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## What Are the Best and Worst Ways to Prepare for an Exam?

***Scientists have a lot of practical information on this topic***

***By Lola Irele | Jun 11, 2015***

Daniel Willingham, a professor of psychology at the University of Virginia and author of Raising Kids Who Read: What Parents and Teachers Can Do, responds:

So glad you asked! Scientists have a lot of practical information on this topic, but most students do not know about it.

Research investigating how students learn was first conducted at highly competitive institutions such as the University of California, Los Angeles. Even students at these top schools used terrible strategies.

For example, students commonly highlight what they read, but research shows that it does not help memory. Most students highlight as they are reading text for the first time, when they do not know what is important enough to highlight.

Another ineffective comprehension method is rereading. Doing so makes the student feel he or she is getting to know the material better and better. Rereading is like someone explaining the same thing repeatedly. It all makes sense, so you say, “Yes, yes, got it.” But reviewing an explanation is not the same as being able to explain something yourself.

The flaw in rereading—failing to know if you have learned the material—points to our first good study technique: self-testing. Self-testing may involve flash cards, it may mean answering questions at the back of a book chapter or it may be fielding questions lobbed by a study buddy.

There are two main benefits to self-testing. First, in contrast to rereading, self-testing offers an accurate assessment of what has been learned and whether one needs to keep studying. Second, scores of studies show that self-testing is a great way to cement material into memory. It is even better than equivalent time spent perusing the material.

Another useful technique is to periodically pause when reading to ask why a statement in the text is true. We have all had the experience of passing our eyes over words but not really thinking about what we have read. Pausing every few paragraphs to ask, “Why does that make sense?” prompts thinking and learning.

A third technique is to spread out study sessions instead of cramming. Much research shows that memory is more enduring when material is reviewed days or even weeks apart. This is a practice that teachers can promote by giving more frequent assignments and quizzes that require a review of material covered earlier in the course. Even brief memory refreshers can result in big returns in learning.

http://www.eurekalert.org/pub_releases/2015-07/tjnj-mdc070915.php

## Microbleeds, diminished cerebral blood flow in cognitively normal older patients

***Study suggests cortical cerebral microbleeds were associated with reduced brain blood flow in a group of cognitively normal older patients***

A small imaging study suggests cortical cerebral microbleeds in the brain, which are the remnant of red blood cell leakage from small vessels, were associated with reduced brain blood flow in a group of cognitively normal older patients, according to an article published online by JAMA Neurology.

Cerebral microbleeds (CMBs) are a common finding in magnetic resonance imaging of elderly patients. Some previous research has suggested an association between CMBs and cognitive deficits, although the mechanism is not clear. Some studies also have suggested CMBs may be related to abnormal cerebral blood flow, although those abnormalities had not been reported for healthy patients with incidental CMBs.

William E. Klunk, M.D., Ph.D., of the University of Pittsburgh, and colleagues used imaging to study 55 cognitively normal individuals (average age nearly 87) to examine CMBs and cerebral blood flow, among other things.

The authors found CMBs in 21 of the 55 participants (38 percent) for a total of 54 CMBs. Cortical CMBs in the brain were associated with reduced cerebral blood flow in multiple regions, according to the results.

"In cognitively normal elderly individuals, incidental CMBs in cortical locations are associated with widespread reduction in resting state-CBF [cerebral blood flow]. Chronic hypoperfusion [insufficient blood flow] may put these people at risk for neuronal injury and neurodegeneration. Our results suggest that resting-state CBF is a marker of CMB-related small-vessel disease," the study concludes.

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http://www.eurekalert.org/pub_releases/2015-07/tju-lmf063015.php

## Lynchpin molecule for the spread of cancer found

***A single molecule called DNA-PKcs may drive metastatic processes that turn cancer from a slowly growing relatively benign disease to a killer***

PHILADELPHIA - Cancer is a disease of cell growth, but most tumors only become lethal once they metastasize or spread from their first location to sites throughout the body. For the first time, researchers at Thomas Jefferson University in

Philadelphia report a single molecule that appears to be the central regulator driving metastasis in prostate cancer. The study, published online July 13th in Cancer Cell, offers a target for the development of a drug that could prevent metastasis in prostate cancer, and possibly other cancers as well.

"Finding a way to halt or prevent cancer metastasis has proven elusive. We discovered that a molecule called DNA-PKcs could give us a means of knocking out major pathways that control metastasis before it begins," says Karen Knudsen, Ph.D., Director of the Sidney Kimmel Cancer Center at Thomas Jefferson University, the Hilary Koprowski Professor and Chair of Cancer Biology, Professor of Urology, Radiation Oncology, and Medical Oncology at Jefferson.

Metastasis is thought of as the last stage of cancer. The tumor undergoes a number of changes to its DNA - mutations - that make the cells more mobile, able to enter the bloodstream, and then also sticky enough to anchor down in a new location, such as the bone, the lungs, the liver or other organs, where new tumors start to grow. Although these processes are fairly well characterized, there appeared to be many non-overlapping pathways that ultimately lead to these traits.

Now, Dr. Knudsen and colleagues have shown that one molecule appears to be central to many of the processes required for a cancer to spread. That molecule is a DNA repair kinase called DNA-PKcs. The kinase rejoins broken or mutated DNA strands in a cancer cell, acting as a glue to the many broken pieces of DNA and keeping alive a cell that should normally self-destruct.

In fact, previous studies had shown that DNA-PKcs was linked to treatment resistance in prostate cancer, in part because it would repair the usually lethal damage to tumors caused by radiation therapy and other treatments. Importantly, Dr. Knudsen's work showed that DNA-PKcs has other, far-reaching roles in cancer.

The researchers showed that DNA-PKcs also appears act as a master regulator of signaling networks that turn on the entire program of metastatic processes. Specifically, the DNA-PKcs modulates the Rho/Rac enzyme, which allows many cancer cell types to become mobile, as well as a number of other gene networks involved in other steps in the metastatic cascade, such as cell migration and invasion.

In addition to experiments in prostate cancer cell lines, Dr. Knudsen and colleagues also showed that in mice carrying human models of prostate cancer, they could block the development of metastases by using agents that suppress DNA-PKcs production or function. And in mice with aggressive human tumors, an inhibitor of DNA-PKcs reduced overall tumor burden in metastatic sites.

In a final analysis that demonstrated the importance of DNA-PKcs in human disease, the researchers analyzed 232 samples from prostate cancer patients for the amount of DNA-PKcs those cells contained and compared those levels to the patients' medical records. They saw that a spike in the kinase levels was a strong predictor of developing metastases and poor outcomes in prostate cancer.

They also showed that DNA-PKcs was much more active in human samples of castrate-resistant prostate cancer, an aggressive and treatment-resistant form of the disease.

"These results strongly suggest that DNA-PKcs is a master regulator of the pathways and signals that lead to the development of metastases in prostate cancer, and that high levels of DNA-PKcs could predict which early stage tumors may go on to metastasize," says Dr. Knudsen.

"The finding that DNA-PKcs is a likely driver of lethal disease states was unexpected, and the discovery was made possible by key collaborations across academia and industry," explains Dr. Knudsen.

Key collaborators on the study, in addition to leaders of the Sidney Kimmel Cancer Center's Prostate Program, included the laboratories of Felix Feng (University of Michigan), Scott Tomlins (University of Michigan), Owen Witte (UCLA), Cory Abate-Shen (Columbia University), Nima Sharifi (Cleveland Clinic) and Jeffrey Karnes (Mayo Clinic), and contributions from GenomeDx.

Although not all molecules are easily turned into drugs, at least one pharma company has already developed a drug that inhibits DNA-PKcs, and is currently testing it in a phase 1 study (NCT01353625). "We are enthusiastic about the next step of clinical assessment for testing DNA-PKcs inhibitors in the clinic. A new trial will commence shortly using the Celgene CC-115 DNA-PKcs inhibitor. This new trial will be for patients advancing on standard of care therapies, and will be available at multiple centers connected through the Prostate Cancer Clinical Trials Consortium, of which we are a member," explained Dr. Knudsen.

"Although the pathway to drug approval can take many years, this new trial will provide some insight into the effect of DNAP-PKcs inhibitors as anti-tumor agents. In parallel, using this kinase as a marker of severe disease may also help identify patients whose tumors will develop into aggressive metastatic disease, so that we can treat them with more aggressive therapy earlier," says Dr. Knudsen. "Given the role of DNA-PKcs in DNA repair as well as control of tumor metastasis, there will be challenges in clinical implementation, but this discovery unveils new opportunities for preventing or treating advanced disease."

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*Article reference: J. F. Goodwin et al., "DNA-PKcs mediated transcriptional regulation drives prostate cancer progression and metastasis," Cancer Cell, 2015.*

http://www.eurekalert.org/pub_releases/2015-07/b-fdm070915.php

## Funeral directors may be at heightened risk of progressive neurodegenerative disease

***Link with amyotrophic lateral sclerosis may be formaldehyde in embalming fluid***

Funeral directors, who prepare bodies for burial, may be at heightened risk of the neurodegenerative disease amyotrophic lateral sclerosis, or ALS for short, as a result of the formaldehyde used in embalming fluid, suggests research published online in the Journal of Neurology Neurosurgery & Psychiatry.

ALS, also known as Lou Gehrig's disease, was the subject of last year's ice bucket challenge. It is progressive, causing muscle weakness, paralysis, and eventually respiratory failure and death. There is no cure for the condition, which is thought to affect 450,000 people worldwide. Some environmental factors have been mooted as possibly increasing the risk of developing ALS, including formaldehyde. The researchers therefore looked at the links between death from ALS and occupational exposure to formaldehyde, using the US National Longitudinal Mortality Study (NLMS), involving almost 1.5 million adults.

When they were 25 or older, participants were asked about their current or most recent job. Their exposure to formaldehyde at work was estimated, using criteria developed by industrial hygienists at the National Cancer Institute.

The intensity (frequency and level) and probability (likelihood) of exposure to formaldehyde were calculated for each job and industry sector. Men in jobs with a high probability of exposure to formaldehyde were around three times as likely to die of ALS as those who had not been exposed to this chemical at all.

But women with a high probability of exposure did not have an increased risk of ALS, possibly because too few had jobs that exposed them to high levels of formaldehyde, making it difficult to calculate risk level, say the researchers.

Men whose intensity and probability of exposure were rated as high were more than four times as likely to die of ALS as those with no exposure, although there were only two ALS deaths in this group.

All the 493 men with high intensity and probability of exposure to formaldehyde were funeral directors as were nearly all the women, none of whom died of ALS.

This gender discrepancy in death rates might be because women funeral directors in the US are more often involved in dealing with bereaved relatives than in embalming, which would limit their exposure to formaldehyde, suggest the researchers.

This is an observational study so no definitive conclusions can be drawn about cause and effect, and the authors caution that jobs involving a high level of exposure to formaldehyde are relatively rare, added to which funeral directors are exposed to other chemicals used in embalming as well as to bacteria, and prions.

But experimental research has linked formaldehyde to nerve damage, increased permeability of the energy powerhouses of cells--mitochondria--and harmful free radical production, all of which are implicated in ALS, they say.

http://www.bbc.com/news/magazine-33505017

## What's the best way to fight memory loss?

***We'd all like to about keep our brains as sharp as possible as we age. But what are the best ways to do this, asks Michael Mosley.***

Ask anyone over the age of 40 what worries them most about growing older and the answer that comes back is almost always the fear of losing your memory. I worry about the fact that I find it harder than ever to remember names and that without my phone to remind me, I would forget many of my daily appointments.

There are some fairly obvious things to avoid if you want to maintain good brain health. These include smoking, becoming overweight and developing Type 2 diabetes. But what can you positively do to enhance your brain?

With the help of Newcastle University we recruited 30 volunteers to find out.

Before we began our experiment all our volunteers were subjected to a barrage of tests that measured things like memory, ability to problem solve and general psychomotor speed (reaction times).

Everyone was then fitted with an activity monitor to measure how much and when they were moving. The volunteers were then randomly allocated to three groups and asked to do a particular activity for the next eight weeks.

One group we simply asked to walk briskly, so that they were just out of breath, for three hours a week. The idea is that walking - in fact any form of vigorous exercise - will keep your brain fed with lots of oxygen-rich blood. This was not a popular choice with some. "Walking is my least favourite activity," sighs Ann. (Newcastle does have punishingly steep hills.)

The second group were asked to do puzzles, such as crosswords or Sudoku. Again they had to do it for three hours each week. The reasoning behind this approach is that your brain, like a muscle, benefits from being challenged. Use it or lose it.

The final group were asked to stare at a naked man for three hours a week. Or, to be more accurate, they were asked to take part in an art class which also happened to involve drawing a naked man, Steve.

**The results**

By the end of our eight-week trial almost everyone in the walking group noticed a big improvement in their general health - how much easier they found managing a particular hill. Some of the puzzler group had found the puzzles hard at first, but by the end of the eight weeks many were hooked and swapping Sudoku tips.

The most enthusiastic group, however, was undoubtedly the art class. Although a few found attending a class once a week daunting, all of them commented on how much they enjoyed it. "I have become a compulsive drawer of everything," says Simone. "I have been out to buy myself some pastel pencils and even a book on 'How to'."

So, art equals pleasure, but which group enjoyed the greatest improvements in brain power? Our scientists redid their battery of cognitive tests and the results were clear-cut. All the groups had got a bit better, but the stand-out group was those who had attended the art class. It seems the naked man, Steve, had made a big impression.

But why should going to an art class make a difference to things like memory? Clinical Psychologist Daniel Collerton, one of our experts from Northumberland, Tyne and Wear NHS Trust and Newcastle University, says that part of the benefit came from learning a new skill. "Learning something new," he says, "engages the brain in ways that seem to be key. Your brain changes in response, no matter how many years you have behind you."

Learning how to draw was not only a fresh challenge to our group but, unlike the puzzlers, it also involved developing psychomotor skills. Capturing an image on paper is not just intellectually demanding. It involves learning how to make the muscles in your hand guide the pencil or paintbrush in the right directions.

An additional benefit was that going to the art class meant that for three hours a week they had to stand while drawing or painting. As we've shown before on Trust Me I'm a Doctor, standing for longer periods is a good way of burning calories and keeping your heart in good shape.

The art class was also the most socially active, another important thing to bear in mind if you want to keep your brain sharp. This group met regularly outside class, were keen to exchange emails and there was a definite social aspect to this intervention.

All of which meant that this group enjoyed a triple benefit when it came to boosting brain health. One of our volunteers, Lynn, says that learning to draw had produced other, unexpected benefits.

"Part of my job involves writing and pitching bids, which is a difficult and lengthy process," she explains. "I am dyslexic which is an added hurdle. But having done the art class I found that my writing now flows and my ability to concentrate has improved. It seems to have opened my mind. I'm not sure I can explain it properly, I just know it made a difference."

It is likely that any group activity which involves being active and learning a new skill will help boost your brain. Ballroom dancing, anyone?

***http://www.bbc.com/news/magazine-33506081***

## The plant that can kill and cure

***Nightshades have a deadly reputation but these plants, steeped in myth and folklore, have been used for thousands of years for medicinal purposes.***

And they may have properties that could keep us healthy today, writes Mary Colwell. "J K Rowling was extremely good at botany, and one of the plants she put into Harry Potter was mandrake," says Sandy Knapp, head of the Plants Division at the Natural History Museum in London.

In Harry Potter and the Chamber of Secrets, Prof Sprout shows Harry and his classmates how to repot young mandrakes, but not without everyone wearing earmuffs. "The cry of the mandrake is fatal to anyone who hears it," says Hermione, showing off her knowledge to the class. But the students are dealing with young plants which are not quite so dangerous. Prof Sprout points out that as they are "only seedlings, their cries won't kill yet… but they will knock you out for several hours".

The pupils cover their ears and Harry pulls a mandrake out of its pot. "Instead of roots, a small, muddy and extremely ugly baby popped out… He had pale green mottled skin, and was clearly bawling at the top of his lungs."

The scene is based on a medieval myth - it was believed that when pulled from the ground the root emitted a shrill cry that drove people mad and killed them.

The plant also features in Shakespeare's Romeo and Juliet: "What with loathsome smells, And shrieks like mandrakes torn out of the earth, That living mortals, hearing them, run mad."

Herbalists who wanted to use mandrake were advised to plug their ears, tie the plant to a dog and place some meat out of reach - then when the dog ran to the meat it would pull the screaming root out of the soil. The dog would die, but the herbalist would get the mandrake safely. This practice was actually recorded by the renowned Spanish Muslim herbalist Ibn al-Baitar in the 13th Century. Fortunately, he relates that when he tried it the dog was unharmed.

The mandrake is steeped in folklore, myth and legend. "One of the reasons I think they were called mandrakes is that often the mandrake root will branch and it looks like it has little legs like people," says Knapp. "In all the medieval herbals the mandrakes were always drawn with heads, then the bodies would be the roots with the legs crossed."

The plant grows in arid areas around the Mediterranean and Middle East where it has been used as a hallucinogen, painkiller, aphrodisiac and fertility drug for thousands of years. But the dose has to be right.

"In essence, if you were to consume it you would basically get hallucinations, dizziness and increased heart rate, and you could get disturbed vision as a

consequence of it, and then disturbed cognition. If the dose is high enough it could kill you," says Prof Michael Heinrich from the School of Pharmacy at UCL.

Witches were said to put it in potions which sent them flying around the world on their broomsticks. An early reference to mandrake being used as a fertility drug can be found in the Bible in the Book of Genesis (30:14) where Rachel tells Leah she can spend the night with her husband in exchange for mandrakes, which she hopes will help her to conceive. But the roots were also used for dastardly deeds by murderers and a relative of mandrake, henbane, is thought to have been used by Dr Crippen who was convicted of killing his wife in 1910.

It is also said that mandrake-infused wine was offered to those being crucified to hasten the end. And later the root was believed to grow where the bodily fluids of murderers dripped beneath the gallows. Few plants are the subject of so many diverse stories.

The mandrake is just one of 2,500 species belonging to the Solanaceae family, which also contains tomatoes, potatoes, chillies, aubergines, peppers, tobacco, deadly nightshade and henbane - they are commonly called the Nightshades.

They all contain powerful alkaloids that affect the human body.

But "it's like the two headed coin, there's the bad guys and the good guys," says Knapp. "In Europe we have things like mandrake and henbane and deadly nightshade, so Solanaceae in Europe are baddies, they are not to be touched and not to be eaten and not to be meddled with.

"The potatoes and tomatoes from the New World don't have those poisonous compounds in them, they have a different type of compound which was used at one time as a basis for making birth control pills."

Today around 164 million tonnes of tomatoes and 376 million tonnes of potatoes are grown for food each year. But when tomatoes and potatoes first arrived in Europe from South America in the early 1500s, they were treated with suspicion because they looked so similar to the Nightshades. "The tomato was characterised in early herbals as a strange type of mandrake, so people weren't that keen," says Knapp. As a result, tomatoes were grown as ornamental plants in Northern Europe and North America until the 18th Century.

The potato was also viewed with suspicion for a while. Eating a mandrake root was certainly not recommended so why risk a potato? But when we did, its effect on Europe was extraordinary. "You have a very important part of the English and Northern European diet coming in about 1600 to 1700," says Andrew Smith, writer and lecturer in food history at the New School University in New York.

"And it's the major reason why in Northern Europe populations doubled in a hundred years, which is a fascinating story of demographics." Potato tubers provide starch and vitamins in abundance, but the fruits of the plants are to be avoided - they contain high levels of solanine, one of the poisonous alkaloids of the Nightshade family.

Dr Edward Giovannucci, a professor of nutrition and epidemiology at the Harvard School of Public Health, conducted experiments in the late 1990s to show that men who ate two or more servings of tomatoes a week reduced their chances of developing prostate cancer. It's all due to the lycopene found in tomatoes. "The shape of the lycopene molecule makes it very effective in being able to quench free radicals," he says.

"We don't really understand it entirely yet, but lycopene may have specific properties that protect the cell in a way other antioxidants may not." Investigations continue into the ability of tomatoes to help reduce blood pressure, prevent strokes and reduce cholesterol.

Red peppers too are being investigated to see if they can help reduce the risk of developing Parkinson's Disease, and the whole family is considered to be, "the most promising plant species to develop as efficacious and safer medicines for diabetes and its complications," according to the Journal of Drug Delivery and Therapeutics.

The Nightshades are a diverse group of plants that feed us, poison us, send us on mind-bending trips, dull pain and look pretty in gardens (petunias are part of the family). From witches brew to modern medicine, they are still fundamentally part of our lives and they continue to work their magic.

***http://nyti.ms/1LqrkiO***

## Experts Urge Sparing Use of Nonaspirin Painkillers

***The Food and Drug Administration will ask that labels of some popular painkillers reflect new evidence of their health risks***

**By SABRINA TAVERNISE JULY 13, 2015**

The Food and Drug Administration warned last week that the risk of heart attack and stroke from widely used painkillers that include Motrin IB, Aleve and Celebrex but not aspirin was greater than it previously had said. But what does that mean for people who take them?

Experts said that the warning reflected the gathering evidence that there was risk even in small amounts of the drug, so-called nonaspirin, nonsteroidal anti-inflammatory drugs, or Nsaids, and that everyone taking them should use them sparingly for brief periods. Millions of Americans take them.

“One of the underlying messages for this warning has to be there are no completely safe pain relievers, period,” said Bruce Lambert, director of the Center for Communication and Health at Northwestern University, who specializes in drug safety communication.

But the broader context is important. The relative risk of heart attack and stroke from the drugs is still far smaller than the risk from smoking, having uncontrolled high blood pressure or being obese. At the same time, use of the drugs by someone with those other habits and conditions could compound the risk.

"The additional risk is relatively small, but it could be the straw that breaks the camel's back for someone already at risk," Professor Lambert said. The evidence that the drugs increase the risk of heart attack, stroke and heart failure "is now extremely solid," he said. "I don't think we will ever see a study that says, 'Oops, Nsaids were safe after all,' " he added.

The agency said it would ask drug manufacturers to change the labels to reflect new evidence that the drugs increased the risk of heart attack and stroke soon after patients first started taking them, and that while the risk was higher for people with heart disease, it surfaced even for people who had never had heart problems.

Dr. Peter Wilson, a professor of medicine and public health at Emory University in Atlanta, was a member of an expert panel convened by the F.D.A. last year to sift through new evidence on the drugs, including a meta-analysis of a number of scientific trials, as well as some observational studies. He offered a rule of thumb for the scale of risk based on studies he and others reviewed last year.

The over-the-counter medications, which have the lowest doses, probably increased risk by about 10 percent, he said. Low-dose prescription medications were likely to increase the risk by about 20 percent and higher-level dose prescription medications by about 50 percent, Dr. Wilson said. He emphasized that there was significant variability in each estimate. For example, the risk for the over-the-counter drugs might be zero or might be 20 percent.

"There is great concern that people think these drugs are benign, and they are probably not," he said. "The thought is these are good for short-term relief, probably for your younger person with no history of cardiovascular trouble."

People over 65 with a history of heart disease should be especially careful, Dr. Wilson said.

Less clear is whether one of the drugs is safer than another, whether there is a safe minimum dose or minimum duration of exposure, or whether some populations might be less vulnerable.

Dr. Sanjay Kaul, a cardiologist at Cedars-Sinai Medical Center in Los Angeles, who was a member of the same expert panel attended last year by Dr. Wilson, said the evidence was too weak to tell if one drug was better than another. He said a more conclusive answer could come from a large randomized trial, called Precision, that is comparing the rate of heart problems among patients with high cardiovascular risk for ibuprofen (Motrin IB), naproxen (Aleve) and celecoxib (Celebrex).

"The F.D.A. is basically hedging — they still have questions," Dr. Kaul said. "It's messy, and the randomized trial is the only reliable way to sort it out."

The agency's move is important, he said, because the drugs are so widely used, often for "little aches and pains" that do not warrant their use. "The point of this warning is that we have to be very careful," he said. "There has to be a good reason to take them. We shouldn't just be using these drugs willy-nilly."

But what practical advice does Dr. Kaul have for patients?

"I'm not going to stop using these medications," he said. "But there has to be a good reason to use them."

Professor Lambert said the warning might encourage people to manage pain without drugs, or to try to treat the underlying cause of the pain. One of the most effective treatments for arthritis pain, he said, is weight loss. (Less weight means less pressure on joints.)

"It's a risk-benefit decision," he said. "When people get cancer, we give them incredibly toxic drugs, but the extra benefit they get is worth it. For people who are in the habit of taking these drugs for headaches or mild pain, they might want to reconsider."

***http://bit.ly/1LqsniK***

## Burst of light speeds up healing by turbocharging our cells

***It sounds too good to be true. Shining red light on skin or cells in a dish gives an instant energy boost that could help heal wounds, relieve pain and perhaps help male infertility and other medical conditions.***

The curious healing effect has been known for decades – researchers have been investigating its use in eye injuries since 2002 – but why it works has been a mystery. It turns out the explanation could be simple and yet strange: the red light seems to alter the physical properties of water, which turbocharges the chemical reactions that provide a cell's energy. The revelation has come from work led by Andrei Sommer of the University of Ulm in Germany.

The effect on cells of near-infrared light, which has a wavelength of 670 nanometres, was first reported 40 years ago. The light causes mitochondria, the cell's powerhouses, to produce more ATP, a compound that provides the cell's energy.

Until now, the best explanation was that an important respiration enzyme called cytochrome C is affected by the near-infrared energy, but we now know that it doesn't absorb light at quite the right frequency.

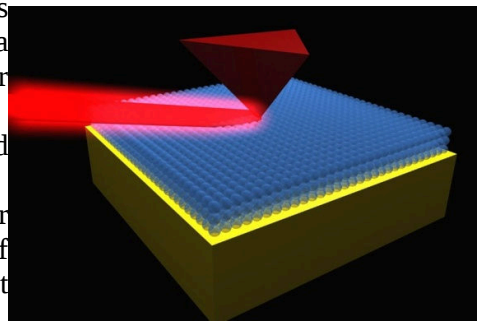
**Thinner than water**

The work from Sommer's team now points at the water within the cell. Normally the layer of water next to any solid object has high surface tension, making it viscous. "It's like molasses," says Sommer.

His team found that when surface layers of water are illuminated with the red light, it increases the distance between each water molecule, making the liquid become "runnier".

Mitochondria are powered by an enzyme bound into their membranes. It spins like a molecular turbine, and being surrounded by runnier water should make it turn more easily, generating more ATP.

Because it is hard to measure water inside a living cell, the team measured the effect of near-infrared light on thin layers of water by examining the friction on a diamond probe as it pushed through water and into a metal block (see picture above). Illuminating the water cut the force needed to push in the probe by 72 per cent.



"It's highly significant," says Horst-Dieter Försterling of the Philipp University of Marburg in Germany. "This is the first explanation of how the light might work."

***A near infrared laser beam makes it easier for a nanoscale probe to pass through water (Image: Andrei Sommer et al)***

**Healing with light**

Other research groups are investigating this phenomenon as a way to speed up the healing of skin wounds and to repair burns to the eye. It may also be able to reduce pain and inflammation in tissues underneath the skin. Others are investigating whether red light shone into mice's heads using fibre optics can help with Parkinson's disease.

A better understanding of how red light affects cells should make it easier to expand its medical uses, says Sommer. "If we start from an incorrect model then everything is trial and error."

One of the next applications could be in helping couples undergoing IVF because of problems with male fertility. Some men's sperm do not have enough energy to fertilise an egg in a lab, even though they only have to swim 1 millimetre to reach it, says IVF doctor Friedrich Gagsteiger of the Fertility Centre in Ulm.

Gagsteiger has previously investigated other ways of giving sperm more oomph, such as using caffeine – which does make them swim faster but also seems to be toxic.

Gagsteiger is now starting tests of irradiating sperm with the near-infrared light before fertilisation. "We hope this will increase the chance of the sperm finding the eggs," he says.

*Journal reference: Scientific Reports, DOI: 10.1038/srep12029*

***http://www.eurekalert.org/pub_releases/2015-07/uoe-ncs071415.php***

## New classification system for brain tumors

***Doctors at Universitätsklinikum Erlangen have developed a simple radiological method to predict the development of gliomas***

Despite modern chemoradiation therapy it is still very difficult to give reliable prognoses for malignant gliomas. Surgical removal of the glioma is still the preferred method of treatment.

Doctors at Universitätsklinikum Erlangen's Department of Neurosurgery have now developed a new procedure for analysing radiological imaging scans which makes it possible to predict the course of a disease relatively precisely. Their findings have now been published in the journal 'Scientific Reports'.*

The Friedlein Grading A/B (FGA/B) classification system - named after the physician Katharina Friedlein - is a quick and precise way of determining whether surgical removal is the best possible treatment method for a given tumour. Essentially, the Erlangen-based doctors classify tumours according to their position in the brain in the context of a routine magnetic resonance imaging (MRI) scan. Tumours that are not located in functional brain regions or that are located at a certain distance from such regions are classified as FGA, while tumours that are close to or inside a functional brain region are classified as FGB.

With the FGA/B method it possible to plan the consequences of tumour surgery, which is crucial for the success of the treatment, in a precise, low-risk and quantitative manner.

This makes the Friedlein Grading system the first classification system which can be easily applied in clinical practice.

There have already been several attempts in medicine to develop such a classification system. However, most approaches were too complicated and were based on academic values only, which made it difficult to use them in clinical practice,' says PD Dr. Nicolai Savaskan from FAU's Chair of Neurosurgery.

'The FGA/B method can be applied on the basis of a standard MRI scan which glioma patients have to undergo anyway and is highly reliable despite being so simple.

We hope that our colleagues in neurosurgery departments in smaller hospitals will also be able to use it successfully in everyday clinical practice.'

**Scientific Reports, July 2015. A new functional classification system (FGA/B) with prognostic value for glioma patients. Katharina Friedlein, Yavor Bozhkov, Nirjhar Hore, Andreas Merkel, Björn Sommer, Sebastian Brandner, Michael Buchfelder, Nicolai E. Savaskan & Ilker Y. Eyüpoglu*

http://www.eurekalert.org/pub_releases/2015-07/danl-crf071415.php

# Curiosity rover finds evidence of Mars' primitive continental crust

***ChemCam instrument shows ancient rock much like Earth's***

The ChemCam laser instrument on NASA's Curiosity rover has turned its beam onto some unusually light-colored rocks on Mars, and the results are surprisingly similar to Earth's granitic continental crust rocks. This is the first discovery of a potential "continental crust" on Mars.

"Along the rover's path we have seen some beautiful rocks with large, bright crystals, quite unexpected on Mars" said Roger Wiens of Los Alamos National Laboratory, lead scientist on the ChemCam instrument. "As a general rule, light-colored crystals are lower density, and these are abundant in igneous rocks that make up the Earth's continents."

Mars has been viewed as an almost entirely basaltic planet, with igneous rocks that are dark and relatively dense, similar to those forming the Earth's oceanic crust, Wiens noted. However, Gale crater, where the Curiosity rover landed, contains fragments of very ancient igneous rocks (around 4 billion years old) that are distinctly light in color, which were analyzed by the ChemCam instrument.

French and US scientists observed images and chemical results of 22 of these rock fragments. They determined that these pale rocks are rich in feldspar, possibly with some quartz, and they are unexpectedly similar to Earth's granitic continental crust. According to the paper's first author, Violaine Sautter, these primitive Martian crustal components bear a strong resemblance to a terrestrial rock type known to geologists as TTG (Tonalite-Trondhjemite-Granodiorite), rocks that predominated in the terrestrial continental crust in the Archean era (more than 2.5 billion years ago).

The results were published this week in Nature Geoscience, "In situ evidence for continental crust on early Mars."

Gale crater, excavated about 3.6 billion years ago into rocks of greater age, provided a window into the Red Planet's primitive crust. The crater walls provided a natural geological cut-away view 1-2 miles down into the crust. Access to some of these rocks, strewn along the rover's path, provided critical information that could not be observed by other means, such as by orbiting satellites.

*ChemCam, a laser-induced breakdown spectrometer (LIBS), provides chemical analyses at a sub-millimeter scale; detailed images were provided by its Remote Micro Imager. Photo caption: Igneous clast named Harrison embedded in a conglomerate rock in Gale crater, Mars, shows elongated light-toned feldspar crystals. The mosaic merges an image from Mastcam with higher-resolution images from ChemCam's Remote Micro-Imager. Credit: NASA/JPL-Caltech/LANL/IRAP/U. Nantes/IAS/MSSS.*

http://bit.ly/1JnJSfc

# The Psychological Cost of Being a Maverick

***A surprise: identifying with a group brings a sense of personal control***

**By Daniel Yudkin | July 14, 2015**

Of the many values that typify the American dream, surely one of the most cherished is that of rugged individualism. The “go-it-alone” mentality characterizes all sorts of indispensable American icons, including the brave revolutionaries of 1776, the lonely cowboy on the open range, and the craggy pickup-truck driver in a recent TV advertisement who, the ad declares, is at the age of “knowing how to get things done” (the ad is for Viagra). Bucking the trend, flying solo, doing one’s own thing, being a maverick: each of these aphorisms demonstrates American culture’s approving attitude towards ditching the “we” in favor of the “me.”

Implicit in this worship of individuality is the assumption that the best way to find yourself, to control your destiny, is on your own. No one is more courageous or empowered, the idea goes, than the person who casts off the ropes of group mentality and strikes out alone. Hence the obsession with the story of the iconoclastic CEO who drops out of college and starts a technology revolution.

But despite this received wisdom, advances in social psychology call into question the unmitigated supremacy of the freewheeling solo act. One recently published article suggests, instead, that people’s greatest source of strength may not lie in their sense of unbridled autonomy but rather in their sense of belonging and pride in their community—known as group identification. (Class rings, national flags, college sweatshirts—all are signs of people high in group identification.)

The researchers examined the effect of group identification on something known as perceived personal control — how much power and influence people feel they have over their lives. It is important because it can help people recover from setbacks. Instead of throwing their hands up and admitting defeat, they are better able to cope with challenges, which ultimately increases their happiness and wellbeing.

The researchers predicted that, far from causing people to be weak and ineffectual, group identification can actually boost people’s perceived personal control. As a preliminary test of this hypothesis, they turned to the

World Values Survey—a large-scale project spanning 62,000 individuals across forty-seven countries. The researchers noticed that the more people identified with different groups—their local community, their country, and humanity in general—the more control they felt they had in their lives. Moreover, perceived control also positively influenced people’s overall happiness.

To further investigate this idea, researchers conducted a study in which they asked average American citizens how much they identified with their political party (Republican or Democrat) in the time surrounding the 2012 Presidential Election. Again, those who identified with their political party had higher perceived control and life satisfaction—even after their candidate lost the election.

But these studies were only correlational, making it difficult to know for sure what caused what. So the experimenters conducted another experiment to help determine the causal pathway. To do this, they utilized a subtle psychological instrument designed to temporarily shift people's group identification. The experimenters randomly assigned Americans to one of two conditions: high identification and low identification. Those in the former condition they asked a series of questions that made it very easy to disagree with negative statements about their country (e.g., "I feel no affiliation with the United States") and agree with positive (e.g., "In general, I like living in the United States."). Those in the latter, by contrast, were asked questions that made it very easy to agree with negative statements about their country ("There are some things I don't like about the United States") and disagree with positive ("I identify very strongly with the United States").

The experimenters reasoned that answering these questions would cause a temporary shift in people's sense of national identity. And sure enough, those in the "high identification" condition reported being more proud to be an American than those in the "low identification" condition. Additionally, the more identified as American, the more control they felt over their lives.

But the most important finding emerged when the experimenters asked participants to write about an experience in which they felt totally powerless. This sort of writing exercise can cause a temporary negative mood. And indeed, people in the "low identification" condition exhibited various negative emotions consistent with depression. On the other hand, those in the "high identification" condition showed no significant decrease in mood. Their feeling of national pride had bolstered their perceived personal control, which in term buffered them against dejection.

Overall, then, this research suggests that belonging to a community—whether it's your family, your workplace, your religious organization, or your country—can help you deal with life's challenges. This cuts against the pervasive notion in American culture that the best way to find yourself is to strike out on your own. Ironically, the more you give yourself over to the group, the more personal control you will feel. As the researchers write, these findings highlight "not only how groups can help people, but how groups can help people help themselves."

***http://www.eurekalert.org/pub_releases/2015-07/acs-ap071515.php***

## A portable 'paper machine' can diagnose disease for less than $2

***Successfully determined whether as few as five cells of E. coli were present in test samples***

In the U.S. and other industrialized nations, testing for infectious diseases and cancer often requires expensive equipment and highly trained specialists. In countries where resources are limited, performing the same diagnostics is far more challenging. To address this disparity, scientists are developing a portable, low-cost "paper machine" for point-of-care detection of infectious diseases, genetic conditions and cancer. Their report appears in the ACS journal Analytical Chemistry.

Many modern diagnostic techniques involve analyzing DNA in a patient's blood sample. If pathogenic bacteria, for example, are present, the test will detect the foreign genetic material. Part of the barrier to bringing this kind of technology everywhere is that it often requires multiple steps under precisely controlled temperatures to prepare a sample and analyze it. Scientists are working to simplify these procedures, but most are still not ideal for remote locations. John T. Connelly and colleagues set out to make this critical technology more accessible.

Using materials that cost a less than $2 total, the researchers condensed sample preparation, DNA analysis and detection steps into a hand-held paper machine. It successfully determined whether as few as five cells of E. coli were present in test samples. The results can be read using ultraviolet light and a smartphone camera. The researchers say they are further refining the machine to make it even simpler to use.

*The authors acknowledge funding from the Defense Advanced Research Projects Agency.*

***http://www.eurekalert.org/pub_releases/2015-07/e-jtd071415.php***

## Jupiter twin discovered around solar twin

***Brazilian-led team leading the search for a Solar System 2.0***

So far, exoplanet surveys have been most sensitive to planetary systems that are populated in their inner regions by massive planets, down to a few times the mass of the Earth. This contrasts with our Solar System, where there are small rocky planets in the inner regions and gas giants like Jupiter farther out.

According to the most recent theories, the arrangement of our Solar System, so conducive to life, was made possible by the presence of Jupiter and the gravitational influence this gas giant exerted on the Solar System during its formative years.

It would seem, therefore, that finding a Jupiter twin is an important milestone on the road to finding a planetary system that mirrors our own.

A Brazilian-led team has been targeting Sun-like stars in a bid to find planetary systems similar to our Solar System. The team has now uncovered a planet with a very similar mass to Jupiter, orbiting a Sun-like star, HIP 11915, at almost exactly the same distance as Jupiter.

The new discovery was made using HARPS, one of the world's most precise planet-hunting instruments, mounted on the ESO 3.6-metre telescope at the La Silla Observatory in Chile.

Although many planets similar to Jupiter have been found at a variety of distances from Sun-like stars, this newly discovered planet, in terms of both mass and distance from its host star, and in terms of the similarity between the host star and our Sun, is the most accurate analogue yet found for the Sun and Jupiter.

The planet's host, the solar twin HIP 11915, is not only similar in mass to the Sun, but is also about the same age.

To further strengthen the similarities, the composition of the star is similar to the Sun's. The chemical signature of our Sun may be partly marked by the presence of rocky planets in the Solar System, hinting at the possibility of rocky planets also around HIP 11915.

According to Jorge Melendez, of the Universidade de São Paulo, Brazil, the leader of the team and co-author of the paper, "the quest for an Earth 2.0, and for a complete Solar System 2.0, is one of the most exciting endeavors in astronomy. We are thrilled to be part of this cutting-edge research, made possible by the observational facilities provided by ESO."

Megan Bedell, from the University of Chicago and lead author of the paper, concludes: "After two decades of hunting for exoplanets, we are finally beginning to see long-period gas giant planets similar to those in our own Solar System thanks to the long-term stability of planet hunting instruments like HARPS. This discovery is, in every respect, an exciting sign that other solar systems may be out there waiting to be discovered."

Follow-up observations are needed to confirm and constrain the finding, but HIP 11915 is one of the most promising candidates so far to host a planetary system similar to our own.

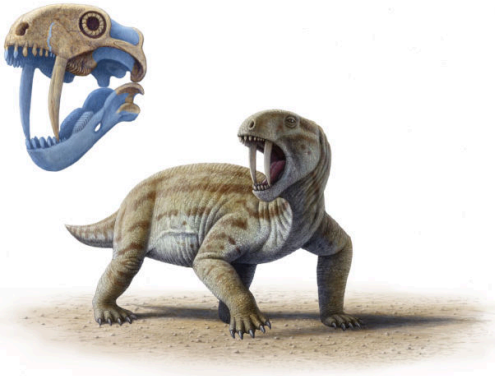
*An example of another Jupiter Twin is the one around HD 154345, described here: http://iopscience.iop.org/1538-4357/683/1/L63/pdf/587461.pdf.*

*Since the signature of the Brazilian accession agreement in December 2010, Brazilian astronomer have had full access to the ESO observing facilities. This research was presented in a paper entitled "**The Solar Twin Planet Search II. A Jupiter twin around a solar twin**", by M. Bedell et al., to appear in the journal Astronomy and Astrophysics.*

http://www.eurekalert.org/pub_releases/2015-07/uotw-wtl071515.php

## With teeth like that, this pre-dinosaur vegetarian was no push over

***Head-butting and canine display during male-male combat first appeared some 270 million years ago***



Discovered four years ago, and following an updated and more in-depth study of the herbivorous mammalian ancestor, Tiarajudens eccentricus, researchers from Brazil and South Africa can now present a meticulous description of the skull, skeleton and dental replacement of this Brazilian species. They also learned that 270 million years ago, the interspecific combat and fighting we see between male deer today were already present in these forerunners of mammals.

***Skull and life reconstruction of the "sabertoothed" therapsid Tiarajudens from the Permian of Brazil***

This description by Brazilian researcher, Dr Juan Carlos Cisneros, and his co-authors from the Evolutionary Studies Institute at the University of the Witwatersrand, Professor Fernando Abdala and Dr Tea Jashasvili, is published in an article, titled: Tiarajudens eccentricus and Anomocephalus africanus, two bizarre anomodonts (Synapsida, Therapsida) with dental occlusion from the Permian of Gondwana in the journal, Royal Society Open Science, on 15 July 2015.

Saber-teeth are known to belong to the large Permian predators' gorgonopsians (also known as saber-tooth reptiles), and in the famous saber-tooth cats from the Ice Age.

When Tiarajudens eccentricus was discovered it had some surprises install: Despite large protruding saber-tooth canines and occluding postcanine teeth, it was an herbivore. The discovery of this Brazilian species also allowed for a reanalysis of the South African species Anomocephalus africanus, discovered 10 years earlier. The two species have several similar features that clearly indicated they are closely related but the African species lack of the saber-tooth canines of its Brazilian cousin. In the Middle Permian, where these Gondwana cousins were living, around 270 million years ago, the first communities with diverse, abundant tetrapod herbivores were evolving.

In deer today enlarged canines are used in male-male displays during fighting. The long canine in the herbivore T. eccentricus is interpreted as an indication of its use in a similar way, and is the oldest evidence where male herbivores have used their canines during fights with rivals. "It is incredible to think that features found in deer such as the water deer, musk deer and muntjacs today were already represented 270 million years ago," says Cisneros.

The researchers found the Tiarajudens' marginal teeth are also located in a bone from the palate called epipterygoid. "This is an extraordinary condition as no other animal in the lineage leading to mammals show marginal dentition in a bone from the palate," says Abdala.

In another group of mammal fossil relatives, dinocephalians - that lived at the same time as anomodonts, some of the bones in their foreheads were massively thickened. This can be interpreted as being used in head-butting combat, a modern behaviour displayed by several deer species today.

"Fossils are always surprising us. Now they show us unexpectedly that 270 million years ago two forms of interspecific combat represented in deer today, were already present in the forerunners of mammals," says Cisneros.

***http://www.eurekalert.org/pub_releases/2015-07/usmc-rhs071515.php***

## Researchers have shown that a drug currently in testing shows potential to cure malaria

***Researchers at UT Southwestern Medical Center and in Australia have shown that a drug currently in testing shows potential to cure malaria in a single dose and offers promise as a preventive treatment as well.***

DALLAS - The new drug - DSM265 - kills drug-resistant malaria parasites in the blood and liver by targeting their ability to replicate. Malaria is a highly infectious, mosquito-transmitted disease that kills nearly 600,000 people worldwide each year, mostly children under 5 years old living in sub-Saharan Africa. Nearly 200 million cases of malaria are reported annually, and about 3 billion people are at risk of malaria in 97 countries.

"DSM265 could be among the first single-dose cures for malaria, and would be used in partnership with another drug," said lead author Dr. Margaret Phillips, Professor of Pharmacology at UT Southwestern. "The drug also could potentially be developed as a once-weekly preventive."

The research team included UT Southwestern, the Monash Institute of Pharmaceutical Sciences in Australia, the University of Washington, and the not-for-profit Medicines for Malaria Venture (MMV). The study was published in Science Translational Medicine.

Researchers determined that the compound DSM265 kills the malaria parasite Plasmodium in both liver and blood stages of infection. Further, the compound was shown to be well tolerated and effective in preclinical models.

Currently, the frontline anti-malarial treatments are artemisinin-based combination therapies, or ACTs, which are credited with helping to reduce the malaria burden. However, malaria strains resistant to ACTs have recently been reported in Thailand, Cambodia, Vietnam, Myanmar, and Laos.

"The problem is we're starting to see more drug resistance, and this is what's taken out every anti-malarial drug we've had," said Dr. Phillips, who holds the Beatrice and Miguel Elias Distinguished Chair in Biomedical Science, and the Carolyn R. Bacon Professorship in Medical Science and Education. "The parasite is very good at adapting and becoming resistant to drugs - this is inevitable. What we can do is deliver new medicines with new modes of action and safeguard the longevity of the anti-malarial through use in combination as long as possible."

In order to combat drug resistance, DSM265 likely would be partnered with another new drug and used as a one-dose combination therapy. Another option is to develop DSM265 as a once-weekly preventive for individuals traveling to malaria-endemic regions or for people living in areas where malaria infections are primarily seasonal and human immunity is low. Either scenario is still several years away, pending the outcome of current and future trials, said Dr. Phillips.

DSM265 targets the ability of the parasite to synthesize the nucleotide precursors required for synthesis of DNA and RNA, said Dr. Phillips.

The study concluded that DSM265 appeared to be safely tolerated in non-human tests and established optimal dosing levels and length of drug effectiveness in preclinical models to estimate dosing for humans, paving the way for clinical trials. The first clinical trial was a safety study in Australia, followed by an ongoing efficacy study in Peru to evaluate the ability to treat patients with malaria. Additional human studies are planned, including one to test the drug as a preventive medicine. UT Southwestern is assisting in an advisory capacity in these studies and is providing support with biomarker assays.

Work on DSM265 began in Dr. Phillips' lab. In 2008, her research team identified an inhibitor of an enzyme that the malaria parasite requires for survival. This enzyme, dihydroorotate dehydrogenase (DHODH), enables the parasite to replicate and spread during infection of humans. The lead drug compound discovered during high-throughput tests at UT Southwestern's core screening laboratory was then refined to DSM265 in partnership with Dr. Susan Charman at Monash University, the study's senior author; Dr. Pradipsinh Rathod at the University of Washington; and MMV-affiliated researchers.

DSM265 is the first DHODH inhibitor to reach clinical development for treatment of malaria.

Drs. Phillips, Charman, Rathod, and Dr. Jeremy Burrows of MMV are named as inventors in a pending patent application covering DSM265 and related compounds. The drug has been licensed to MMV, which is leading the clinical trial in Peru. MMV works with institutions and drug companies worldwide to further research and development of new malaria treatments. DSM265 is one of several potential anti-malarial drugs now in various stages of development in collaboration with MMV.

*Other UT Southwestern researchers involved in this study included Farah El Mazouni, a research scientist in Pharmacology; Dr. Diana Tomchick, Professor of Biophysics and Biochemistry, and Dr. Xiaoyi Deng, Instructor of Pharmacology.*

*UT Southwestern collaborated on this study with researchers from the University of Washington, Massachusetts Institute of Technology, Columbia University Medical Center, SUNY Upstate Medical University, SRI International, and the National Institutes for Allergy and Infectious Diseases in the United States; MMV, and the Swiss Tropical and Public Health Institute in Switzerland; Monash and Griffith University in Australia; Biomedical Primate Research Center, and TropIQ Health Sciences of The Netherlands; the Imperial College of Science, Technology and Medicine in the United Kingdom; and GlaxoSmithKline divisions in both Spain and the United Kingdom.*

*The research was funded by MMV, the National Institutes of Health, the Welch Foundation, and the Wellcome Trust. Dr. Phillips and two other authors not affiliated with UT Southwestern are paid consultants for MMV. Other authors hold stock in TropIQ, and another is a paid consultant to Hepregen.*

***http://www.eurekalert.org/pub_releases/2015-07/cp-ais070915.php***

## Altruism is simpler than we thought

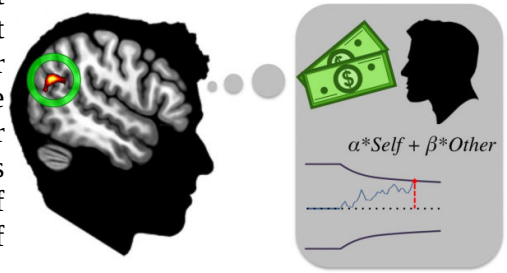
***A new computational model of how the brain makes altruistic choices is able to predict when a person will act generously in a scenario involving the sacrifice of money.***

The work, led by California Institute of Technology scientists and, appearing July 15 in the journal Neuron, also helps explain why being generous sometimes feels so difficult.

The reason people act altruistically is well contested among academics. Some argue that people are innately selfish and the only way to override our greedy tendencies is to exercise self-control. Others are more positive, believing that humans naturally find generosity rewarding and that we only act selfishly when we pause to think about it. The Caltech model suggests that neither side fits all; both generosity and selfishness can be fast and effortless. But it depends on the person and the context.

"We take a very simple model of choice that's been developed for predicting perceptual decisions--like whether a dot is moving left or right--and adapt it to capture generosity," says lead author Cendri Hutcherson, who did the work as a postdoctoral fellow at the California Institute of Technology and now directs the Decision Neuroscience Lab at the University of Toronto. "With this simple model, we are able to explain a huge host of previously confusing patterns about how people make altruistic choices."

"We find that what matters is not whether you can exert self-control, but simply how strongly you consider others' needs relative to your own," she says. "If you consider the other person's needs more, being generous feels easy. If you consider yourself more, generosity requires a lot of effort."




***Researchers find that a simple computational model of altruism, where specific brain regions represent other's needs, can predict when people are generous and why generosity sometimes feels so difficult.*** **Credit: Cendri Hutcherson**

Hutcherson also thinks the model sheds light on debates about whether the mere act of behaving generously is rewarding. "Researchers have observed that if you act generously then you see greater activity in areas of the brain that represent reward value, and so have concluded that generosity is an inherently rewarding act--but our model actually suggests that you can get that activity just because of the way these regions construct a decision," she says. "You would see more activation in reward areas simply because the decision is complex and so requires more processing to make."

The model is based on brain scans of 51 males as they made decisions in a modified version of the "Dictator Game." To play this game, each participant was paired up with a stranger he would never meet and asked whether he would be willing to sacrifice different amounts so that the stranger could get a significantly larger pay-out (e.g., lose $25 and the other person receives an extra $100). The money was real and each participant had to make a total of 180 decisions.

The brain scans suggested that different brain areas represent one's own and others' interests. Self-oriented values correlated with activity in the ventral striatum, an area linked to basic reward processing. Other-oriented values correlated with activation of the temporoparietal junction, which has been implicated in empathy. Hutcherson believes this is evidence that people are more

likely to give away resources if they already have in mind how their donation will benefit someone else.

Perhaps unsurprisingly, most people tended to be greedy, but the model also explains another puzzle: sometimes even the most selfish participants at times made generous decisions. The researchers see these choices not as evidence of self-control, as previously thought, but simply mistakes, a moment in which the benefit for the self was accidently underweighted. These errors suggest that time pressure could be one way to get people to behave out-of-character of their normal giving behaviors, but this is likely not a successful long-term strategy for fundraising.

"Our results indicate that people are happier when mistaken generosity doesn't happen." Hutcherson says. "But if we can increase people's focus on the thoughts and experiences of others, we can decrease those mistakes while increasing charitable giving and making altruism feel a lot easier."

*This research was supported by the National Science Foundation, the Gordon and Betty Moore Foundation, and the Lipper Foundation.*

*Neuron, Hutcherson et al.: "A Neurocomputational Model of Altruistic Choice and Its Implications"* http://dx.doi.org/10.1016/j.neuron.2015.06.031

***http://www.medscape.com/viewarticle/847683***

## What Is Vascular Dementia?

### *Response from David B. Reuben, MD*

**David B. Reuben, MD**

How is vascular dementia diagnosed and differentiated from Alzheimer disease?

Making a diagnosis of vascular dementia is complicated for several reasons. First, vascular dementia has multiple causes and clinical types. Second, in contrast to Alzheimer disease, the diagnosis of vascular dementia has no pathognomonic criteria. Third, the clinical diagnostic criteria are poorly validated. Fourth, on MRI, white-matter lesions, which are related to cerebral hypoperfusion or ischemia, are nonspecific findings yet often are interpreted as diagnostic. Fifth, many patients with vascular dementia also have other causes of dementia (eg, Alzheimer disease)—so-called "mixed dementia."

Several causes and presentations of vascular dementia have clinical value. Perhaps the most obvious patients are those who meet criteria for dementia and have sustained a clinical stroke—either large artery (usually cortical) or small artery (lacunes) in subcortical areas. Strokes are usually confirmed by neuroimaging (MRI is more sensitive than CT) that demonstrates either multiple infarcts or a single strategically placed infarct (eg, angular gyrus, thalamus, brain forebrain, posterior cerebral artery, or anterior cerebral artery).

Patients with dementia who have evidence of cerebral infarction on MRI without clinical presentations of stroke may also have vascular dementia. Finally, chronic subcortical ischemia of small vessels in the periventricular white matter can result in the loss of neurons and supporting brain cells, leading to vascular dementia.

As result of these diverse causes, the clinical presentation of vascular dementia varies considerably. Features that indicate cortical dysfunction (often caused by cerebral embolism) include executive dysfunction; aphasia, apraxia, and agnosia; hemineglect visual-spatial and construction difficulty; and anterograde amnesia. Features that indicate subcortical dysfunction (typically owing to lacunar infarcts and chronic ischemia) include focal motor signs, gait disturbance and falls, urinary tract symptoms, pseudobulbar palsy, personality changes, psychomotor retardation, and abnormal executive function. Clinically, executive dysfunction may be the earliest presenting symptom, even when cognitive impairment is mild.

The temporal relationship between stroke and the onset of cognitive impairment is important in establishing the diagnosis of vascular dementia. For example, dementia occurring within 3 months of a recognized stroke or a pattern of stepwise progression of cognitive deficits strongly supports the diagnosis.

A clinically useful tool for distinguishing vascular dementia from Alzheimer disease is the Hachinski Ischemic Score,[1] which assigns two points to each of the following:

- ***Abrupt onset;***
- ***Fluctuating course;***
- ***History of stroke;***
- ***Focal neurologic symptoms; and***
- ***Focal neurologic signs***

and one point to the following:

- ***Stepwise deterioration;***
- ***Nocturnal confusion;***
- ***Preservation of personality;***
- ***Depression;***
- ***Somatic complaints;***
- ***Emotional incontinence;***
- ***Hypertension; and***
- ***Associated atherosclerosis.***

A score of 7 or higher suggests vascular dementia, whereas a score of 4 or less suggests Alzheimer disease.

*Developed in association with the UCLA Alzheimer's and Dementia Care Program.*

1. Hachinski VC, Iliff LD, Zilhka E, et al. Cerebral blood flow in dementia. Arch Neurol. 1975;32:632-637.

http://www.eurekalert.org/pub_releases/2015-07/qmuo-cmh071615.php

## Common mental health drug could be used to treat arthritis

***Lithium chloride slowed the degradation associated with osteoarthritis***

The research carried out at Queen Mary University of London (QMUL) in collaboration with scientists at the University of Otago in New Zealand, tested the effects of lithium chloride on cartilage and found that it slowed the degradation associated with osteoarthritis.

Osteoarthritis results in degradation of cartilage in joints leading to pain and immobility. It currently affects a third of over 45s in the UK and there are currently no treatments that can prevent it.

The study used bovine cartilage samples exposed to inflammatory molecules to mimic the effects of arthritis and then treated the tissue with lithium chloride. The researchers demonstrated that this already commonly-used drug could be used to prevent the degradation and loss of mechanical integrity of cartilage in patients with arthritis. The researchers also found that, contrary to some reports, long-term dietary use of lithium did not cause arthritis.

Professor Martin Knight, co-author of the research, said:

"Osteoarthritis has a devastating impact on the lives of many people in the UK and it's vital that we look for novel ways to prevent it.

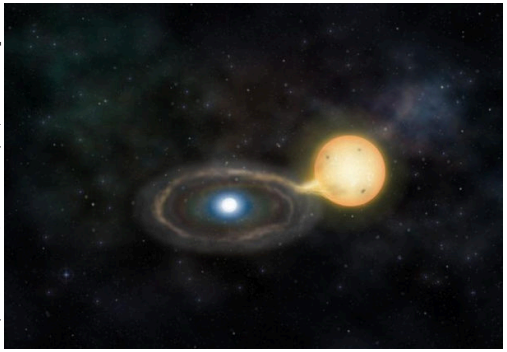
"While we're still at an early stage in researching lithium's effects on cartilage and its suitability as a treatment, the possibility that an already widely available pharmaceutical could slow its progress is a significant step forward."

http://www.eurekalert.org/pub_releases/2015-07/uoc-qsa071515.php

## Gaia satellite and amateur astronomers spot one in a billion star

***System Gaia14aae contains large amounts of helium, but no hydrogen***

An international team of researchers, with the assistance of amateur astronomers, have discovered a unique binary star system: the first known such system where one star completely eclipses the other. It is a type of two-star system known as a Cataclysmic Variable, where one super dense white dwarf star is stealing gas from its companion star, effectively 'cannibalising' it.



***This is an artist's impression of Gaia14aae*. Credit: Marisa Grove/Institute of Astronomy**

The system could also be an important laboratory for studying ultra-bright supernova explosions, which are a vital tool for measuring the expansion of the Universe. Details of the new research will be published in the journal Monthly Notices of the Royal Astronomical Society.

The system, named Gaia14aae, is located about 730 light years away in the Draco constellation. It was discovered by the European Space Agency's Gaia satellite in August 2014 when it suddenly became five times brighter over the course of a single day. Astronomers led by the University of Cambridge analysed the information from Gaia and determined that the sudden outburst was due to the fact that the white dwarf - which is so dense that a teaspoonful of material from it would weigh as much as an elephant - is devouring its larger companion.

Additional observations of the system made by the Center for Backyard Astrophysics (CBA), a collaboration of amateur and professional astronomers, found that the system is a rare eclipsing binary, where one star passes directly in front of the other, completely blocking it out when viewed from Earth. The two stars are tightly orbiting each other, so a total eclipse occurs roughly every 50 minutes.

"It's rare to see a binary system so well-aligned" said Dr Heather Campbell of Cambridge's Institute of Astronomy, who led the follow-up campaign for Gaia14aae. "Because of this, we can measure the system with great precision in order to figure out what these systems are made of and how they evolved. It's a fascinating system - there's a lot to be learned from it."

Using spectroscopy from the William Herschel Telescope in the Canary Islands, Campbell and her colleagues found that Gaia14aae contains large amounts of helium, but no hydrogen, which is highly unusual as hydrogen is the most common element in the Universe. The lack of hydrogen allowed them to classify Gaia14aae as a very rare type of system known as an AM Canum Venaticorum (AM CVn), a type of Cataclysmic Variable system where both stars have lost all of their hydrogen. This is the first known AM CVn system where one star totally eclipses the other.

"It's really cool that the first time that one of these systems was discovered to have one star completely eclipsing the other, that it was amateur astronomers who made the discovery and alerted us," said Campbell. "This really highlights the vital contribution that amateur astronomers make to cutting edge scientific research."

AM CVn systems consist of a small and hot white dwarf star which is devouring its larger companion. The gravitational effects from the hot and superdense white dwarf are so strong that it has forced the companion star to swell up like a massive balloon and move towards it.

The companion star is about 125 times the volume of our sun, and towers over the tiny white dwarf, which is about the size of the Earth - this is similar to comparing a hot air balloon and a marble. However, the companion star is lightweight, weighing in at only one percent of the white dwarf's mass.

AM CVn systems are prized by astronomers, as they could hold the key to one of the greatest mysteries in modern astrophysics: what causes Ia supernova explosions? This type of supernova, which occurs in binary systems, is important in astrophysics as their extreme brightness makes them an important tool to measure the expansion of the Universe. In the case of Gaia14aae, it's not known whether the two stars will collide and cause a supernova explosion, or whether the white dwarf will completely devour its companion first.

"Every now and then, these sorts of binary systems may explode as supernovae, so studying Gaia14aae helps us understand the brightest explosions in the Universe," said Dr Morgan Fraser of the Institute of Astronomy.

"This is an exquisite system: a very rare type of binary system in which the component stars complete orbits faster than the minute hand of a clock, oriented so that one eclipses the other," said Professor Tom Marsh of the University of Warwick. "We will be able to measure their sizes and masses to a higher accuracy than any similar system; it whets the appetite for the many new discoveries I expect from the Gaia satellite."

"This is an awesome first catch for Gaia, but we want it to be the first of many," said the Institute of Astronomy's Dr Simon Hodgkin, who is leading the search for more transients in Gaia data. "Gaia has already found hundreds of transients in its first few months of operation, and we know there are many more out there for us to find."

Gaia's mission, funded by the European Space Agency and involving scientists from across Europe, is to make the largest, most precise, three-dimensional map of the Milky Way ever attempted. During its five-year mission, which began in late 2013, Gaia's billion-pixel camera will detect and very accurately measure the motion of stars in their orbit around the centre of the galaxy. It will observe each of the billion stars about a hundred times, helping us to understand the origin and evolution of the Milky Way.

The follow-up campaign used several professional telescopes, including those located in the Canary Islands, where observing time was made available through the International Time Program.

*The research was supported by ESA Gaia, DPAC, and the DPAC Photometric Science Alerts Team. The DPAC is funded by national institutions, in particular the institutions participating in the Gaia Multilateral Agreement.*

***http://www.eurekalert.org/pub_releases/2015-07/uovh-cpo071615.php***

## Child paralysis outbreak: UVA identifies potential cause

***'We need to keep an open mind' in hunt for pathogen, doctor urges***

A mysterious outbreak of child paralysis cases previously linked to enterovirus D68 may instead have another cause, doctors at the University of Virginia Children's Hospital are cautioning after determining that a stricken child appeared to be suffering from a different virus.

A 6-year-old girl arrived at UVA Children's Hospital in October after her parents noticed that her right shoulder was drooping and that she was having difficulty using her right hand. She had previously exhibited cold-like symptoms, including a cough, a slight fever and headache. The child's paralysis symptoms were similar to those seen in more than 100 other children during an outbreak of acute flaccid myelitis that began in the summer of 2014.

While enterovirus D68 has been the primary suspect in the paralysis cases, the girl's test results identified a different potential culprit, enterovirus C105. "Surprisingly, it came back with this enterovirus C105, which I'll admit, when it came back, I'd never heard of," said UVA's Ronald B. Turner, MD. "It was just described in the last eight or nine years and it hasn't been seen much around the world. Now, I think you have to be careful with that, because we don't look for it. And you don't see what you don't look for. So it's possible it's out there and it's not being detected because nobody's sending specimens to be tested in this way."

While Turner has published a case study detailing the girl's diagnosis, he stops short of suggesting that enterovirus C105 is responsible for the paralysis outbreak. "You can only learn so much from one case. My plea is that we not over-interpret this information," he said. "It was really just an attempt to say, 'Hey wait a minute, there are other possibilities for what's going on with this flaccid paralysis and we need to keep an open mind about this.'"

In the case study, Turner and his co-authors note that while many of the 118 children affected by the paralysis outbreak had also exhibited cold-like symptoms, enterovirus D68 was detected in only eight of the 41 children tested for it. Turner suggests that the outbreak of enterovirus D68 at the same time as the paralysis outbreak may have been a misleading coincidence.

"Last fall there was this outbreak of enterovirus D68 disease that was going around the country and mostly causing respiratory symptoms, asthma exacerbations, that sort of thing. Right in the middle of that, there was also an outbreak of acute flaccid paralysis," Turner said. "Because of the temporal relationship, a lot of people connected those two events and basically assumed that the enterovirus D68 was somehow related to the acute flaccid paralysis."

He emphasized that enterovirus C105 may also not be the cause of the paralysis, and that more analysis needs to be done as the federal Centers for Disease Control and Prevention gathers information. "We need to kind of step back and say, 'OK, we really don't know what's going on here,'" Turner said. "It's really more a caution than an answer we're providing, in my opinion."

UVA's case study has been published online by the journal Emerging Infectious Diseases. It was authored by Liana M. Horner, a resident physician; Melinda D. Poulter; J. Nicholas Brenton and Turner. The 6-year-old girl seen at UVA has been doing well, Turner's case study reports. Her right arm weakness has improved and the strength in her right hand has returned.

***http://www.eurekalert.org/pub_releases/2015-07/byu-waf071615.php***

## Women and fragrances: Scents and sensitivity

***Why women buy fragrances for their boyfriend, not their best friend***

Researchers have sniffed out an unspoken rule among women when it comes to fragrances: Women don't buy perfume for other women, and they certainly don't share them.

Like boyfriends, current fragrance choices are hands off, forbidden--neither touch, nor smell. You can look, but that's all, says BYU industrial design professor and study coauthor Bryan Howell.

"Women treasure fragrances as a vital pillar of their personal identity," said Howell, who caught wind of the finding while researching fragrance-packaging preferences. "They may use the same fragrance for many years, and some women keep their fragrance choice a secret so their friends won't wear it."

For most women, the response to those findings is likely, well, duh, of course. Howell now freely admits that. Still, to have it blossom in an academic research experiment was surprising and fascinating--especially to his male colleagues, including lead author Hendrik Schifferstein of Delft University of Technology in the Netherlands.

According to the study, published in the journal Food Quality and Preference, women who do buy or share fragrances with other women choose fragrances they don't like themselves--or no longer value. Women in the study said gifting a friend with perfume might suggest they need to address a negative smell. Women prefer to avoid the possibility of negative connotations with friends and choose safer gifts instead.

"Buying perfume for another woman is like buying a swimsuit for someone else," said BYU campus news manager Emily Hellewell, who refused to reveal her perfume preference. "Swimsuits, like perfume choices, are very personal and it's not a gift you would give a friend."

BYU public relations major Ashley Lindenau also turned her nose up at the idea: "You wouldn't buy perfume you like for a friend because then they would smell like you. That's a little too creepy."

The study investigated fragrance-buying intentions of 146 women from the United States and the Netherlands. Although the researchers were primarily looking to see if consumers are more likely to buy fragrances with packages that are congruent with the product (they're not) the purchasing behavior of women towards women caught their eye.

Howell said the original statistical analysis appeared to say that women like to sabotage their best female friends when it comes scents.

"When women like a fragrances, they will purchase it for themselves or a male friend, but not for a female friend," Howell said. "When they dislike a scent, they won't purchase it for themselves or their boyfriend, but they will buy it for a female friend. It was a very strange finding so I had to go back and dig deeper."

Digging deeper included interviewing 12 female subjects to add qualitative layers to the research. Researchers, including undergraduate BYU student Drew Smith, not only learned why women don't buy perfume for other women, but they also discovered why women will buy fragrances for men.

"While women hold fragrances as personally intimate and respect other women's intimate choices, they happily want to influence what fragrances men wear," Howell said. "Assuming it is for a spouse or boyfriend, they want to pick fragrances they also like since they'll be around that person often."

Howell's research focuses on developing design methods to educate young student designers. His students, who have garnered attention for forward thinking bike helmet designs, outdoor equipment for females and many more products, work alongside him and other industrial design faculty to prepare for careers in product design.

***http://www.eurekalert.org/pub_releases/2015-07/uoo-jsf071515.php***

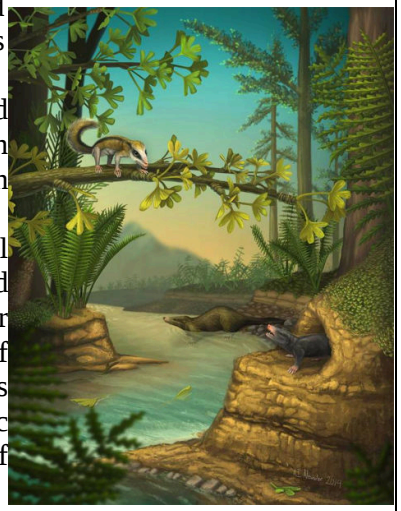
## Jurassic saw fastest mammal evolution

***Mammals were evolving up to ten times faster in the middle of the Jurassic than they were at the end of the period, coinciding with an explosion of new adaptations, new research shows.***

Early mammals lived alongside the dinosaurs during the Mesozoic era (252-66 million years ago). They were once thought to be exclusively small nocturnal insect-eaters, but fossil discoveries of the past decade - particularly from China and South America - have shown that they developed diverse adaptations for feeding and locomotion, including gliding, digging, and swimming.

To find out when and how rapidly these new body shapes emerged a team led by Oxford University researchers did the first large-scale analysis of skeletal and

dental changes in Mesozoic mammals. By calculating evolutionary rates across the entire Mesozoic, they show that mammals underwent a rapid 'burst' of evolutionary change that reached its peak around the middle of the Jurassic (200-145 million years ago).



The team comprised researchers from Oxford University in the UK and Macquarie University in Australia. A report of the research is published in Current Biology.

'What our study suggests is that mammal 'experimentation' with different body-plans and tooth types peaked in the mid-Jurassic,' said Dr Roger Close of Oxford University's Department of Earth Sciences, lead author of the report. 'This period of radical change produced characteristic body shapes that remained recognisable for tens of millions of years.'

***Research led by Oxford University scientists shows that mammals were evolving up to ten times faster in the middle of the Jurassic than they were at the end of the period. An illustration showing docodonts, now extinct mammals that saw an explosion of skeletal and dental changes (including the special molar teeth that give them their name), in the Middle Jurassic.*** **Credit: April Neander**

The team recorded the number of significant changes to body plans or teeth that occurred in mammal lineages every million years. During the mid-Jurassic the frequency of such changes increased to up to 8 changes per million years per lineage, almost ten times that seen at the end of the period. This is exemplified by therian mammals, the lineage leading to placental mammals and marsupials, which were evolving 13 times faster than average in the mid-Jurassic, but which had slowed to a rate much lower than average by the later Jurassic. This 'slow-down' occurred despite the increase in the number of mammal species seen in this later period.

'We don't know what instigated this evolutionary burst. It could be due to environmental change, or perhaps mammals had acquired a 'critical mass' of 'key innovations' - such as live birth, hot bloodedness, and fur - that enabled them to thrive in different habitats and diversify ecologically,' said Dr Close. 'Once high ecological diversity had evolved, the pace of innovation slowed.'

Multituberculates, for instance, saw radical changes to their skeletons and teeth during the mid-Jurassic. However, by the end of the period they had evolved their rodent-like body shape and distinctive teeth, a form that, despite diversifying into hundreds of different species, they would generally retain until they went extinct around 130 million years later.

'This is characteristic of other 'adaptive radiation' events of this kind, such as the famous 'Cambrian explosion',' said Dr Close. 'In the Jurassic we see a profusion of weird and wonderful bodies suddenly appear and these are then 'winnowed down' so that only the most successful survive. What we may have identified in this study is mammals' own 'Cambrian explosion' moment, when evolutionary experimentation ran wild and the future shape of mammals was up for grabs.'

***http://www.bbc.com/news/science-environment-33510288***

## Dinosaur find: Velociraptor ancestor was 'winged dragon'

***Scientists have discovered a winged dinosaur - an ancestor of the velociraptor - that they say was on the cusp of becoming a bird.***

**By Victoria Gill Science reporter, BBC News**

The 6ft 6in (2m) creature was almost perfectly preserved in limestone, thanks to a volcanic eruption that had buried it in north-east China. And the 125-million year-old fossil suggests many other dinosaurs, including velociraptors, would have looked like "big, fluffy killer birds". But it is unlikely that it could fly.


***An artist's impression of Zhenyuanlong shows how strange this feathered beast may have looked***

The dinosaur has been named Zhenyuanlong, meaning "Zhenyuan's dragon" - in honour of the man who procured the fossil for the museum in Jinzhou, allowing it

to be studied. The University of Edinburgh and the Chinese Academy of Geological Sciences collaboration is published in the journal Scientific Reports.

Lead researcher Dr Steve Brusatte said it was "the single most beautiful fossil I have had the privilege to work on". "It has short arms, and it is covered in feathers [with] proper wings with layers of quill-pen feathers," he said.

"So even though this is a dinosaur, even though it is a close relative of velociraptor, it looks exactly like a turkey or a vulture."

Dr John Nudds, a senior lecturer in palaeontology at the University of Manchester, told BBC News the find was part of an "increasingly complex picture" of emerging evidence "that certainly a lot of [dinosaurs] and possibly even all of them had feathers or at least downy hair".

Dr Brusatte said: "It will blow some people's minds to realise that those dinosaurs in the movies would have been even weirder, and I think even scarier - like big fluffy birds from hell."

He said its large body made it unlikely Zhenyuanlong would have been able to fly.

The complex feathers of the dinosaur's wings are beautifully preserved "So maybe [wings] did not evolve for flight - perhaps they evolved as a display structure, or to protect eggs in the nest," he said. "Or maybe this animal was starting to move around in the trees and was able to glide."

Dr Brusatte said: "China is the epicentre of palaeontology right now. "There are [museum] storerooms full of new dinosaur fossils that have never been studied before. He added: "This is the most exciting time maybe in the history of palaeontology."

***http://www.bbc.com/news/health-33551498***

## Obesity: 'Slim chance' of return to normal weight

***The chance of returning to a normal weight after becoming obese is only one in 210 for men and one in 124 for women over a year, research suggests.***

For severe obesity, shedding excess weight in a year is even more unlikely, a study of UK health records concluded. Researchers say current strategies for helping obese patients are failing. A team from King's College London is calling for "wider-reaching public health policies" to prevent people becoming obese in the first place.

Lead researcher Dr Alison Fildes said the main treatment options offered to obese people in the UK - weight management programmes via their GP - were not working for the vast majority. "Treatment needs to focus on stopping people gaining more weight and maintaining even small levels of weight loss," she said.

"Current strategies that focus on cutting calories and boosting physical activity aren't working for most patients to achieve weight loss and maintain that. "The greatest opportunity for fighting the obesity epidemic might be in public health policies to prevent it in the first place at a population level."

**Health records**

The research tracked the weight of 278,982 men and women between 2004 and 2014 using electronic health records. People who had had weight loss surgery were excluded.

During the study, 1,283 men and 2,245 women got back to a normal body weight.

For obese people (with a Body Mass Index of 30 to 35), the annual probability of slimming down was one in 210 for men and one in 124 for women. This increased to one in 1,290 for men and one in 677 for women with morbid obesity (BMI 40 to 45).

Dr Fildes said the figures for losing 5% of body weight were more encouraging - one in 12 men and one in 10 women managed this over a year, although most had regained the weight within five years. And more than a third of the men and women studied went though cycles of weight loss and weight gain.

Co-researcher Prof Martin Gulliford of King's College London said current strategies to tackle obesity were failing to help the majority of obese patients shed weight. "The greatest opportunity for stemming the current obesity epidemic is in wider-reaching public health policies to prevent obesity in the population," he said.

The research is published in the American Journal of Public Health.

***http://www.eurekalert.org/pub_releases/2015-07/uom-uom071715.php***

## U of M study explains why hemp and marijuana are different

***Genetic differences between hemp and marijuana determine whether Cannabis plants have the potential for psychoactivity, a new study by University of Minnesota scientists shows.***

"Given the diversity of cultivated forms of Cannabis, we wanted to identify the genes responsible for differences in drug content," says U of M plant biologist George Weiblen. While marijuana is rich in psychoactive tetrahydrocannabinol (THC), hemp produces mostly a non-euphoric cannabidiol (CBD), but the genetic basis for this difference was a matter of speculation until now. The study was published in the July 17 online edition of New Phytologist.

The discovery of a single gene distinguishing the two varieties, which according to Weiblen took more than 12 years of research, could strengthen hemp producers' argument that their products should not be subject to the same narcotics laws as hemp's cannabinoid cousin. Since 1970, all Cannabis plants have been classified as controlled substances by the federal government, but nearly half of all states, including Minnesota, now define hemp as distinct from marijuana. Efforts to revise hemp's U.S. legal status so that it could again be cultivated commercially have gained momentum in recent years.

The market for hemp seed and fiber in the U.S. surpassed $600 million last year alone. But despite the plant's surging popularity as an ingredient in food, personal care products, clothing and even construction, commercial hemp cultivation is prohibited by the federal government. Currently, all hemp products are imported to the U.S.

Research on hemp is tightly controlled by government regulations. Weiblen and his co-authors at the University of Mississippi are among few labs in the country with the federal clearance to study Cannabis.

"It's a plant of major economic importance that is very poorly understood scientifically. With this study, we have indisputable evidence for a genetic basis of differences among Cannabis varieties," says Weiblen, "further challenging the position that all Cannabis should be regulated as a drug."

*Weiblen is a professor with a joint appointment in the University of Minnesota's College of Biological Sciences and College of Food, Agricultural and Natural Resource Sciences, a resident fellow in the Institute on the Environment and serves as the Curator of Plants at the Bell Museum of Natural History.*

***http://bit.ly/1fhASR4***

## Universal plaque-busting drug could treat various brain diseases

***A virus found in sewage has spawned a unique drug that targets plaques implicated in a host of brain-crippling diseases, including Alzheimer's disease, Parkinson's disease and Creutzfeldt-Jakob disease (CJD).***

Results from tests of the drug, announced this week, show that it breaks up plaques in mice affected with Alzheimer's disease or Parkinson's disease, and improves the memories and cognitive abilities of the animals.

Other promising results in rats and monkeys mean that the drug developers, NeuroPhage Pharmaceuticals, are poised to apply for permission to start testing it in people, with trials starting perhaps as early as next year.

The drug is the first that seems to target and destroy the multiple types of plaque implicated in human brain disease. Plaques are clumps of misfolded proteins that gradually accumulate into sticky, brain-clogging gunk that kills neurons and robs people of their memories and other mental faculties. Different kinds of misfolded proteins are implicated in different brain diseases, and some can be seen within the same condition (see "Proteins gone rogue", below).

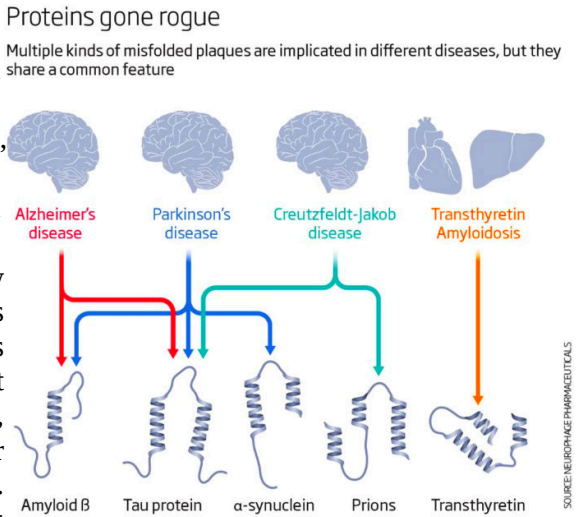
Universal plaque-busting drug could treat various brain diseases

**Structural kink**

One thing they share, however, is a structural kink known as a canonical amyloid fold, and it is this on which the new drug acts (Journal of Molecular Biology, DOI: 10.1016/j.jmb.2014.04.015).

Animal tests show that the drug reduces levels of amyloid beta plaques and tau protein deposits implicated in Alzheimer's disease, and the alpha-synuclein protein deposits thought to play a role in Parkinson's disease.

Tests on lab-made samples show that the drug also targets misfolded transthyretin, clumps of which can clog up the heart and kidney, and prion aggregates, the cause of CJD, another neurodegenerative condition. Because correctly folded proteins do not have the distinct "kink", the drug has no effect on them.




"This is a next-generation drug," says Maria Carrillo, chief science officer at the US Alzheimer's Association. "It could be stopping the root causes of these diseases and preventing them happening," she says.

**Simultaneous effect**

But there is still a long way to go. Progress treating brain diseases characterised by plaques, particularly Alzheimer's disease, has been slow and there have been many false dawns, where initially promising drugs have failed when tested in people. Because the new drug acts in a different way, there is reason to think that it could be the real deal.

For example, most drugs that have been tried against Alzheimer's so far target the individual proteins that make up the plaques, rather than the plaques themselves. The only drug that does target the plaques – aducanumab – is also the only one to show signs of halting progression of the disease. Because NeuroPhage's drug targets both types of plaque involved in Alzheimer's disease, it has the potential to perform even better, says Richard Fisher, chief scientist at NeuroPhage, who presented the latest results from mice at the annual Alzheimer's Association International Conference in Washington DC.

"This is something very novel," he says. "There's never been anything that can target all these plaques simultaneously."

**Biggest challenge**

Other researchers want to see more results. The key thing is whether reducing the plaque results in the death of fewer brain cells, says Michel Goedert of the

Medical Research Council Laboratory of Molecular Biology in Cambridge, UK. "To give patients a compound that reduces plaque by, say, 30 per cent without affecting brain degeneration is of no use."

"It's too early to conclude that the cognitive improvements in mice will have relevance for those living with dementia, but as the condition poses our biggest medical challenge, testing new approaches is vital in the hunt for better treatments," says Simon Ridley, head of research at the charity Alzheimer's Research UK.

If the drug is approved for clinical testing, Fisher and his colleagues hope to test it in people with early-stage Alzheimer's disease who have detectable amyloid-beta and tau plaques in their brains. The hope is that the drug will slow the progression of their disease. The next stage will be trials on people with Parkinson's disease and possibly other diseases that involve the build-up of plaques outside the brain.

**How the universal plaque-buster works**

A key component of the new plaque-busting drug from NeuroPhage Pharmaceuticals is a protein from a bacteriophage, a type of virus that exclusively infects bacteria. Called M13, the phage was originally isolated from sewage in Germany 50 years ago. Today it is used to screen for antibodies with medical potential. Its plaque-defeating properties were discovered by sheer chance. "It was a total surprise," says Richard Fisher, chief scientist at NeuroPhage.

The drug is made up of a viral protein that recognises the structural kink that is shared by the misfolded proteins implicated in various brain diseases. This is attached to a fragment of a human antibody. The phage protein binds to the plaques, then the antibody portion marks it for clearance from the brain, says Fisher.

***http://bit.ly/1Kq9gsY***

## There Are Four Types of Drunks, Says Science

***For the people who proudly display their Myers-Briggs results on their online bios, there's a new personality test you can take.***

**Marie Lodi**

Researchers at the University of Missouri-Columbia have categorized drinkers into four different roles, inspired by cultural icons and film characters. Right next to your Myers-Brigg "INFP" type, you can now say you're one of the following kinds of alcohol imbibers: "Ernest Hemingway," "Mr. Hyde," "Mary Poppins" or "The Nutty Professor."

If you're a Mary Poppins-type, that means you're a sweet and responsible drinker. Probably the kind who would hold a friend's hair back while they barf and not get mad if it gets on your shoes. If you're a Nutty Professor, you're the type that is more quiet and reserved when sober, but gets wild when you knock back a few whisky sours. Mr. Hyde types become hostile, and are thought to be the ones most likely to get arrested or experience blackouts, according to the Telegraph.

Those whose behavior doesn't seem to be affected much by alcohol are known as Hemingways. The researchers stated, "Two previous studies have found that, on average, these two factors reportedly decrease the most with intoxication, so the moderate decreases demonstrated by this group make its members stand out as being 'less affected' than drinkers in some of the other groups, much like the author Ernest Hemingway, who claimed that he could 'drink hells any amount of whiskey without getting drunk'. Most of the subjects fell into that category.

***http://www.eurekalert.org/pub_releases/2015-07/giot-fto071915.php***

## Finding the origins of life in a drying puddle

***Anyone who's ever noticed a water puddle drying in the sun has seen an environment that may have driven the type of chemical reactions that scientists believe were critical to the formation of life on the early Earth.***

Research reported July 15 in the journal Angewandte Chemie International Edition demonstrates that important molecules of contemporary life, known as polypeptides, can be formed simply by mixing amino and hydroxy acids - which are believed to have existed together on the early Earth - then subjecting them to cycles of wet and dry conditions. This simple process, which could have taken place in a puddle drying out in the sun and then reforming with the next rain, works because chemical bonds formed by one compound make bonds easier to form with the other.

The research supports the theory that life could have begun on dry land, perhaps even in the desert, where cycles of nighttime cooling and dew formation are followed by daytime heating and evaporation. Just 20 of these day-night, wet-dry cycles were needed to form a complex mixture of polypeptides in the lab. The process also allowed the breakdown and reassembly of the organic materials to form random sequences that could have led to the formation of the polypeptide chains that were needed for life.

"The simplicity of using hydration-dehydration cycles to drive the kind of chemistry you need for life is really appealing," said Nicholas Hud, a professor in the School of Chemistry and Biochemistry at the Georgia Institute of Technology, and director of the NSF Center for Chemical Evolution, which is also supported by the NASA Astrobiology Program. "It looks like dry land would have provided a very favorable environment for getting the chemistry necessary for life started."

Origin-of-life scientists had previously made polypeptides from amino acids by heating them well past the boiling point of water, or by driving polymerization with activating chemicals. But the high temperatures are beyond the point at which most life could survive, and the robust availability of activating chemicals

on the early Earth is questionable. The simplicity of the wet-dry cycle therefore makes it attractive to explain how peptides could have formed, Hud added.

The idea for combining chemically similar amino acids and hydroxyl acids was inspired by the demonstration that polyesters are easy to form by repetitive hydration-dehydration cycles and the fact that esters are activated to attack by the amino group of amino acids. The potential importance of this reaction in the earliest stages of life is supported by studies of meteorites, which revealed that both compounds would have been present on the prebiotic Earth.

Hydroxy acids combine to form polyester, better known as a synthetic textile fiber, and that reaction requires less energy than formation of the amide bonds needed to create peptides from amino acids. In the wet-dry cycles, formation of polyester comes first - which then facilitates the more difficult peptide formation, Hud said.

"The ester linkages that we are making in the polyester can serve as an activating agent formed within the solution," he explained. "Over the course of a very simple chemical evolution, the polymers progress from having hydroxy acids with ester linkages to amino acids with peptide linkages. The hydroxy acids are gradually replaced through the wet and dry cycles because the ester bonds holding them together are not as stable as the peptide bonds."

Experimentally, graduate student Sheng-Sheng Yu put the amino and hydroxy acid mixtures through 20 wet-dry cycles to produce molecules that are a mixture of polyesters and peptides, containing as many as 14 units. After just three cycles, and at temperatures as low as 65 degrees Celsius, peptides consisting of two and three units began to form. Postdoctoral fellow Jay Forsythe confirmed the chemical structures using NMR mass spectrometry.

"We allowed the peptide bonds to form because the ester bonds lowered the energy barrier that needed to be crossed," Hud added.

On the early Earth, those cycles could have taken 20 days and nights - or perhaps much longer if the heating and drying cycles corresponded to seasons of the year.

Beyond easily forming the polypeptides, the wet-dry process has an additional advantage. It allows compounds like peptides to be regularly broken apart and reformed, creating new structures with randomly-ordered amino acids. This ability to recycle the amino acids not only conserves organic material that may have been in short supply on the early Earth, but also provides the potential for creating more useful combinations.

A combination of hydroxy and amino acids likely existed in the prebiotic soup of the early Earth, but analyzing such a "messy" reaction was challenging, Hud said.

"We were led into this idea that a mixture might work better than separate components," he explained. "It might have been messy at the start, but it's easier to get going than a pristine chemical reaction."

Beyond helping explain how life might have started, the wet-dry cycles could also provide a new way to synthesize polypeptides. Existing techniques produce the chemicals through genetic engineering of microorganisms, or through synthetic organic chemistry. The wet-dry cycling could provide a simpler and more sustainable water-based process for producing these chemicals.

The demonstration of peptide formation opens the door to asking other questions about how life may have gotten going in prebiotic times, said Ramanarayanan Krishnamurthy, a member of the research team and an associate professor of chemistry at the Scripps Research Institute. Future studies will include a look at the sequences formed, whether there are sequences favored by the process, and what sequences might result. The process could ultimately lead to reactions able to continue without the wet-dry cycles.

"If this process were repeated many times, you could grow up a peptide that could acquire a catalytic property because it had reached a certain size and could fold in a certain way," Krishnamurthy said. "The system could begin to develop certain emergent characteristics and properties that might allow it to self-propagate."

*In addition to those already named, the paper's authors include Irena Mamajanov, Martha A Grover, and Facundo M. Fernández, all from Georgia Tech.*

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***http://www.eurekalert.org/pub_releases/2015-07/yu-yrb072015.php***

## Yale researchers beat untreatable eczema with arthritis drug

***Researchers at Yale School of Medicine have successfully treated patients with moderate to severe eczema using a rheumatoid arthritis drug recently shown to reverse two other disfiguring skin conditions, vitiligo and alopecia areata.***

New Haven, Conn. - The study is evidence of a potential new era in eczema treatment, they report. The research findings are published early online in the Journal of the American Academy of Dermatology.

Eczema (atopic dermatitis) is a chronic condition that causes severe itching and leaves the skin red and thickened. It can adversely affect sleep and quality of life. Standard treatments, such as steroid creams and oral medicines, commonly fail to relieve symptoms in patients with moderate to severe eczema.

Based on current scientific models of eczema biology, assistant professor of dermatology Brett King, M.D. hypothesized that a drug approved for rheumatoid

arthritis, tofacitinib citrate, would interrupt the immune response that causes eczema.

In the new study, King and his colleagues report that treatment with the drug led to dramatic improvement in six patients with moderate to severe eczema who had previously tried conventional therapies without success.

During treatment all six patients reported significant reduction in itch as well as improved sleep. The redness and thickening of the skin diminished, also.

"These individuals were not only very happy with the results, they also expressed a tremendous sense of relief at being comfortable in their skin for the first time in many years," King said.

King and fellow Yale dermatologist Brittany Craiglow, M.D., had previously shown that tofacitinib citrate regrows hair in patients with an autoimmune-related form of hair loss called alopecia areata. They also published findings reporting the successful treatment of a patient with vitiligo, which can leave widespread irregular white patches all over the body.

The new study suggests that a change in the standard of care for eczema -- a condition for which there is no targeted therapy -- may be on the horizon, say the researchers.

"Eczema affects millions of children and adults in the United States," said King. "I'm hopeful we are entering a whole new era in treatment."

The researchers note that further research is needed to confirm the treatment's long-term efficacy and safety for eczema patients.

*Other Yale authors include Lauren L. Levy, M.D., and Jennifer Urban, M.D.*