without surgery.

Byeongmoon Jeong and colleagues point out that currently, the only established method for treating liver failure or severe cases of liver disease is complete or partial transplantation. But the need is much greater than the number of available organs. Plus, surgery has inherent risks and a hefty price tag. A promising alternative in development is transplanting liver cells. One such approach involves using adult stem cells to make liver cells. Stem cells from bone marrow could be used, but they have limitations. Recently, scientists identified another source of adult stem cells that could be used for this purpose - tonsils. Every year, thousands of surgeries are performed to remove tonsils, and the tissue is discarded. Now it could have a new purpose, but scientists needed a way to grow them on a 3-D scaffold that mimics real liver tissue. Jeong's team set out to do just that.

The researchers encapsulated tonsil-derived stem cells in a heat-sensitive liquid that turns into a gel at body temperature. They added substances called growth factors to encourage the stem cells to become liver cells. Then, they heated the combination up to a normal body temperature. The result was a 3-D, biodegradable gel that contained functioning liver cells. The researchers conclude that the same process has promise - with some further tweaking for ideal conditions - as an injectable tissue engineering technique to treat liver disease without surgery.

The authors acknowledge funding from the National Research Foundation of Korea.

http://www.eurekalert.org/pub_releases/2014-09/bmj-ssi092214.php

Skirt size increase linked to 33 percent greater postmenopausal breast cancer risk

Mid-20s to mid-50s critical period, association irrespective of overall weight

Overall weight gain during adulthood is known to be a risk factor for breast cancer, but a thickening waist seems to be particularly harmful, indicating the importance of staving off a midriff bulge, the research shows.

The researchers base their findings on almost 93,000 women taking part in the UK Collaborative Trial of Ovarian Cancer Screening (UKCTOCS) in England.

The women were all aged over 50, had gone through the menopause, and had no known breast cancer when they entered the study between 2005 and 2010.

At enrolment they provided detailed information on height and weight (BMI); reproductive health; fertility; family history of breast and ovarian cancer; and use of hormonal contraceptives and HRT, all of which influence breast cancer risk.

They were also asked about their current skirt size, and what this had been in their 20s. After a monitoring period of three to four years they were asked about continuing use of HRT; their general health; a subsequent diagnosis of cancer; and lifestyle, including how much they smoked and drank.

Most of the women were white, educated to university degree level, and overweight at the point of study entry, with a BMI of 25-26.

During the monitoring period, 1090 women developed breast cancer, giving an absolute risk of just over 1%. As expected, infertility treatment, family history of breast/ovarian cancer, and use of HRT were all significantly associated with a heightened risk of being diagnosed with the disease, while pregnancies were protective. But after taking account of other influential factors, increases in skirt size emerged as the strongest predictor of breast cancer risk.

At the age of 25, the women's average skirt size had been a UK 12 (US 8; Europe 40-44), and when they entered the study at the average age of 64, it was a 14 (US: 10; Europe 42-46). Skirt size increased over the course of their adult lives in three out of four of the women.

The analysis revealed that going up one skirt size every 10 years was associated with a 33% greater risk of developing breast cancer after the menopause; going up two skirt sizes in the same period was associated with a 77% greater risk.

The researchers estimate that the five year absolute risk of postmenopausal breast cancer rises from 1 in 61 to 1 in 51 with each increase in skirt size every 10 years.

Adding BMI to the calculations did not significantly improve the prediction of risk.

As this is an observational study, no definitive conclusions can be drawn about cause and effect, and there is likely to have been some variation in skirt sizing over the years, say the researchers. But an expanding waistline has been linked to other cancers, including those of the pancreas, lining of the womb, and ovaries, they point out, possibly because midriff fat is more harmful.

"Although the exact mechanism of these relationships need to be better understood, there is a suggestion that body fat around the waist is more metabolically active than adipose tissue elsewhere," they write, adding that extra fat is known to boost levels of the female hormone oestrogen, on which many breast cancer cells rely for fuel.

http://bit.ly/1sZDItu

Earth's Impending Magnetic Flip

A geomagnetic reversal may happen sooner than expected

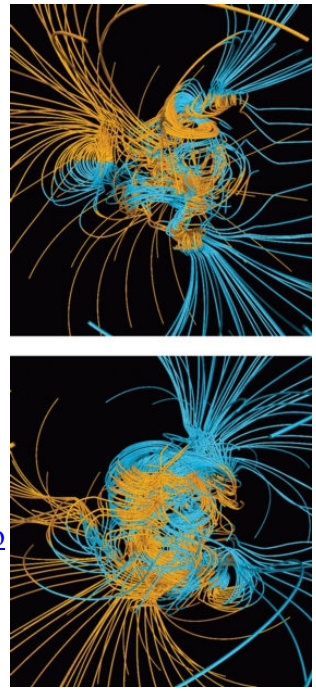
Sep 16, 2014 |By Annie Sneed

Earth's magnetic north and south poles have flip-flopped many times in our planet's history - most recently, around 780,000 years ago. Geophysicists who study the magnetic field have long thought that the poles may be getting ready to switch again, and based on new data, it might happen earlier than anyone anticipated.

The European Space Agency's satellite array dubbed "Swarm" revealed that Earth's magnetic field is weakening 10 times faster than previously thought, decreasing in strength about 5 percent a decade rather than 5 percent a century. A weakening magnetic field may indicate an impending reversal, which scientists predict could begin in less than 2,000 years. Magnetic north itself appears to be moving toward Siberia.

Geophysicists do not yet fully understand the process of geomagnetic reversals, but they agree that our planet's field is like a dipole magnet. Earth's center consists of an inner core of solid iron and an outer core of liquid iron, a strong electrical conductor. The liquid iron in the outer core is buoyant, and as it heats near the inner core, it rises, cools off and then sinks. Earth's rotation twists this moving iron liquid and generates a self-perpetuating magnetic field with north and south poles.

Every so often the flow of liquid iron is disturbed locally and twists part of the field in the opposite direction, weakening it. What triggers these disturbances is unknown. It seems they are an inevitable consequence of a naturally chaotic system, and geophysicists observe them frequently in computer simulations. "Similar to a hurricane, you can't predict [exactly] when or where a reversal will start, even though you understand the basic physics," says Gary A. Glatzmaier, a geophysicist at the University of California, Santa Cruz. Typically the local reversal peters out after 1,000 years or so, but sometimes the twisting of the field continues to spread and eventually succeeds in reversing the polarity of the entire field. The flipping takes an average of 5,000 years; it can happen as quickly as 1,000 years or as slowly as 20,000 years.



There is a good chance the weakening magnetic field that the Swarm satellites observed will not lead to a full flip. Indeed, Glatzmaier notes that there have been several false starts over geologic history. The intensity of Earth's magnetic field, though waning, now equals its average strength over millions of years. The field would need to weaken at its current rate for around 2,000 years before the reversal process actually begins. It is hard to know how a geomagnetic reversal would impact our modern-day civilization, but it is unlikely to spell disaster. Although the field provides essential protection from the sun's powerful radiation, fossil records reveal no mass extinctions or increased radiation damage during past reversals.

Earth's magnetic field is shown in midreversal. **Gary A. Glatzmaier University Of California, Santa Cruz, And Paul H. Roberts University of California, Los Angeles**

A flip could possibly interfere with power grids and communications systems - external magnetic field disturbances have burned out transformers and caused blackouts in the past. But Glatzmaier is not worried. "A thousand years from now we probably won't have power lines," he says. "We'll have advanced so much that we'll almost certainly have the technology to cope with a magnetic-field reversal."

http://www.eurekalert.org/pub_releases/2014-09/sumc-ssu092214.php

Stanford scientists use stem cells to learn how common mutation in Asians affects heart health

Over 500 million people worldwide carry a genetic mutation that disables a common metabolic protein called ALDH2.

The mutation, which predominantly occurs in people of East Asian descent, leads to an increased risk of heart disease and poorer outcomes after a heart attack. It also causes facial flushing when carriers drink alcohol.

Now researchers at the Stanford University School of Medicine have learned for the first time specifically how the mutation affects heart health. They did so by

comparing heart muscle cells made from induced pluripotent stem cells, or iPS cells, from people with the mutation versus those without the mutation. IPS cells are created in the laboratory from specialized adult cells like skin. They are "pluripotent," meaning they can be coaxed to become any cell in the body.

"This study is one of the first to show that we can use iPS cells to study ethnic-specific differences among populations," said Joseph Wu, MD, PhD, director of the Stanford Cardiovascular Institute and professor of cardiovascular medicine and of radiology.

"These findings may help us discover new therapeutic paths for heart disease for carriers of this mutation," said Wu. "In the future, I believe we will have banks of iPS cells generated from many different ethnic groups. Drug companies or clinicians can then compare how members of different ethnic groups respond to drugs or diseases, or study how one group might differ from another, or tailor specific drugs to fit particular groups."

The findings are described in a paper that will be published Sept. 24 in Science Translational Medicine. Wu and Daria Mochly-Rosen, PhD, professor of chemical and systems biology, are co-senior authors of the paper, and postdoctoral scholar Antje Ebert, PhD, is the lead author.

ALDH2 and cell death

The study showed that the ALDH2 mutation affects heart health by controlling the survival decisions cells make during times of stress. It is the first time ALDH2, which is involved in many common metabolic processes in cells of all types, has been shown to play a role in cell survival. In particular, ALDH2 activity, or the lack of it, influences whether a cell enters a state of programmed cell death called apoptosis in response to stressful growing conditions.

The use of heart muscle cells derived from iPS cells has opened important doors for scientists because tissue samples can be easily obtained and maintained in the laboratory for study. Until recently, researchers had to confine their studies to genetically engineered mice or to human heart cells obtained through a heart biopsy, an invasive procedure that yields cells which are difficult to keep alive long term in the laboratory.

"People have studied the enzyme ALDH2 for many years in animal models," said Ebert. "But there are many significant differences between mice and humans. Now we can study actual human heart muscle cells, conveniently grown in the lab."

The iPS cells in this study were created from skin samples donated by 10 men, ages 21-22, of East Asian descent.

About 8 percent of the world's population carries the mutation in one of their two copies of the ALDH2 gene, which encodes a protein known as aldehyde dehydrogenase 2. The mutation in the gene short-circuits the production of the functional protein. (Because most carriers have one normal and one mutated copy of the gene, they are not completely lacking in the functional ALDH2 protein.)

One of ALDH2's many jobs in a cell is to seek out and neutralize toxic aldehydes, harmful substances caused by a class of compounds called reactive oxygen species. One toxic aldehyde, called 4HNE, causes the accumulation of yet more reactive oxygen species. Left to their own devices, high levels of reactive oxygen species can signal a cell to undergo programmed cell death in response to stress, such as the lack of oxygen that mimics what happens during a heart attack.

In this study, Ebert and her colleagues first studied the skin cells obtained from the volunteers. Five of the 10 volunteers had an ALDH2 mutation; the other five did not. The researchers found that skin cells with the mutation in the ALDH2 gene had strongly decreased function of the ALDH2 protein compared with the cells without the mutation. The mutated cells also had significantly higher amounts of reactive oxygen species, and grew more slowly than the other cells.

They next created iPS cells from the donated skin samples, and stimulated the iPS cells to become heart muscle cells called cardiomyocytes. They then compared how the newly created cardiomyocytes responded to low-oxygen conditions.

Cardiomyocytes with the ALDH2 mutation had higher levels of reactive oxygen species in response to low oxygen levels than those without the mutation, but this difference could be alleviated by treating the cells with a compound that boosts activity of the ALDH2 protein in patients with one unmutated copy of the gene.

Cells with the mutation also were less viable and more likely to undergo programmed cell death than were cells without the mutation. Further study has identified the involvement of a protein called JNK that is activated by high levels of reactive oxygen species. JNK activates a protein called c-Jun known to stimulate programmed cell death.

"This is an entirely new function attributed to this well-known metabolic enzyme," said Ebert. "It's the first time ALDH2 has been shown to play a role in cell survival. Now we have come to understand that when the ALDH2 gene is mutated, cells are more likely to undergo programmed cell death, causing tissue damage."

Establishing biobank of diverse iPS cells

The researchers plan to continue their studies of ALDH2 and its role in maintaining heart health. They would like to investigate further the signaling mechanisms and structural DNA changes that may occur in the presence of the mutation in the ALDH2 gene. This will also allow research on drugs that would increase the activity of the ALDH2 protein in carriers with one good copy and one

mutated copy of the gene, which might become a useful therapy for coronary artery disease and heart attacks.

"With our current state of knowledge, it is very likely that we are ignorant of many functions that ALDH2 has in physiological processes," said Ebert.

Wu is working to start a biobank at the Stanford Cardiovascular Institute of iPS cells from about 1,000 people of many different ethnic backgrounds and health histories. "This is one of my main priorities," he said. "For example, in California, we boast one of the most diverse populations on Earth. We'd like to include male and female patients of major representative ethnicities, age ranges and cardiovascular histories. This will allow us to conduct 'clinical trials in a dish' on these cells, a very powerful new approach, to learn which therapies work best for each group. This would help physicians to understand for the first time disease process at a population level through observing these cells as surrogates."

Other Stanford co-authors are postdoctoral scholars Kazuki Kodo, MD, PhD, Ping Liang, PhD, HaoDi Wu, PhD, Bruno Huber, MD, Johannes Riegler, PhD, Jared Churko, PhD, Jaecheol Lee, PhD, Patricia de Almeida, PhD, DVM, Feng Lan, PhD, and Sebastian Diecke, PhD; instructor Paul Burridge, PhD; and Joseph Gold, PhD, assistant director of translational research at the Stanford Cardiovascular Institute.

The research was supported by the American Heart Association, the National Institutes of Health (grants R01HL113006, U01HL099776, R24HL117756, P01GM099130, and AA11147), the Deutsche Forschungsgemeinschaft and the Fondation Leducq.

Wu is a cofounder of Stem Cell Theranostics. Mochly-Rosen is the founder of ALDEA Pharmaceuticals, a company that is developing a number of small-molecule modulators of ALDH activity for medical use. However, she has no role in the company. The research in her lab is supported only by the NIH and not disclosed to the company.

http://bit.ly/1oiZoPT

Colombian Girls Blame Vaccine for Mysterious Symptoms

In a small town in rural Colombia, dozens of teen girls have complained about strange symptoms including getting cold feet, headaches, convulsions, and fainting.

Sep 24, 2014 06:14 PM ET // by Benjamin Radford

Though no official cause has been determined, reports an article on Yahoo news, the villagers "place the blame squarely on a vaccination campaign against HPV, one of the most common sexually transmitted diseases, which can trigger cervical cancer."

According to an article on Latin America-based Telesurv, at least "276 girls have been reported sick in the Caribbean coastal town, after having receiving the Gardasil vaccine in the last several months."

The girls, ranging from 9 to 16, all experienced similar symptoms including dizziness, fainting, headaches, numbness and tingling throughout their bodies. Mayor Francisco Vega, who is also a doctor, explained that the illnesses began at the end of May and have increased steadily ever since. Could vaccines be responsible for this mysterious incident?

Blaming Vaccines

It's not hard to understand why the HPV vaccine was blamed. For one thing, the vaccination was a common factor among the victims, who were all school-aged females. It's a classic example of a logical fallacy -- post hoc ergo propter hoc -- Latin for "after this, therefore because of it" (also known as faulty causation). People tend to assume that if one event follows another event, there must be some causal link between the two: The girls began having strange symptoms after they got the vaccine, and therefore the vaccine caused the symptoms. But that's not necessarily true. There could have been any number of other factors.

Doubts about vaccine safety is common around the world, often fueled by medical misinformation, anti-vaccination myths and conspiracy theorists.

Radio host Alex Jones, for example, wasted no time in playing up the Colombian story, along with other examples including a 2008 case where homeless people in Poland may have died from bird flu vaccinations. Never mind that these are completely different vaccines given to different populations on different continents six years apart - and that the symptoms are completely different: "This week I saw vaccine deaths in Pakistan, in Syria, and now in Colombia … They say, 'We take the shots, and the little girls start dying,'" Jones said in a Sept. 20 video. Jones is apparently unaware that the girls were vaccinated nearly half a year ago, and that the range of ailments are minor - dizziness, headaches, numbness, etc. - and fall somewhat short of "dying."

Doctors and epidemiologists have investigated the cases and can find no common cause, including the HPV vaccine. Numerous public health officials including the World Health Organization, the Health Ministry, the Colombian Panamerican Health Organization and even Colombia's president, Juan Manuel Santos, have stated clearly and firmly that the vaccines given are safe and effective. It's true that all medicine and vaccines, including Gardasil, can have side effects. However the side effects are mild and temporary, including pain at the injection site, redness, swelling, fever and headache. The benefits –such as preventing cancer - far outweigh the risks.

Mass Hysteria Link

Since the HPV vaccination cannot cause the symptoms described - and certainly not months after being administered - and no other agents or toxins have been found, the most likely cause is mass sociogenic illness, better known as mass hysteria. It happens when psychological symptoms are converted into physical conditions. The girls are not faking nor imagining the physical symptoms they're

reporting. They really do experience headaches, nausea, occasional fainting and so on. But the problems are not caused by any external substance or contaminant. The cause is social and psychological.

While it's true that the affected girls got the HPV vaccine, they also have something else in common: They go to the same school. Schools are among the most common places for mass hysteria outbreaks to occur, and they happen more often to females than males.

Sociologist Robert Bartholomew, co-author of "Mass Hysteria in Schools: A Worldwide History Since 1566," notes that outbreaks of mass hysteria in schools "are far more common than most realize and are impossible to eradicate. Each year the financial costs run in the tens of millions of dollars as schools in Western countries are forced to temporarily close while costly tests are conducted in a vain attempt to identify the cause of a mysterious illness."

Parents of the Colombian girls have angrily (and understandably) rejected the mass hysteria diagnosis, instead accusing the local authorities of incompetence or even conspiracy. Public health officials fear that if others accept the HPV explanation, parents will refuse to vaccinate their children against deadly diseases. Mass hysteria symptoms are what doctors call self-limiting, and usually subside after a few weeks or months. If it's truly a case of mass hysteria, as most medical experts believe, then the girls should be fine by the end of the year. Ironically, the rumors and conspiracy theories blaming vaccines may cause more lasting damage.

http://bit.ly/YcW2qZ

This Device Lets Fully Paralyzed Rats Walk Again, and Human Trials Are Planned

Researchers have figured out a way to reactivate the severed spinal cords of fully paralyzed rats, allowing them to walk again via remote control

Jordan Pearson

In the past few years, there have been some pretty impressive breakthroughs for those suffering from partial paralysis, but a frustrating lack of successes when it comes to those who are fully paralyzed. But a new technique pioneered by scientists working on project NEUWalk at the Swiss Federal Institute for Technology (EPFL) have figured out a way to reactivate the severed spinal cords of fully paralyzed rats, allowing them to walk again via remote control.

And, the researchers say, their system is just about ready for human trials.

Previous studies have had some success in using epidural electrical stimulation (EES) to improve motor control in rodents and humans with spinal cord injuries. However, electrocuting neurons in order to get allow natural walking is no easy task, and it requires extremely quick and precise stimulation.

As the researchers wrote in a study published in Science Translational Medicine, "manual adjustment of pulse width, amplitude, and frequency" of the electrical signal being supplied to the spinal cord was required in EES treatment, until now. Manual adjustments don't exactly work when you're trying to walk.

The team developed algorithms that can generate and accommodate feedback in real-time during leg movement, making motion natural. Well, sort of. We're talking about rats with severed spinal cords hooked up to electrodes being controlled by advanced algorithms, after all.

"We have complete control of the rat's hind legs," EPFL neuroscientist Grégoire Courtine said in a statement. "The rat has no voluntary control of its limbs, but the severed spinal cord can be reactivated and stimulated to perform natural walking. We can control in real-time how the rat moves forward and how high it lifts its legs."

The first step was to tune the EES pulses accurately enough to control the fine motor functions of a normal gait. To do this, the researchers put paralyzed rats onto a treadmill and supported them with a robotic harness. After several weeks of testing, the researchers had mapped out how to stimulate the rats' nervous systems precisely enough to get them to put one paw in front of the other.

Next, the team developed a robust algorithm that could monitor a host of factors like muscle action and ground reaction force in real-time. By feeding this information into the algorithm, EES impulses could be precisely controlled, extremely quickly.

The result, the researchers say, is a closed-loop system that can make paralyzed subjects mobile.

Courtine is quick to note in the above EPFL video that while his team hasn't found the cure for spinal cord injury-related paralysis, they've developed a system that can, and will be scaled to human size.

According to the researchers, human trials are scheduled to begin during summer 2015. The trials will take place at the EPFL, in a specially-designed Gait system, which includes a treadmill, harness support for the subjects, and myriad cameras and sensors to measure their performance.

The EPFL team's research is very exciting, and it could even be huge, but there are months, perhaps even years, of trials and experimentation ahead of them before they can make a person walk again.

It's anyone's guess when something like this could become portable and effective enough to become practical, for instance.

George Church, Harvard's mad geneticist, once told me that any new technology is a lot like a baby: It has to learn to crawl before it can walk. You don't want to oversell it. In this case, that sentiment almost couldn't be any more literal.

http://www.eurekalert.org/pub_releases/2014-09/jcu-aws092414.php

A wriggly solution to a first-world problem

Spaghetti for celiac patients? Just add worms

Australian researchers have achieved groundbreaking results in a clinical trial using hookworms to reduce the symptoms of celiac disease. The results are also good news for sufferers of other inflammatory conditions such as asthma and Crohn's disease.

In the small trial run over a year, 12 participants were each experimentally infected with 20 Necator americanus (hookworm) larvae. They were then given gradually increasing doses of gluten – beginning with just one-tenth of a gram per day (the equivalent of less than a one-inch segment of spaghetti) and increasing in two further stages to a final daily dose of three grams (75 spaghetti straws).

"By the end of the trial, with worms onboard, the trial subjects were eating the equivalent of a medium-sized bowl of spaghetti, with no ill effects," James Cook University (JCU) immunologist Paul Giacomin said.

"That's a meal that would usually trigger a debilitating inflammatory response, leaving a celiac patient suffering symptoms like diarrhea, cramps and vomiting."

Four participants withdrew in the earlier stages of the trial (for various reasons mostly unrelated to gluten) but the remaining eight experienced significant and ongoing benefits. "The eight who stuck with the trial were able to increase their gluten tolerance by a factor of 60, a massive change," said Alex Loukas, head of the Centre for Biodiscovery and Molecular Development of Therapeutics at JCU, and joint principal investigator of the study. "We and others have had promising results in earlier trials but this is clear proof-of-principle of the benefits of hookworm in treating inflammatory disease," Professor Loukas said.

Significantly, all the trial subjects rejected the researchers' offer of drugs that would eliminate the hookworms. "They all chose to keep their worms, and they continue to report good health. However they were instructed to return to a gluten-free diet after the trial," Professor Loukas said.

The potential of helminths (parasitic worms) in treating inflammatory diseases lies in their ability to dial back the human immune response – a skill that enables them to survive, and thrive, in the human gut, without compromising their host's ability to fight off other infectious diseases.

A collaboration between JCU scientists in Cairns and gastroenterologist Dr John Croese at The Prince Charles Hospital in Brisbane, this study investigated the mechanism by which hookworms reduce the inflammatory response. "In gut biopsies collected before, during and at the end of the trial, we identified specific cells of the immune system, known as T cells, that we suspected were targeted by hookworm proteins," Dr Giacomin said. "We found that over the duration of the trial the T cells within the intestine changed from being pro-inflammatory to anti-inflammatory."

Hookworm infestation can be devastating in poorer tropical countries, where Professor Loukas and Dr Giacomin are working on a vaccine to help the 740 million who are infected. "With poor sanitation, repeated infections result in blood loss that can cause severe anemia. For newborns, children, pregnant women and the malnourished, the result can be debilitating illness or death," Professor Loukas said. "People can get treated, but then they get reinfected – a vaccine could break that cycle."

Conversely, inflammatory conditions such as celiac disease, inflammatory bowel disease, Crohn's disease and asthma are less common in developing countries, but are rife in affluent nations where helminths have been largely eradicated. 'In the one out of every 70 Australians who suffer from celiac disease, the immune system reacts abnormally to gluten, resulting in small bowel damage," Dr Croese said. "Symptoms vary, with the most common being gastrointestinal upsets. Others symptoms, some more severe, may include fatigue, anemia, unexplained weight loss or gain, bone or joint pains and swelling of the mouth or tongue."

Professor Loukas said his research team was aiming for a win-win. "We're working on both a vaccine to break that cycle of reinfection in developing countries, and a treatment for the inflammatory conditions that are a growing first-world problem."

The researchers believe that the key to the hookworm's anti-inflammatory prowess lies within the proteins that the worms secrete. They are actively seeking these molecules for further research, with the ultimate goal of developing an entirely new class of anti-inflammatory drug. "This trial has confirmed hookworms as our choice of parasite for clinical applications," Professor Loukas said. "But despite our growing fondness for them, we do acknowledge that a protein pill will have broader market appeal than a dose of worms."

The trial was funded by the Australian National Health and Medical Research Council (NHMRC).

The findings have been published in the Journal of Allergy and Clinical Immunology.

http://bit.ly/1uJCZyI

Unknown rice parasite threatens harvests in Africa

Few agronomists are familiar with Rhamphicarpa fistulosa, a fragile weed with white flowers, from the broomrape family.

Yet this root parasite is increasingly affecting rice cultivation in Africa. This has become clear from the initial results of the research programme PARASITE on parasitic weeds in rice in sub-Saharan Africa. The rice pest was described by the Beninese agronomist Gualbert Gbèhounou in the early 1990s. More than twenty

years later, still very few people are familiar with it. This was the motivation for seven Dutch and African research groups, led by Wageningen UR, to start investigating the problem in 2012.

Rhamphicarpa is easily overlooked at first

The Dutchman Jonne Rodenburg has been investigating the plant since 2006. He is a weed expert at the CGIAR institute AfricaRice in Tanzania, one of the seven research partners of the PARASITE programme. "Women farmers showed us the plant during field visits in Senegal and Benin," he recalls. "In both locations, they had no idea what to do about it" Agricultural extension officers to whom Jonne spoke also didn't know the plant. And he understands why: Rhamphicarpa is easily overlooked before it overgrows a rice field as it is a fragile plant with thin, needle-like leaves and its flowers only open at night.

Twenty per cent less yield

The partners in PARASITE organised workshops, interviewed farmers and other stakeholders like extension and crop protection officers, consulted herbaria and studied the relevant biology. The studies showed that Rhamphicarpa occurs in almost all countries south of the Sahara. It is increasingly prevalent in the low-lying, rain-dependent rice fields where rice cultivation is expanding rapidly. The parasite can easily reduce yields by as much as twenty per cent and even cause complete crop failure. In fields at higher altitudes, rice cultivation is more susceptible to Striga, the other major rice parasite.

Field trials

Wageningen UR, AfricaRice and the Tanzanian agricultural institute MARI have now started field trials. Along with farmers and extension agents, scientists examined the effect of organic and chemical fertilisers, and combinations of the two. Fertilisation is important because it reduces the parasite infection and the parasite may cause less of an effect as well-fed plants may be more resilient. The partners are also looking into whether other varieties or seeding intervals could suppress the pest. "Pesticides are often unavailable or too expensive," project leader Lammert Bastiaans of Wageningen UR explains. "Besides, the technology is very knowledge intensive and therefore not very suitable for promotion among farmer communities with high literacy rates"

Still too little attention to Rhamphicarpa

The lack of awareness of Rhamphicarpa appears to be due to a variety of reasons. African governmental crop protection services focus less on weeds than, for example, locust plagues or fungal diseases, as the latter cause more visible losses in yield. In addition, field visits by extensions agents are scarce due to limited financial support. The extension agents often even lack funds to purchase petrol for their motorcycles, while rice fields may be quite remote.

Socioeconomic conditions

The research programme PARASITE is funded by the Dutch organisation NWO-WOTRO and runs until 2016. The partners will make educational material on Rhamphicarpa and encourage farmers to start their own tests. Jonne Rodenburg praises the interdisciplinary approach. "We also look at the socioeconomic conditions, consider which approach is best for the farmers' needs and examine how the information can best be disseminated."

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http://phys.org/news/2014-09-when-finding-nothing-means-something.html

When finding 'nothing' means something

Positives in negative results: when finding 'nothing' means something

September 25th, 2014 by Natalie Matosin And Martin Engel

Scientists usually communicate their latest findings by publishing results as scientific papers in journals that are almost always accessible online (albeit often at a price), ensuring fast sharing of latest knowledge. But negative findings – those that do not agree with what the researchers hypothesised – are often overlooked, discouraged or simply not put forward for publication.

Yet negative findings can save scientists valuable time and resources by not repeating already performed experiments, so it is important that all results, regardless of the outcome, are published.

Adding human nature to the mix

Despite devoting their lives to logic and facts, scientists are still human. Their decisions are influenced by emotions and opinions. They are, at times, unlikely to trust conflicting results due to a pre-existing belief that something else is true. This phenomenon is known as cognitive bias. If presented with evidence that disproves an old theory, scientists may simply attribute the discrepancy to experimental error. In extreme cases, reporting a negative result, particularly when it refutes previous research, is to some extent considered a form of discreditation. At other times, human error and the fact that science cannot always be reproduced has led to the belief that negative results are associated with flawed or poor science.

Revolt against the negative-finding culture

The stigma surrounding negative findings means that they are a low priority for publication. High-quality journals are less likely to accept negative findings

because they are associated with a lower citation rate, lower impact knowledge and are often controversial.

This raises a major issue: if results are not reported (positive or negative) then other scientists may waste time and resources needlessly repeating experiments.

Positives in negative results: when finding 'nothing' means something

Or, in some situations, theories that are untrue or incomplete are never corrected, despite their potentially dire consequences (as in the case of the measles, mumps and rubella MMR vaccine despite the original research linking it to autism being retracted by The Lancet).

A scientist's success depends largely on the impact of their research. Higher-impact findings published in prominent journals tend to attract more funding grants. As citations are a measure of a scientist's worth, and negative results attract fewer citations, many scientists simply choose not to spend the time publishing negative results.

Dissemination of negative results has traditionally been one of the hardest battles faced by scientists. It is particularly difficult when these negative findings contradict previously published research, even though many reputable journals have policies to publish such work. It was a problem Australian researcher David Vaux wrote about in a Retraction Watch blog on his attempts to publish contradictory results.

In recent years, open-access and broad-scope journals such as *PLOS One*, Frontiers and the *Biomed Central* journal series are increasingly publishing papers with negative findings. Additionally, a number of journals have surfaced whose primary objective is to disseminate negative findings, such as Journal of Articles in Support of the Null Hypothesis, Journal of Negative Results in Biomedicine and The All Results Journal.

The purpose of these journals is to give negative findings a home, where they can still be accessed widely by the international science community without facing prejudice in the review process. But these journals have lower publication rates, reflective of a scientific culture that deems negative results less valuable.

How to turn a negative into a positive

The issues surrounding the negative finding culture are certainly gaining traction. Many reputable journals such as *Disease Models & Mechanisms* and *Nature* have covered the topic recently. Nonetheless, publication bias is still an issue, indicating that a shift in the scientific culture is required.

Some journals have suggested that negative findings be published open access and free of charge, while others have suggested that scientists be encouraged to submit corrections as well as new results.

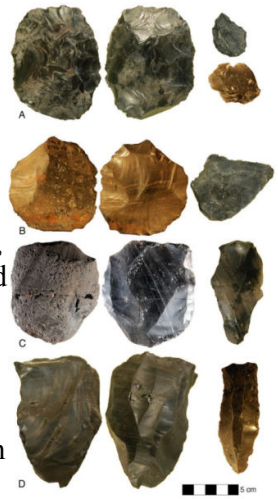
Additionally, a push by funding agencies for scientists to make available all data gathered (such as via Open Science) from their support may reduce the stigma attached to negative findings. As proposed by American physicist and philosopher Thomas Kuhn, a shift in scientific thinking will occur when the amount of evidence in support of the new paradigm overtakes the old one.

Following this logic, perhaps the answer to reversing the anti-negative-finding culture lies in educating young scientists about the importance of disseminating all results. This way, the next generation of scientists may experience improved scientific communication and more efficient science.

http://www.eurekalert.org/pub_releases/2014-09/rhuo-isa092514.php

Innovative Stone Age tools were not African invention, say researchers

Discovery of 325,000-year old Stone Age tools provides a major insight into human innovation and how early technology spread across the world



Levallois and biface tools. **Royal Holloway, University of London**

A new discovery of thousands of Stone Age tools has provided a major insight into human innovation 325,000 years ago and how early technological developments spread across the world, according to research published in the journal Science.

Researchers from Royal Holloway, University of London, together with an international team from across the United States and Europe, have found evidence which challenges the belief that a type of technology known as Levallois – where the flakes and blades of stones were used to make useful products such as hunting weapons – was invented in Africa and then spread to other continents as the human population expanded.

They discovered at an archaeological site in Armenia that these types of tools already existed there between 325,000 and 335,000 years ago, suggesting that local populations developed them out of a more basic type of technology, known as biface, which was also found at the site.

Dr Simon Blockley and Dr Alison MacLeod, from the Department of Geography at Royal Holloway, analysed volcanic material that preserved the archaeological site in the village of Nor Geghi, in the Kotayk Province of Armenia. By employing innovative procedures developed at Royal Holloway, they extracted suitable material to help date the Levallois tools.

"The discovery of thousands of stone artefacts preserved at this unique site provides a major new insight into how Stone Age tools developed during a period of profound human behavioural and biological change", said Dr Blockley.

"The people who lived there 325,000 years ago were much more innovative than previously thought, using a combination of two different technologies to make tools that were extremely important for the mobile hunter-gatherers of the time.

"Our findings challenge the theory held by many archaeologists that Levallois technology was invented in Africa and spread to Eurasia as the human population expanded. Due to our ability to accurately date the site in Armenia, we now have the first clear evidence that this significant development in human innovation occurred independently within different populations."

Archaeologists argue that Levallois technology was a more innovative way of crafting tools, as the flakes produced during the shaping of the stone were not treated as waste but were made at predetermined shapes and sizes and used to make products that were small and easy to carry. With the more primitive biface technology, a mass of stone was shaped through the removal of flakes from two surfaces in order to produce bigger tools such as a hand axes.

http://www.eurekalert.org/pub_releases/2014-09/ci-ewi092214.php

Earth's water is older than the sun

Much of our Solar System's water likely originated as interstellar ices

Washington, D.C.- Water was crucial to the rise of life on Earth and is also important to evaluating the possibility of life on other planets. Identifying the original source of Earth's water is key to understanding how life-fostering environments come into being and how likely they are to be found elsewhere.

New work from a team including Carnegie's Conel Alexander found that much of our Solar System's water likely originated as ices that formed in interstellar space. Their work is published in Science.

Water is found throughout our Solar System. Not just on Earth, but on icy comets and moons, and in the shadowed basins of Mercury. Water has been found included in mineral samples from meteorites, the Moon, and Mars.

Comets and asteroids in particular, being primitive objects, provide a natural "time capsule" of the conditions during the early days of our Solar System. Their ices can tell scientists about the ice that encircled the Sun after its birth, the origin of which was an unanswered question until now.

In its youth, the Sun was surrounded by a protoplanetary disk, the so-called solar nebula, from which the planets were born. But it was unclear to researchers whether the ice in this disk originated from the Sun's own parental interstellar molecular cloud, from which it was created, or whether this interstellar water had been destroyed and was re-formed by the chemical reactions taking place in the solar nebula.

"Why this is important? If water in the early Solar System was primarily inherited as ice from interstellar space, then it is likely that similar ices, along with the prebiotic organic matter that they contain, are abundant in most or all protoplanetary disks around forming stars," Alexander explained. "But if the early Solar System's water was largely the result of local chemical processing during the Sun's birth, then it is possible that the abundance of water varies considerably in forming planetary systems, which would obviously have implications for the potential for the emergence of life elsewhere."

In studying the history of our Solar System's ices, the team - led by L. Ilsedore Cleeves from the University of Michigan - focused on hydrogen and its heavier isotope deuterium. Isotopes are atoms of the same element that have the same number of protons but a different number of neutrons.

The difference in masses between isotopes results in subtle differences in their behavior during chemical reactions. As a result, the ratio of hydrogen to deuterium in water molecules can tell scientists about the conditions under which the molecules formed.

For example, interstellar water-ice has a high ratio of deuterium to hydrogen because of the very low temperatures at which it forms. Until now, it was unknown how much of this deuterium enrichment was removed by chemical processing during the Sun's birth, or how much deuterium-rich water-ice the newborn Solar System was capable of producing on its own.

So the team created models that simulated a protoplanetary disk in which all the deuterium from space ice has already been eliminated by chemical processing, and the system has to start over "from scratch" at producing ice with deuterium in it during a million-year period.

They did this in order to see if the system can reach the ratios of deuterium to hydrogen that are found in meteorite samples, Earth's ocean water, and "time capsule" comets.

They found that it could not do so, which told them that at least some of the water in our own Solar System has an origin in interstellar space and pre-dates the birth of the Sun.

"Our findings show that a significant fraction of our Solar System's water, the most-fundamental ingredient to fostering life, is older than the Sun, which indicates that abundant, organic-rich interstellar ices should probably be found in all young planetary systems," Alexander said.

This research was supported by the NSF, the Rackham Predoctoral Fellowship, NASA Astrobiology, NASA Cosmochemistry and NASA.

http://www.eurekalert.org/pub_releases/2014-09/wsu-ard092314.php

Agonizing rabies deaths can be stopped worldwide

Mass dog vaccination clinics can eliminate a neglected infectious disease that brutally kills tens of thousands of people each year

The deadly rabies virus--aptly shaped like a bullet-- can be eliminated among humans by stopping it point-blank among dogs, according to a team of international researchers led by the Paul G. Allen School for Global Animal Health at Washington State University.

Ridding the world of rabies is cost-effective and achievable through mass dog vaccination programs, the scientists report in a paper that appears in the Sept. 26 issue of Science magazine.

What's more, they write, because infections occur as a result of interactions between animals and people, a "One Health" approach is necessary, where veterinary, medical and public health professionals collaborate to eliminate the disease worldwide.

Publication of the article, "Implementing Pasteur's vision for rabies elimination" coincides with the 119th anniversary of French scientist's Louis Pasteur's death and a global campaign to wrench an ancient disease in the shadows to the forefront.

A rabies vaccine has long existed, developed by Pasteur in 1885. Even so, the disease kills an estimated 69,000 people worldwide - that's 189 each day. Forty percent of them are children, mostly in Africa and Asia. The disease is spread primarily through the saliva of infected dogs. Once a person develops symptoms, the chance that he or she will die is nearly 100-percent.

"The irony is that rabies is 100 percent preventable. People shouldn't be dying at all," said veterinary infectious disease expert Guy Palmer, who directs WSU's Allen School and is co-author of the paper.

The disease persists, partly due to political complacency but also because of a lack of international commitment, researchers state in the article.

And yet, eliminating it "meets all the criteria for a global health priority: It is epidemiologically and logistically feasible, cost-effective and socially equitable," they conclude.

The authors cite the success of mass dog vaccination clinics held in the East African country of Tanzania.

Working in 180 villages, members of the Allen School and the Serengeti Health Initiative vaccinate as many as 1,000 dogs in a single day.

Since the program began in 2003, the number of people killed by rabies has dropped from an average of 50 each year to almost zero, according to Allen School researcher Felix Lankester, based in East Africa, who is the paper's lead author.

Vaccinating 70-percent of the dogs in the region broke the route of transmission from dogs to humans, he explained.

Though human rabies is rarely seen in developed nations that conduct mass dog vaccination programs, the disease should be viewed as a global public health problem that can be solved, writes Lankester, Palmer and co-authors from the Nelson Mandela African Institution of Science and Technology, the University of Glasgow in Scotland and the Global Alliance for Rabies Control.

http://bit.ly/ZVFTqZ

No Single Missing Link Between Birds and Dinosaurs, Study Finds

Birds didn't evolve in one fell swoop from their dinosaur ancestors, suggests a newly constructed dinosaur family tree showing our feathery friends evolved very gradually, at first.

By Tanya Lewis, Staff Writer | September 25, 2014 12:00pm ET

The new pedigree of carnivorous dinosaur evolution is the most comprehensive one ever assembled, the researchers say.

The findings show that birdlike features such as wings and feathers developed slowly over tens of millions of years.

But once the bird body plan was complete, the group underwent a burst of evolution that produced thousands of species, according to the study published today (Sept. 25) in the journal Current Biology.

"It's basically impossible to draw a line on the tree between dinosaurs and birds," said study co-author Steve Brusatte, a paleontologist at the University of Edinburgh, in Scotland. But after the bird body arose, "something was unlocked, and [birds] began to evolve at a supercharged rate," Brusatte told Live Science.

Scientists have long known that birds are part of the dinosaur lineage.

But because the fossil record has many gaps, some scientists and members of the public thought that a "missing link" must exist between the first bird and its closest dino ancestor. But more and more feathered dinosaur fossils have been cropping up over the past two decades, particularly in China, suggesting the development of birds was more piecemeal.

Brusatte and his colleagues examined more than 850 body features in 150 extinct species of birds and their closest dinosaur relatives. By analyzing the data using statistics, the researchers constructed a complete family tree.

The tree reveals that the characteristic features of birds evolved very gradually about 150 million years ago, and the earliest birds would have been indistinguishable from their closest relatives.

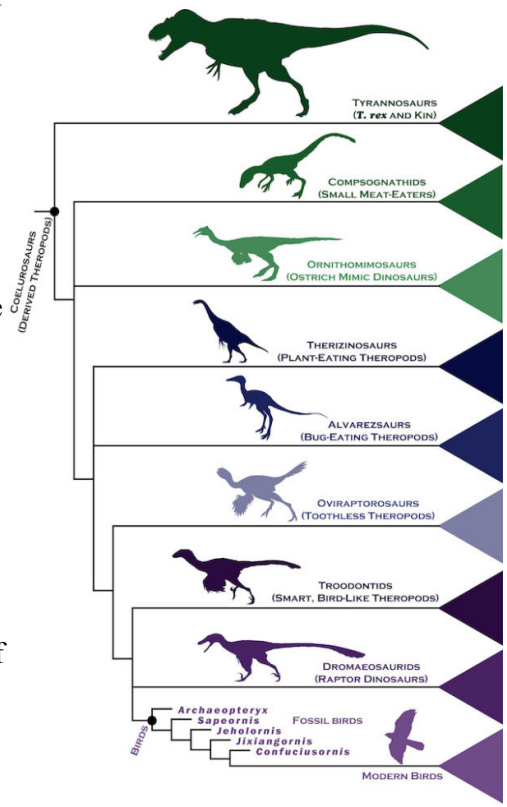
The label of "bird" is somewhat arbitrary, but scientists consider the feathered fossil Archaeopteryx to be the first of the group, Brusatte said. "What probably distinguishes birds is the ability to have powered flight," he said, though it's possible that other dinosaurs could fly too.

"Dinosaurs became ever more 'birdy' over time," Brusatte said, but there was no single missing link, he added. Birds and dinosaurs are like two colors in a rainbow, he said - you can recognize each, but they bleed into each other at their borders.

Yet once the basic body plan was established, the findings show, birds began to evolve much faster than other dinosaur groups.

"It is particularly cool that it is evidence from the fossil record that shows how an oddball offshoot of the dinosaurs paved the way for the spectacular variety of bird species we see today," Graeme Lloyd, another co-author of the study and a paleontologist at the University of Oxford, in England, said in a statement.

The findings provide support for the controversial idea that extreme bursts of evolution usually follow the origin of new body plan, first hypothesized by American paleontologist George Gaylord Simpson in the 1940s.



Dinosaur family tree depicting the origin of birds. **Steve Brusatte/University of Edinburgh**

The researchers don't know what about birds made them so successful. Perhaps because birds are small, warm-blooded and move fast, they were able to persist while non-avian dinosaurs died out, Brusatte said.

But the researchers really don't know why avians outperformed their comrades. You might as well ask why Homo sapiens were so successful, compared with other human relatives, Brusatte said.

http://www.eurekalert.org/pub_releases/2014-09/sh-fmt092514.php

Fecal microbiota transplantation recommended for treatment of C. difficile

Fecal microbiota transplantation now officially recommended for the effective treatment of C. difficile infection

Vienna- The transplantation of faecal microbiota from a healthy donor has been shown in recent clinical studies to be a safe and highly effective treatment for recurrent *Clostridium difficile* (*C. difficile*) infection and is now recommended in European treatment guidelines.[1,2]

Faecal microbiota transplantation (FMT) has emerged as a revolutionary, potentially life-saving treatment for this common, difficult-to-treat infection, and is showing promise in the management of other microbiota-related conditions.[3,4]

Presenting at the 22nd United European Gastroenterology Week (UEG Week 2014) in Vienna, Austria, Professor Antonio Gasbarrini from the Gemeli University Hospital in Rome believes that FMT should now be used more widely in order to reduce both the clinical and economic burden of microbiota-related disease.

"FMT is an old procedure that has gained in popularity in recent years," he says. "When used in patients with recurrent *C. difficile* infections, which are extremely difficult to treat, FMT eradicates the bacteria in around 90% of cases with a good safety profile."

The challenges of *C. difficile* infection

C. difficile infection is the most common cause of hospital-acquired diarrhoea, and is associated with significant morbidity and mortality in hospitalized patients. Infection rates have been rising rapidly in Europe and reports of emerging new strains, growing antibiotic resistance, and increased susceptibility in non-hospitalized individuals are of grave concern.

C. difficile infection causes severe diarrhoea, intestinal inflammation and toxin-mediated cell death that, in severe cases, can lead to shock, hypotension, ileus or megacolon. Standard first-line therapies include the antibiotics, vancomycin or metronidazole, which are initially effective in most individuals.

Unfortunately, approximately 20% of successfully-treated patients will have an infection recurrence, and many of these will experience multiple recurrences.[5]

"Recurrent *C. difficile* infections are particularly difficult to treat, with long courses of antibiotics further disrupting the normal gut microflora, putting the patient at great risk of serious complications such as sepsis or perforation of the bowel," says Prof. Gasbarrini. "There is an urgent need for more effective treatments for recurrent *C. difficile* infections and FMT is definitely one of them."

FMT for *C. difficile* infection

FMT is an innovative treatment that was first described in *C. difficile* infection in the 1950s, and is being used increasingly in everyday practice. In FMT, healthy microbiota harvested from a donated stool sample is transplanted into the intestine of the recipient – often by colonoscopy or enema – where it helps to restore the normal composition of the gut flora and overcome the toxic consequences of *C. difficile* infection.

Studies in patients with *C. difficile* infection have confirmed that the treatment has a good safety record and is highly effective – quickly eradicating recurrent infections in around 90% of patients.[5,6] While once considered a last-resort option for only the brave or desperate, FMT is now officially recommended in influential European treatment guidelines for recurrent *C. difficile* infections.[1,2]

"FMT can be considered a very simple form of organ transplantation that does not require immunological matching of donor and recipient and does not need immunosuppression after the procedure," says Prof. Gasbarrini. "I am delighted that FMT has now been formally recognised as an effective treatment for recurrent *C. difficile* infection and I hope the technique will now be used more widely in an effort to relieve some of the burden of this troublesome infection."

1. Debast SB, et al. Clin Microbiol Infect 2014; 20 (Suppl 2): 1-26.
2. National Institute for Health and Care Excellence. Faecal microbiota transplant for recurrent Clostridium difficile infection. NICE interventional procedure guidance 485. March 2014.
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4. Smits LP, et al. Gastroenterology 2013; 145: 946-953.
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http://nyti.ms/1wNd9vv

A Tiny Emissary From the Ancient Past

Viroids existed at the earliest stages of life on Earth

In the early 1920s, farmers in New Jersey noticed their potatoes were shriveling, their leaves becoming deformed. The plants were sick with an illness that came to be known as potato spindle tuber disease. But it took almost five decades for someone to find the cause.

In 1971, Theodor O. Diener, a plant pathologist at the Department of Agriculture, discovered that the culprit is an inconceivably tiny pathogen - one-80th the size of a virus. Dr. Diener called it a viroid.

Since Dr. Diener's initial discovery, scientists have identified nearly three dozen species of viroids that attack crops from tomatoes to coconuts, as well as flowers such as dahlias and chrysanthemums. In many cases, the only way to stop an outbreak is to destroy all the infected plants. These days many countries require that plants be certified viroid-free before being imported.

But viroids may be much more than agricultural pests. New research suggests that they existed at the earliest stages of life on Earth, enduring in their primitive state for billions of years. These are the pterodactyls of the microbial world — except that they are still very much with us. We just didn't realize it.

Today, most living things are composed of three basic ingredients. They contain proteins, which give a body structure and carry out chemical reactions. They also contain double-stranded DNA, which encodes genes.

And they contain RNA, a single-stranded molecule similar to DNA. Among many other jobs, RNA carries the information for building proteins from a cell's genes to its protein factories.

Many scientists have argued that before this kind of life emerged, life was based solely on RNA. RNA can store genetic information, but scientists have discovered that some RNA molecules also carry out chemical reactions. In other words, this single molecule might have been able to handle all the basic tasks required for life. Only later did DNA and proteins evolve.

At first, the proponents of the so-called RNA-world theory assumed that RNA-based life had become extinct long ago, driven to extinction with the arrival of superior DNA-based life. Researchers have relied only on indirect hints to infer what RNA-based life was like.

But in the current issue of Annual Reviews of Microbiology, a team of Spanish scientists argues that these primitive life forms share the planet with us today.

"Viroids are probably relics of the RNA world," said Santiago F. Elena, an evolutionary biologist at the University of València.

Dr. Elena and his colleagues base their argument on the bizarre biology of viroids, which are nothing more than naked loops of RNA. Viruses, by contrast, package their genetic material in a protein shell.

A viroid contains astonishingly little genetic material. DNA and RNA are made from building blocks called nucleotides. All the genetic material in a viroid may total less than 400 nucleotides. A flu virus is gigantic by comparison, with 14,000 nucleotides; the human genome contains 3.2 billion pairs of nucleotides.

As scant as the viroid's genome may be, it's enough for reproduction. The first step is to slip into a plant, usually through a wound (pruning shears can spread viroids from flower to flower, for example). Once inside a cell, the viroid tricks the host into making new copies of its genes.

As the new strand of RNA grows, it cuts itself, creating a newly liberated strand of RNA. The strand then loops into a circle — a new viroid.

To Dr. Elena and his colleagues, that suggests that viroids behave exactly as the organisms in an RNA world might have — their RNA carries genes and also performs a chemical task. That viroids might be holdovers from an ancient, almost mythical time seems more logical to Dr. Elena and his colleagues than to think these odd organisms recently evolved.

It's unlikely, for example, that viroids are just viruses that lost their shells. "The evolutionary origins of viruses and viroids are totally different," said Ricardo Flores, a biologist at the Polytechnic University of València and co-author on the new paper.

Originally, Dr. Flores and Dr. Elena argue, the ancestors of today's viroids were free-living organisms. But when DNA-based life emerged and conquered the world, viroids evolved into parasites. They started taking advantage of the cellular machinery of their DNA-based hosts, using it to churn out new viroids.

But it's a long road from the primal ooze to today's potatoes and dahlias. If viroids really did first evolve billions of years ago, then they ought to infect more species than domesticated plants.

Dr. Flores says he thinks this gap has more to do with science than with nature. Scientists notice viroids only when they harm the plants we raise. If researchers looked beyond farms, they might find new species.

Wild plants would be a good place to start, Dr. Flores said. It's possible that wild plants serve as a reservoir where viroids can lurk, spilling over from time to time onto farms.

But viroids may be lurking elsewhere, too. The ancestors of plants gained the ability to capture sunlight by swallowing up photosynthetic microbes. Dr. Flores speculated that these microbes, called cyanobacteria, may have been ancient hosts for viroids, eventually passing them on to plants.

"I wouldn't be surprised if viroids are found in cyanobacteria," Dr. Flores said. It would be a remarkable discovery, a link in a chain connecting the food on our tables to the dawn of life.

http://www.bbc.com/news/science-environment-29368984

Complex organic molecule found in interstellar space

Scientists have found the beginnings of life-bearing chemistry at the centre of the galaxy.

By Michael Eyre Science reporter

Iso-propyl cyanide has been detected in a star-forming cloud 27,000 light-years from Earth. Its branched carbon structure is closer to the complex organic molecules of life than any previous finding from interstellar space. The discovery suggests the building blocks of life may be widespread throughout our galaxy.

Various organic molecules have previously been discovered in interstellar space, but i-propyl cyanide is the first with a branched carbon backbone. The branched structure is important as it shows that interstellar space could be the origin of more complex branched molecules, such as amino acids, that are necessary for life on Earth.

Dr Arnaud Belloche from the Max Planck Institute for Radio Astronomy is lead author of the research, which appears in the journal Science. "Amino acids on Earth are the building blocks of proteins, and proteins are very important for life as we know it. The question in the background is: is there life somewhere else in the galaxy?"

Watch the skies

The molecule was detected in a giant gas cloud called Sagittarius B2, an active region of ongoing star formation in the centre of the Milky Way.

As stars are born in the cloud they heat up microscopic dust grains. Chemical reactions on the surface of the dust allow complex molecules like i-propyl cyanide to form. The molecules emit radiation that was detected as radio waves by twenty 12m telescopes at the Atacama Large Millimeter Array (Alma) in Chile.

Each molecule produces a different "spectral fingerprint" of frequencies. "The game consists in matching these frequencies… to molecules that have been characterised in the laboratory," explained Dr Belloche. "Our goal is to search for new complex organic molecules in the interstellar medium."

Previously discovered molecules in the Sagittarius B2 cloud include vinyl alcohol and ethyl formate, the chemical that gives raspberries their flavour and rum its smell. But i-propyl cyanide is the largest and most complex organic molecule found to date - and the only one to share the branched atomic backbone of amino acids. "The idea is to know whether the elements that are necessary for life to occur… can be found in other places in our galaxy."

Prof Matt Griffin, head of the school of physics and astronomy at Cardiff University, commented on the discovery. "It's clearly very high-quality data - a very emphatic detection with multiple spectral signatures all seen together."

Prof Griffin added that the quantity of i-propyl cyanide detected is significant. "There seems to be quite a lot of it, which would indicate that this more complex organic structure is possibly very common, maybe even the norm, when it comes to simple organic molecules in space. "It's a step closer to discovering molecules that can be regarded as the building blocks or the precursors… of amino acids."

The hope is that amino acids will eventually be detected outside our Solar System. "That's what everyone would like to see," said Prof Griffin.

If amino acids are widespread throughout the galaxy, life may be also.

"So far we do not have the sensitivity to detect the signals from [amino acids]… in the interstellar medium," explained Dr Belloche. "The interstellar chemistry seems to be able to form these amino acids but at the moment we lack the evidence. "Alma in the future may be able to do that, once the full capabilities are available."

Prof Griffin agreed this could be the first of many further discoveries from the "fantastically sensitive and powerful" Alma facility.

http://www.eurekalert.org/pub_releases/2014-09/uab-usc092614.php

UB study: COPD patients breathe easier with Lung Flute

Six-month study demonstrates longer-term benefits to patients from device made by Buffalo-based Medical Acoustics

BUFFALO, N.Y. – Patients with chronic obstructive pulmonary disease (COPD) report improved symptoms and health status when they use a hand-held respiratory device called the Lung Flute®, according to a new study by the University at Buffalo. Usually caused by smoking, COPD, which includes chronic bronchitis and emphysema, is the third leading cause of death in the U.S.

The Lung Flute, manufactured by Medical Acoustics, (Buffalo), uses sound waves to break up mucus in the lungs. The device allows patients to clear lung mucus simply by blowing into the hand-held respiratory device, which produces a low frequency acoustic wave.

Published on Sept. 23 in Clinical and Translational Medicine, the 26-week study demonstrates that patients using the Lung Flute experience less difficulty breathing and less coughing and sputum production than a control group, which saw no change in COPD symptoms.

"This study confirms that the Lung Flute improves symptoms and health status in COPD patients, decreasing the impact of the disease on patients and improving their quality of life," says Sanjay Sethi, MD, principal author of the study and professor and chief, division of pulmonary, critical care and sleep medicine in the Department of Medicine, UB School of Medicine and Biomedical Sciences.

Photos of the Lung Flute and Sethi are at http://www.buffalo.edu/news/releases/2014/09/051.html.

The device is approved by the Food and Drug Administration (FDA) to treat COPD and other lung diseases characterized by retained secretions and congestion. It also is approved by FDA to obtain deep lung sputum samples for "laboratory analysis and pathologic examination."

Colleagues of Sethi's in the UB medical school are now studying the Lung Flute for use in improving symptoms in asthma. The device is also being investigated for diagnostic use in tuberculosis and lung cancer.

The study followed 69 patients with COPD for six months; it was conducted at the Veterans Affairs Western New York Healthcare System (Buffalo VA) by researchers at the UB medical school.

"This study confirms and extends the results of a previous, 8-week study of 40 patients that was conducted in 2010 to obtain FDA approval for the Lung Flute," says Sethi, whose clinical practice is at the Buffalo VA.

He has led a series of clinical trials demonstrating the safety and efficacy of the Lung Flute, including those that played a key role in the FDA's approval of the device for diagnostic and therapeutic uses.

Improvement in the current study was demonstrated by responses reported by patients on the Chronic COPD Questionnaire, which assesses changes in COPD symptoms and the St. George's Respiratory Questionnaire, which measures quality of life. On both questionnaires, patients using the Lung Flute reported significant improvements.

In addition, the Body-Mass Index, Airflow Obstruction, Dyspnea and Exercise Capacity (BODE) score was measured repeatedly in the study. "The BODE index provides a more comprehensive assessment of COPD patients," explains Sethi. "As the disease worsens, the BODE index goes up as it did in the control group. But for patients using the Lung Flute, the BODE index stayed flat."

Sethi adds that the study points to a potential decrease in exacerbations, flare-ups of respiratory symptoms, as a result of using the Lung Flute. Researchers are planning longer-term studies that will focus specifically on how the device affects exacerbations, a key part of what makes COPD patients sicker and leads to health care utilization.

Sethi notes that while similar devices have been developed for cystic fibrosis, the Lung Flute is the only one that has undergone extensive testing specifically for COPD patients. In a previous study comparing a device developed for cystic fibrosis with the Lung Flute, the Lung Flute was superior for COPD patients.

"All therapeutic studies on using the Lung Flute for COPD have been done here in Buffalo," says Sethi. "We have the biggest database by far on using the device in COPD. The Lung Flute is the only one that has been tested and been clearly shown to benefit COPD patients."

The research is the result of a partnership between UB and Medical Acoustics.

"Medical Acoustics has worked closely with UB's medical school since the company's founding in 2002," says Frank Codella, chief executive officer at Medical Acoustics. "We are very fortunate to have had access to UB's vast resources, including medical researchers of the caliber of Sanjay Sethi and his team, to lead many of the Lung Flute's clinical trials.

"Dr. Sethi is recognized as one of the leading COPD research professionals in the United States," Codella continues. "His research has resulted in the Lung Flute receiving FDA clearances for both obtaining deep lung sputum samples for diagnostic use and for airway clearance therapy as well as a series of Phase IV studies such as the one being reported this week."

Adds Sethi: "The people at Medical Acoustics are open-minded and I was willing to help because I saw an unmet medical need. Our relationship satisfies my goal of getting therapies to patients, while it helps the company succeed, satisfying their goals of creating a viable business. That's the way academia and industry partnerships should work."

The research was funded by Medical Acoustics and by the UB Center for Advanced Biomedical and Bioengineering Technology, which is funded by NYSTAR, Empire State Development's Division of Science, Technology and Innovation.

Co-authors with Sethi are Jingjing Yin, PhD, who earned her doctorate at UB's Department of Biostatistics in the School of Public Health and Health Professions and Pamela K. Anderson, currently manager of the Clinical Trials Office in UB's Clinical and Translational Research Center.

http://bit.ly/1vjwPI7

Weak Nuclear Force Shown to Give Asymmetry to Biochemistry of Life

"Left-handed" electrons have been found to destroy certain organic molecules faster than their mirror versions

Sep 26, 2014 |By Elizabeth Gibney and Nature magazine

Physicists have found hints that the asymmetry of life — the fact that most biochemical molecules are ‘left-handed’ or ‘right-handed’ — could have been caused by electrons from nuclear decay in the early days of evolution. In an experiment that took 13 years to perfect, the researchers have found that these electrons tend to destroy certain organic molecules slightly more often than they destroy their mirror images.

Many organic molecules, including glucose and most biological amino acids, are ‘chiral’. This means that they are different than their mirror-image molecules, just like a left and a right glove are. Moreover, in such cases life tends to consistently use one of the possible versions — for example, the DNA double helix in its standard form always twists like a right-handed screw. But the reason for this preference has long remained a mystery.

Many scientists think that the choice was simply down to chance. Perhaps, in one of the warm little ponds filled with organic chemicals where life arose, a statistical fluke generated a small imbalance in the relative amounts of the two versions of one chemical. This small imbalance could have then amplified over time.

But an asymmetry in the laws of nature has led others to wonder whether some physical phenomenon could have tipped the balance during the early stages of life. The weak nuclear force, which is involved in nuclear decay, is the only force of nature known to have a handedness preference: electrons created in the subatomic process known as β decay are always 'left-handed'. This means that their spin — a quantum property analogous to the magnetization of a bar magnet — is always opposite in direction to the electron's motion.

In 1967, biochemist Frederic Vester and environmental scientist Tilo Ulbricht proposed that photons generated by these so-called spin-polarized electrons — which are produced in the decay of radioactive materials or of cosmic-ray particles in the atmosphere — could have destroyed more of one kind of molecule than another, creating the imbalance. Some physicists have since suggested that the electrons themselves might be the source of the asymmetry.

But the hunt to find chemical processes through which electrons or photons could preferentially destroy one version of a molecule over its mirror image has seen little success. Many claims have proven impossible to reproduce. The few experiments in which electron handedness produced a chiral imbalance could not identify the chemical process behind it, says Timothy Gay, a chemical physicist at the University of Nebraska–Lincoln and a co-author of the latest study. But pinpointing a chemical reaction would help scientists to rule out some candidate causes of the process and to better understand the physics that underlie it, he adds.

Taking it slow

Gay and Joan Dreiling, a physicist also at the University of Nebraska–Lincoln, fired low-energy, spin-polarized electrons at a gas of bromocamphor, an organic compound used in some parts of the world as a sedative. In the resulting reaction, some electrons were captured by the molecules, which then were kicked into an excited state. The molecules then fell apart, producing bromide ions and other highly reactive compounds. By measuring the flow of ions produced, the researchers could see how often the reaction occurred for each handedness of electron.

The researchers found that left-handed bromocamphor was just slightly more likely to react with right-handed electrons than with left-handed ones. The converse was true when they used right-handed bromocamphor molecules. At the lowest energies, the direction of the preference flipped, causing an opposite asymmetry.

In all cases the asymmetry was tiny, but consistent, like flipping a not-quite-fair coin. “The scale of the asymmetry is as though we flip 20,000 coins again and again, and on average, 10,003 of them land on heads while 9,997 land on tails,” says Dreiling.

The low speed of the electrons was the key to why the experiment finally worked after so many years, Dreiling says. “The interaction takes longer, and it was that insight, I think, that led to our success,” she says.

The test offers an explanation for how a chiral excess could — at least in principle — arise, Gay says. The research was published in Physical Review Letters on 12 September.

The idea that spin-polarized electrons could transmit their asymmetry to organic molecules is attractive, says Uwe Meierhenrich, an analytical chemist at the University of Nice Sophia Antipolis in France. The tiny effect that Gay and Dreiling observed would have to be amplified to affect the chemistry of life as a whole — but there are known mechanisms for such amplification, he says. “From my point of view, the main question does not concern the amplification processes, but the first chiral-symmetry breaking,” he says.

Meierhenrich says that he would like to see the experiment repeated with chiral molecules that are relevant to the origin of life, such as amino acids, to see whether the left-handed electrons produce the same effect.

Primordial cause

Even if spin-polarized electrons caused life to become chirally selective, it is still unclear what would have produced those electrons in the first place. Sources of β particles include phosphorus-32 decaying into sulphur-32, or the decay of muons, elementary particles produced at the end of a chain of decays that begin when cosmic ray particles hit the atmosphere. In both cases, the electrons would have been travelling much faster than in Gay’s reaction, but he says that it is possible for electrons to slow down without losing their chirality.

Slower-moving, left-handed electrons are produced in other ways than via β decay, says Richard Rosenberg, a chemist at the Argonne National Laboratory in Illinois. In 2008 he and his team showed that irradiating a layer of magnetized iron with X-rays could also produce a chirality preference. Chirality could therefore also have been created in molecules stuck to magnetized particles in a dust cloud or comet, he says.

Gay and his colleagues plan to look at similar reactions with other varieties of camphor molecules to understand how the spin of an electron dictates which of two chiral molecules it prefers.

The interaction of left-handed electrons with organic molecules is not the only potential explanation for the chiral asymmetry of life.. Meierhenrich favors an alternative — the circularly polarized light that is produced by the scattering of light in the atmosphere and in neutron stars. In 2011, Meierhenrich and colleages showed that such light could transfer its handedness to amino acids.

But even demonstrating how a common physical phenomenon would have favoured left-handed amino acids over right-handed ones would not tell us that this was how life evolved, adds Laurence Barron, a chemist at the University of Glasgow, UK. “There are no clinchers. We may never know.”

http://www.eurekalert.org/pub_releases/2014-09/esfm-dop092614.php

Docetaxel or pemetrexed with cisplatin achieve comparable outcomes in non-squamous Lu Ca

Treating non-squamous lung cancer with either pemetrexed or docetaxel in addition to cisplatin has shown that the two combinations achieve similar progression-free survival

The first direct comparison of treating non-squamous lung cancer with either pemetrexed or docetaxel in addition to cisplatin has shown that the two combinations achieve similar progression-free survival, although docetaxel was associated with more frequent adverse events.

At the ESMO 2014 Congress in Madrid, Dr Young-Chul Kim from Chonnam National University Medical School, South Korea, reported the results of an open-label phase III trial that included 149 patients with non-squamous non-small cell lung cancer (NSCLC) conducted at 14 centres in South Korea.

"We wanted to conduct this study because pemetrexed plus platinum chemotherapy is the most commonly used regimen for treating patients with non-squamous NSCLC whose cancer does not have mutations that can be targeted by specific inhibitors," Kim explained.

"However, docetaxel plus platinum is another effective regimen in the first line treatment of lung cancer and there has been no direct comparison of pemetrexed plus cisplatin versus docetaxel plus cisplatin."

In the study, researchers randomly assigned patients with chemotherapy-naive cancer to 3-weekly cisplatin 70 mg/m2 in addition to either docetaxel 60 mg/m2 or pemetrexed 500mg/m2 for up to 4 cycles.

They recorded a median progression-free survival of 4.7 months in those who received the pemetrexed combination, and 4.6 months among those who received docetaxel.

However, the rate of serious adverse events was higher in the docetaxel group, they found, with 24 serious adverse events recorded among pemetrexed patients, and 42 in the docetaxel arm.

Kim notes that recruitment into the study was halted early when pemetrexed maintenance treatment was approved in Korea and its use became widespread.

"As we stopped recruitment prematurely, we could not prove non-inferiority between the arms. However, the pemetrexed plus cisplatin arm was less toxic than

the docetaxel plus cisplatin arm, while there was no significant difference in progression-free survival and response rate," Kim said.

The researchers are continuing to follow patients in the trial to study whether there is any difference in overall survival between the arms.

Commenting on the study, Dr Solange Peters from the University Hospital of Lausanne, Switzerland, noted: "The various available platinum-based regimen demonstrate quite similar activity in NSCLC."

"While a dedicated larger trial published by Scagliotti in 2008 was able to show some superiority of platinum in combination with pemetrexed in non-squamous NSCLC, this trial also confirms its better tolerability, reinforcing most current international NSCLC treatment guidelines," Peters said.

http://bit.ly/Yy775C

Gravity Shift Reveals West Antarctic Ice Loss

The West Antarctic Ice Sheet is headed toward "unstoppable" collapse according to recent studies.

Brian Kahn

A new visual released by the European Space Agency show what the start of that collapse looks like both for the mass of the ice sheet and its signature on the planet's gravitational field.

We think of gravity as a constant, holding us in place on the planet. But the reality is there are small changes in gravity all over the globe. Not enough that you'll feel lighter on your feet in one place compared to another, but enough that scientists can use satellites to measure the differences. Those measurements can, in turn, help us better understand the world around us, from how earthquakes shift land to how fast ice sheets are receding and what that means for sea level rise.

The measurements released by the European Space Agency on Friday fall into the latter category. They show gravity in the region is decreasing as the West Antarctic Ice Sheet has melted faster and faster over a 3-year period from 2009-12, sending more water into the sea.

This region of the ice sheet has been intensely studied by scientists and recent research indicate melt could be "unstoppable." The melt of that section of the ice sheet would raise sea levels 10-13 feet, though the timetable for that happening is centuries, not single years or decades.

The new measurements will help scientists refine their understanding of what's happening in the land way down under. Scientists are looking to expand the analysis to all of Antarctic to get a better sense of how ice is moving there. Recent estimates of Antarctic ice sheet loss are in the range of 125 cubic kilometers a year, which accounts for about 10 percent of observed sea level rise.

http://nyti.ms/ZiPuYY

Roche Breast Cancer Drug Appears to Greatly Extend Patients' Lives

A drug used to treat advanced breast cancer has had what appears to be unprecedented success in prolonging lives in a clinical trial, researchers reported on Sunday.

By ANDREW POLLACKSEPT. 28, 2014

Patients who received the drug - Perjeta, from the Swiss drug maker Roche - had a median survival time nearly 16 months longer than those in the control group. That is the longest amount of time for a drug used as an initial treatment for metastatic breast cancer, the researchers said, and it may be one of the longest for the treatment of any cancer. Most cancer drugs prolong survival in patients with metastatic disease for a few months at most. Metastasis means the cancer has spread to other parts of the body.

"We've never seen anything like this before," said Dr. Sandra M. Swain of the MedStar Washington Hospital Center in Washington, the lead author of the study. "It's really unprecedented to have this survival benefit."

The results were being presented on Sunday in Madrid at the annual meeting of the European Society for Medical Oncology. Dr. Swain has been a paid speaker for the company.

Previous analyses of the clinical trial established that Perjeta, known generically as pertuzumab, increased survival by a statistically significant amount. But until now it was not known by how much, because patients had not been followed long enough.

Two experts not involved in the study, Dr. Edith A. Perez of the Mayo Clinic in Jacksonville, Fla., and Dr. Harold J. Burstein of the Dana-Farber Cancer Institute in Boston, said the results were impressive. "Usually we see two months of improvement," Dr. Perez said.

Perjeta, like the better-known Roche drug Herceptin, or trastuzumab, blocks the action of a protein called HER2, which spurs the growth of some breast tumors. Perjeta is meant to be used with Herceptin for the roughly 20 percent of breast cancers characterized by an abundance of HER2.

Perjeta was approved by the Food and Drug Administration in 2012 and is already considered the standard of care in the United States.

Still, the results could lead to increased use of the drug. Only about half of the eligible women are being treated with the drug in the United States, according to Edward Lang Jr., a spokesman for Roche. And doctors say use is lower in many countries where cost is more of an issue.

In the United States, Perjeta costs about $5,900 a month and Herceptin about $5,300 a month, Mr. Lang said. He said Perjeta was priced lower than some other new cancer medicines because it has to be used with Herceptin. Some recently approved cancer drugs cost more than $10,000 a month.

Roche reported Perjeta sales of 388 million Swiss francs, or about $408 million, in the first half of this year, with about $250 million of that coming from the United States.

The trial, sponsored by Roche, involved 808 patients around the world with previously untreated HER2-positive metastatic breast cancer. Half of them received Perjeta, Herceptin and the chemotherapy drug docetaxel. The other half received Herceptin, docetaxel and a placebo in place of Perjeta.

The median survival time for those who received Perjeta was 56.5 months, or about four and a half years, compared with 40.8 months for those in the control group, a difference of 15.7 months. By another measure, known as the hazard ratio, use of Perjeta reduced the risk of dying 32 percent. Use of Perjeta delayed the progression or worsening of the cancer only about six months in the trial. Experts said it was not clear why the drug extended lives so much longer than that.

Those receiving Perjeta had higher rates of diarrhea and rash and a lowering of white blood cell counts. The labels for both Perjeta and Herceptin contain warnings that the drugs can cause cardiac dysfunction and heart failure. But in the study, patients who received Perjeta did not experience any more of these problems than those in the control group.

Dr. Perez and Dr. Burstein, the experts not involved in the study, said in separate interviews that they were also cheered by a nearly 41-month median survival in the control group. When Herceptin was approved in the late 1990s, people taking that drug lived a median of about 25 months. The experts said doctors now use Herceptin for a longer time and can better manage patients.

http://www.eurekalert.org/pub_releases/2014-09/uoc--hgw092514.php

Human genome was shaped by an evolutionary arms race with itself

New study of primate genomes reveals an ongoing battle to control 'jumping genes,' driving the evolution of greater genomic complexity

New findings by scientists at the University of California, Santa Cruz, suggest that an evolutionary arms race between rival elements within the genomes of primates drove the evolution of complex regulatory networks that orchestrate the activity of genes in every cell of our bodies.

The arms race is between mobile DNA sequences known as "retrotransposons" (a.k.a. "jumping genes") and the genes that have evolved to control them. The UC Santa Cruz researchers have, for the first time, identified genes in humans that make repressor proteins to shut down specific jumping genes. The researchers also traced the rapid evolution of the repressor genes in the primate lineage.

Their findings, published September 28 in Nature, show that over evolutionary time, primate genomes have undergone repeated episodes in which mutations in jumping genes allowed them to escape repression, which drove the evolution of new repressor genes, and so on. Furthermore, their findings suggest that repressor genes that originally evolved to shut down jumping genes have since come to play other regulatory roles in the genome.

"We have basically the same 20,000 protein-coding genes as a frog, yet our genome is much more complicated, with more layers of gene regulation. This study helps explain how that came about," said Sofie Salama, a research associate at the UC Santa Cruz Genomics Institute who led the study.

Retrotransposons are thought to be remnants of ancient viruses that infected early animals and inserted their genes into the genome long before humans evolved. Now they can only replicate themselves within the genome. Depending on where a new copy gets inserted into the genome, a jumping event can disrupt normal genes and cause disease. Often the effect is neutral, simply adding to the overall size of the genome. Very rarely the effect might be advantageous, because the added DNA can itself be a source of new regulatory elements that enhance gene expression. But the high probability of deleterious effects means natural selection favors the evolution of mechanisms to prevent jumping events.

Scientists estimate that jumping genes or "transposable elements" account for at least 50 percent of the human genome, and retrotransposons are by far the most common type.

"There have been successive waves of retrotransposon activity in primate evolution, when a transposable element changed to become expressed and replicated itself throughout the genome until something turned it off," Salama said. "We've discovered a major mechanism by which the genome is able to shut down these mobile DNA elements."

The repressors identified in the new study belong to a large family of proteins known as "KRAB zinc finger proteins." These are DNA-binding proteins that repress gene activity, and they constitute the largest family of gene-regulating proteins in mammals. The human genome has over 400 genes for KRAB zinc finger proteins, and about 170 of them have emerged since primates diverged from other mammals.

According to Salama, her team's findings support the idea that expansion of this family of repressor genes occurred in response to waves of retrotransposon activity. Because repression of a jumping gene also affects genes located near it

on the chromosome, the researchers suspect that these repressors have been co-opted for other gene-regulatory functions, and that those other functions have persisted and evolved long after the jumping genes the repressors originally turned off have degraded due to the accumulation of random mutations.

"The way this type of repressor works, part of it binds to a specific DNA sequence and part of it binds other proteins to recruit a whole complex of proteins that creates a repressive landscape in the genome. This affects other nearby genes, so now you have a potential new layer of regulation available for further evolution," Salama said.

KRAB zinc finger proteins are the subject of intensive research as scientists try to sort out their many regulatory roles within the genome. The idea that they are involved in repression of jumping genes is not new--previous studies by other researchers have shown that these proteins silence jumping genes in mouse embryonic stem cells. But until now, no one had been able to demonstrate that the same thing occurs in human cells.

The UC Santa Cruz team developed a novel assay to test whether a particular KRAB zinc finger protein could shut down certain jumping genes. The first authors of the paper, postdoctoral researcher Frank Jacobs and graduate student David Greenberg, came up with the strategy of testing primate retrotransposons in non-primate cells by using mouse embryonic stem cells that contain a single human chromosome. In the environment of a mouse cell, jumping genes that were repressed in primate cells became active. Greenberg then developed an assay for testing individual zinc finger proteins for their ability to turn off a primate jumping gene in the mouse cell environment.

"We did all our tests in mouse cells because they lack all of the primate zinc finger proteins, so when you put primate retrotransposons into a mouse cell they're all active," Salama explained.

The results demonstrated that two human proteins called ZNF91 and ZNF93 bind and repress two major classes of retrotransposons (known as SVA and L1PA) that are currently or recently active in primates. Assistant research scientist Benedict Paten directed graduate student Ngan Nguyen in a painstaking analysis of primate genomes, including the reconstruction of ancestral genomes, which showed that ZNF91 underwent structural changes 8 to 12 million years ago that enabled it to repress SVA elements.

Experiments with ZNF 93, which shuts down L1PA retrotransposons, provided a striking illustration of the arms race between jumping genes and repressors. The researchers found that, while it is good at shutting down many L1PA elements, there is one subset of a recently evolved lineage of L1PA that has lost a short section of DNA that includes the ZNF93 binding site. Without the binding site, these jumping genes evade repression by ZNF93. Interestingly, when the researchers put the missing sequence back into one of these genes and put it in a mouse cell without ZNF93, they found that it was better at jumping. So even though the sequence helps with jumping activity, losing it gives the jumping gene an advantage in primates by allowing it to escape repression by ZNF93.

"That's kind of the icing on the cake for aficionados of molecular evolution, because it demonstrates that this is a never-ending race," Salama said. "KRAB zinc finger proteins are a rare class of proteins that is rapidly expanding and evolving in mammalian genomes, which makes sense because the transposable elements are themselves continually evolving to escape repression."

Corresponding author David Haussler, professor of biomolecular engineering and director of the UC Santa Cruz Genomics Institute, said the study involved close collaboration between his group's "wet lab," directed by Salama, and the "dry lab" where researchers under Paten's direction used the computational tools of genome bioinformatics to reconstruct the evolutionary history of primate genomes.

Haussler, a Howard Hughes Medical Institute investigator who has used his background in computer science to do pioneering work in genomics, said he established the wet lab to enable just this kind of collaboration.

"Both parts were integral to this study, and there was a lot of back and forth between them. This paper shows how important it is to integrate computational and experimental approaches to fundamental scientific problems, such as how and why we continuously evolve to be more complex," Haussler said.

In addition to Jacobs, Greenberg, Paten, Nguyen, Salama, and Haussler, the coauthors of the paper include postdoctoral researchers Maximilian Haeussler and Adam Ewing; and sequencing analyst Sol Katzman. This work was supported by the California Institute for Regenerative Medicine, Human Frontier Science Program, National Institutes of Health, and Howard Hughes Medical Institute.

http://www.eurekalert.org/pub_releases/2014-09/uoia-sda092414.php

Scientists discover a new role for estrogen in the pathology of breast cancer

Scientists have discovered a previously unknown mechanism by which estrogen prepares cells to divide, grow and, in the case of estrogen-positive breast cancers, resist cancer drugs.

CHAMPAIGN, Ill. - The researchers say the work reveals new targets for breast cancer therapy and will help doctors predict which patients need the most aggressive treatment.

The University of Illinois team reports its findings in the journal Oncogene.

Estrogen pre-activates the unfolded-protein response (UPR), a pathway that normally protects cells from stress, the researchers report. The UPR spurs the

production of molecular chaperones that prepare cells to divide and grow. Without chaperone proteins to do the work of folding and packaging other proteins, cells – including cancer cells – cannot divide. For this reason, chaperones are a popular target for new cancer therapies.

Activation of the UPR is known as a normal response to stress – when a cell lacks adequate oxygen or nutrients, for example, or is exposed to cancer-killing drugs. UPR activation prepares the cell for major changes associated with cell growth, division and survival under stress.

It wasn't known before this study, however, that estrogen initiates this pathway before such stresses appear, said University of Illinois biochemistry professor David Shapiro, who led the new analysis with lead author, M.D.-Ph.D.-student Neal Andruska. "This is a new role for estrogen in the pathology of cancer," Shapiro said. "Others have shown that stress activates this pathway, helping to protect some tumors. What is new is our finding that estrogen can pre-activate this pathway to protect tumors."

When estrogen binds to its receptor it sparks a cascade of molecular events in the cell. A key event occurs when a channel opens in the membrane of a compartment that stockpiles calcium, and calcium floods into the cell.

"That's a signal to activate the UPR pathway, the stress pathway," Shapiro said. "It's also a signal that many researchers think has something to do with cell proliferation. The calcium itself may be a proliferation signal."

The stress-response pathway induces the production of chaperone proteins.

"I like to think of this pathway as an assembly line," Shapiro said. "In order for cells to divide, you're going to have to produce a lot more proteins. The chaperones help you to package, fold up and ship all these proteins."

The UPR also is a mediator of cell death. If a normal cell is exposed to too much stress, the stress response spurs apoptosis, a kind of cellular suicide. In cancer, however, mild activation of the UPR by estrogen blunts this cell-death pathway, allowing cancer cells to survive and even resist drugs, the researchers found.

The team also looked at the expression of UPR-related genes in publicly available data from samples of breast tumors obtained from women who had been diagnosed up to 15 years prior.

"Andruska, who spearheaded the research and carried out the computer analysis of the breast cancer data, found that UPR activation is a very powerful prognostic marker of the course of a woman's disease," Shapiro said.

The analysis revealed that among women with estrogen-receptor-positive breast cancer who underwent tamoxifen therapy, breast cancer was 3.7 times more likely to recur in those overexpressing the UPR. Ten years after a breast cancer diagnosis, only 15 percent of those with the highest level of UPR-gene expression were disease-free, compared with 80 percent of women with minimal UPR expression.

"Our marker helps identify breast cancers that are likely to be highly aggressive and therefore require intensive therapy," Shapiro said.

U. of I. graduate student Xiaobin Zheng, postdoctoral researcher Xujuan Yang and food science and human nutrition professor William Helferich contributed to the research.

The National Institute of Diabetes and Digestive and Kidney Diseases at the National Institutes of Health funded the research.

http://bit.ly/1wQx5O3

Back from the Dead: Scientists "Resurrect" Ancient Proteins to Learn about Primordial Life on Earth

Paleobiochemistry has allowed researchers in the last decade to start "resurrecting" ancient proteins

By Adam Hadhazy - Sep 29, 2014

Geological evidence tells us that ancient Earth probably looked and felt very different from the planet we all recognize today. Billions of years ago, our world was a comparatively harsh place. Earth likely had a hotter climate, acidic oceans and an atmosphere loaded with carbon dioxide. The fact that manmade climate change, through carbon dioxide pollution, is re-introducing such hotter, acidified conditions demonstrates their intertwinement.

More recently, the life sciences have begun buttressing these notions of primordial Earth. Thanks to advances in a niche field called paleobiochemistry, researchers in the last decade have started to "resurrect" ancient proteins. Studying these proteins' properties is offering us glimpses of what life was like in bygone epochs. The results so far are compelling. Take, for example, beta lactamase proteins, which first evolved between 2 to 3 billion years ago. These ancient proteins actually remain more stable and work better in hot spring-like temperatures of between 130 and 150 degrees Fahrenheit (54 and 66 degrees Celsius) compared to their modern counterparts. Other proteins, called thioredoxins, originated 4 billion years ago at the time of life's origin, and these ancient proteins stay active in acidities that would break down many modern proteins. Findings of this sort help paint a portrait of life prior to 500 million years ago in the vast era known as the Precambrian.

"Molecular resurrection studies provide a new line of evidence supporting geological models that suggest that the Precambrian Earth hosted a hotter and more acidic ocean than its modern counterpart," Eric Gaucher, a pioneering paleobiochemist and a professor biology at Georgia Tech. "Early life was adapted to this environment."

Paleobiochemistry should have much more to eventually say on this topic. Toward this end, Gaucher and colleagues at the University of Granada in Spain have a new paper in the June 2014 issue of the scientific journal Proteins: Structure, Function, and Bioinformatics. The study compares two common techniques used in paleobiochemistry that have potential biotechnology applications, such as finding ways of dealing with the scourge of antibiotic resistance. The two methods allow scientists to extrapolate the composition of proteins from eons ago.

Deciphering the development of biota on Earth is important not only for piecing together our planet's past — and thus its potential future — but also for gauging where else life might arise in the cosmos.

"Knowing how life originated and diversified on early Earth provides us with a perspective on the conditions that support primitive life," said Gaucher. "This information can better inform our decisions to search for life on other planets."

Breathing new life into old proteins

Living creatures use proteins for much of life's business. These molecules form many of the structural components of cells and facilitate the chemistry for powering them. Made from combinations of any of 20 amino acid building blocks, proteins come in an almost endless variety of complexity and function.

"It is remarkable to think that there are billions of different proteins contained within all organisms on modern Earth," said Gaucher. "Yet, these proteins are composed of the same building blocks, only arranged in different configurations or sequences."

Researchers have compiled huge databases full of the proteins' amino acid sequences. The sequences have changed over evolutionary history. By comparing today's sequences to each other, scientists can get a good idea of the sequence of an ancestral protein from which the modern versions descended.

The concept is rather like that of tracing modern languages back to older, source languages, as Gaucher has previously explained to Astrobiology Magazine. By comparing several European languages, for instance, one would discern that French, Italian, Portuguese, Romanian and Spanish all have clear Latin roots.

"Molecular resurrection studies use a top-down method, whereby modern biological information is used to infer ancient biology," said Gaucher. "Studying this ancient biology gets us closer to the origins of life itself."

A consensus approach

One method is called consensus-sequence engineering, and is the more simplistic of the two. Scientists just plug the sequence of a protein of interest into a protein database. The query returns a large number of "hits," or analogous sequences. "These sequences likely correspond to modern proteins that are evolutionarily related to the query protein," said Valeria Risso, lead author of the new Proteins paper and a chemist at the University of Granada.

From there, Risso and colleagues gather statistics on the particular amino acids that appear at corresponding positions on the analogous proteins. Whichever amino acid pops up most frequently is deemed the "consensus" amino acid.

In theory, this consensus amino acid had previously occurred at the sequence location earlier on in evolutionary history, before mutations led to divergent, modern sequences. This makes sense, because nature is conservative. Evolution should favor keeping a sequence that works versus a mutated one that doesn't. Every now and then, of course, a mutation will "earn its keep" by providing the organism with an advantage or — at the very least — not hinder its possessor from reproducing.

The consensus-seeking task is completed for every amino acid position. The next step: artificially generating the consensus protein in the lab. This is done by introducing a modified gene into a model organism, such as the bacterium E. coli. The organisms handily cranks out the protein through natural means. The new, yet old-fangled protein can then be put through its paces by seeing how it chemically reacts in certain conditions.

Tree of life

The second method more closely follows the historical linguist analogy. It involves creating what is known as a phylogenetic tree. Essentially, the protein sequences are compared, as before, but they go through an evolutionary model-based analysis to search for "nodes," or branching points.The nodes' sequences represent the last common ancestor for the species that subsequently split off, on down to modernity. Another way to think of this phylogenetic tree method is that it is essentially a genealogy.

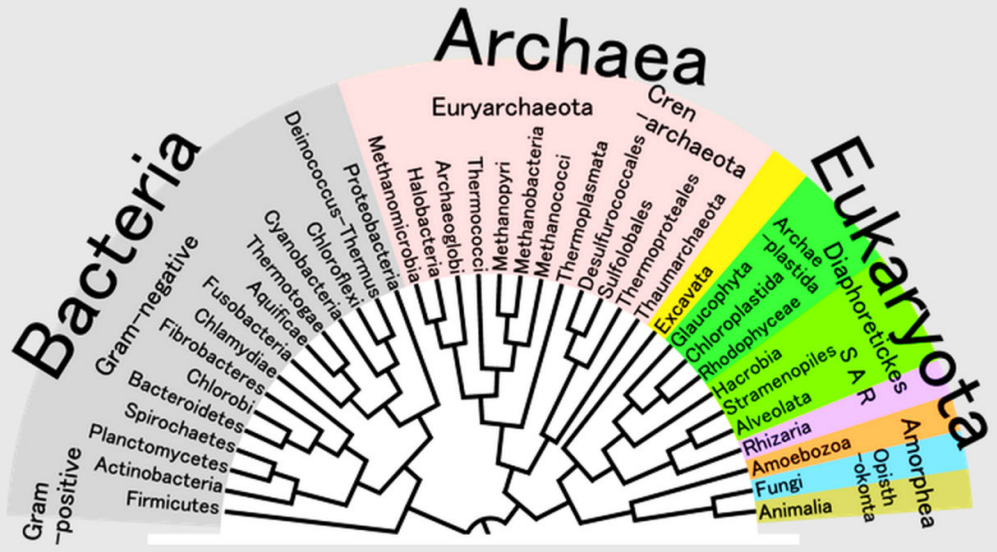
The node sequences are inferred and compiled. The proteins encoded by the reconstructed sequences are then synthesized in the laboratory — "laboratory resurrection," as it's called. The protein, as with consensus-sequence engineering, is produced by a model organism and its properties are then assessed.

Hopefully, the resulting protein's properties, when compared to its descendant proteins, should fit like a link in a logical evolutionary chain.

"These properties are expected to 'tell' a story that makes sense in biological terms by providing a convincing evolutionary narrative," said Gaucher.

An example of this proteinaceous storytelling: the fact that ancient proteins, as mentioned before, seem optimized for the high-heat, high-acidity environmental conditions which geology suggests characterized the young Earth.

Both paleobiochemistry techniques seek to restore proteins long lost through the vicissitudes of evolution. But is the consensus technique as good at recovering "real" primordial proteins as the phylogenetic approach? The new paper aimed to answer this question.



A phylogenetic tree of life. **Credit: Wikimedia Commons**

Dueling time machines

The researchers compared properties of a beta lactamase protein yielded from consensus sequence and phylogenetic sequence methods. Beta lactamase is a primary means of antibiotic resistance. It allows an organism to persevere against the lactam class of antibiotics; we rely on numerous lactam drugs, such as penicillin, to fight off infections.

Three consensus variants were created for the study. Sequence-wise, they were indeed quite like the sequences made by the more rigorous, phylogenetic approach. However, the consensus-sequence derived proteins were not as stable as the phylogenetic proteins. Nor did they partner up with as many other relevant molecules. This is a trending trait of ancient proteins, which according to theory, started out as generalists, then honed and specialized over the course of evolution. Though the consensus sequence proteins differed by just a few amino acids, important differences in functionality followed.

Overall, consensus engineering does not look like the best way to work backwards toward discovering how ancient life worked, either from a biotechnology or an astrobiology standpoint.

"Consensus certainly remains an interesting approach in protein engineering," said paper-coauthor Jose M. Sanchez-Ruiz, also a chemist at the University of Granada. Nevertheless, Sanchez-Ruiz added, the study's "results support ancestral reconstruction and resurrection as a more efficient procedure to obtain proteins with extreme and useful properties."

Life, decoded

Learning more about primordial life will open up a lot of avenues for science. On a fundamental level, reconstructing life back through the ages gets us more familiar with the parts and pieces biology requires.

"Analogous to the engineering adage that you cannot understand something unless you can build it, a fuller understanding of life will only come when we can build life," said Gaucher.

Gauging what sorts of ingredients and environments were conducive to life forming on Earth will inform astrobiological ambitions. Knowing what to look for on future missions to potential places for life, like Jupiter's moon Europa, will be one benefit of a more complete picture of early Earth's microbes.

Better yet than toying with individual proteins, though, would be sizing up a whole organism. And stay tuned: by building on their success with phylogenetics, Gaucher and colleagues hope to be able to bring ancient bacteria and archaea back from the dead.

"Although the majority of resurrection studies currently focus on resurrecting one or two protein families at a time," Gaucher said, "we anticipate that we will be able to resurrect a complete ancestral genome in the near future and jump-start this genome using modern life to, in essence, resurrect long extinct forms of life."

http://phys.org/news/2014-09-tooth-bone-prehistoric-predators-tangled.html

Tooth buried in bone shows two prehistoric predators tangled across land, sea boundaries

It was widely believed the two top predators didn't interact much as phytosaurs ruled the water and rauisuchids ruled the land

by Rosaire Bushey

Phys.org - About 210 million years ago when the supercontinent of Pangea was starting to break up and dog-sized dinosaurs were hiding from nearly everything, entirely different kinds of reptiles called phytosaurs and rauisuchids were at the top of the food chain.

It was widely believed the two top predators didn't interact much as the former was king of the water, and the latter ruled the land. But those ideas are changing, thanks largely to the contents of a single bone.

In a paper published online in September in the German journal Naturwissenschaften, Stephanie Drumheller of the University of Tennessee and Michelle Stocker and Sterling Nesbitt, vertebrate paleontologists with the Virginia Tech's Department of Geosciences, present evidence the two creatures not only interacted, but did so on purpose.

"Phytosaurs were thought to be dominant aquatic predators because of their large size and similarity to modern crocodylians," said Stocker, "but we were able to provide the first direct evidence they targeted both aquatic and large terrestrial prey."

The evidence? A tooth. Not just any tooth, but the tooth of a phytosaur lodged in the thigh bone of a rauisuchid, a creature about 25 feet long and 4 feet high at the hip. The tooth lay broken off and buried about two inches deep in bone, and then healed over, indicating the rauisuchid survived the attack.

Teeth from phytosaurs, a reptile from the Triassic Period about 210 million years ago in what is now the western United States. The blue tooth on the left is a 3-D printed replica of a tooth embedded in the thigh bone of a rauisuchid, another Triassic period carnivore. The details of the tooth were digitally extracted using CT scans. "Finding teeth embedded directly in fossil bone is very, very rare," Drumheller said. "This is the first time it's been identified among phytosaurs, and it gives us a smoking gun for interpreting this set of bite marks."

The researchers came across the bone by chance at the University of California Museum of Paleontology in Berkeley.

"It was remarkable we were able to reconstruct a part of an ancient food web from over 210 million years ago from a few shallow marks and a tooth in a bone," said Nesbitt. "It goes to show how careful observation can lead to important discoveries even when you're not seeking those answers.

"We came across this bone and realized pretty quickly we had something special," Nesbitt said. "There are many bones that get dug up, not all are immediately processed, prepared, and studied. No one had recognized the importance of this specimen before but we were able to borrow it and make our study."

The large rauisuchid thigh bone at the center of the research has the tooth of the attacker, which the researchers recreated using CT scans and a 3-D printer. Multiple bite marks indicate the creature was preyed upon at least twice over the course of its life, by phytosaurs.

"This research will call for us to go back and look at some of the assumptions we've had in regard to the Late Triassic ecosystems," Stocker said. "The distinctions between aquatic and terrestrial distinctions were over-simplified and I think we've made a case that the two spheres were intimately connected."

Explore further: 'Steak-knife' teeth reveal ecology of oldest land predators

More information: "Direct evidence of trophic interactions among apex predators in the Late Triassic of western North America." Stephanie K. Drumheller, Michelle R. Stocker, Sterling J. Nesbitt, Naturwissenschaften September 2014.

http://bit.ly/1wQARH9

Why we weren't ready for Ebola

Peter Piot co-discovered the deadly virus nearly 40 years ago, but says it wasn't thought a major public health threat – until now

29 September 2014 by Catherine de Lange

You discovered the Ebola virus in 1976. How?

My lab received a blood sample from a Belgian nun who had died in Zaire (now the Democratic Republic of the Congo). She was diagnosed with yellow fever, but when we isolated the virus, it didn't look like anything we knew. Under the electron microscope it looked like a worm.

Then we got news from the World Health Organization of a major epidemic with a very high mortality rate in Zaire. We were told to stop all investigations because our lab wasn't equipped to deal with dangerous viruses. So we sent the virus to the US Centers for Disease Control in Atlanta. They confirmed that it was a new virus.

What happened next?

The next step was to figure out how the virus was transmitted and to stop the epidemic. So I went with a team to the epidemic zone in the equatorial forest in the northern part of Zaire. It was my first time ever in Africa, and I was just 27 so I had zero experience. But we did the detective work, unravelling how this virus was spreading.

Nearly 40 years after the virus was found, are you surprised at how bad the situation is?

Yes. This Ebola epidemic has killed more people than all the other epidemics together. It is a perfect storm: a virus hiding in the forest, likely in bats; people who are more exposed to the forest due to deforestation and other factors; no trust in authorities after decades of civil war and a corrupt regime; and a dysfunctional health system. You also have strong beliefs about disease causation, traditional funeral rites that require the family to touch the body and mistrust in Western medicine. Finally, there is the very slow response – both nationally and by the international community.

How was the international response lacking?

We were all far too late. Even today with the much enhanced support, we are still running behind the virus. The epidemic is expanding. Every week the number of deaths is greater than the week before.

Experimental treatments are now being tested. Why hasn't this happened sooner?

After the 2001 anthrax scare, an anti-bioterrorism programme largely funded by the US Department of Defense led to the development of a few vaccines and experimental drugs for Ebola. But the funding dried up. Until now, Ebola hasn't been a real public health issue compared with HIV, malaria, maternal mortality and so on. But now we must accelerate evaluation of experimental vaccines and offer some of the drugs for palliative use.

What are the most promising treatments?

We still need to go through human trials for a potential vaccine, but that will take months and might well be too late for this epidemic.

For treatment, we can use blood plasma or serum from people who have recovered from Ebola – when you recover from an infectious disease you have very high levels of antibodies in your blood. But let's make sure treatments are well evaluated. For the next epidemic we need to have stockpiles of vaccine and drugs that can be mobilised immediately.