

<http://bbc.in/2ljGXiF>

The secret of why we like to eat chocolate

It may seem simple - we like chocolate because it tastes nice. But there's more to it than that - and it relates to a fat/carbohydrates balance that is set right from the very beginning of our lives.

By Dr Michael Mosley BBC

I love chocolate and once I start on a bar I can't stop until it's all gone. One square, or even a few, are never enough. My family know that if they bring chocolate into our house they will have to hide it.

So what is it about the food that so many of us find irresistible? And what characteristics does chocolate share with other foods that we simply can't say, "no" to? As part of a new series on the science of food, botanist James Wong and I went looking for answers.

'Lemonade and a custard apple'

Chocolate is made from cocoa beans, which have been grown and consumed in the Americas for thousands of years. The Maya and the Aztecs made a drink out of cocoa beans called xocolatl, which means "bitter water." That's because in its raw form cocoa beans are intensely bitter.

To get at the beans you first have to crack open the thick husk of the cocoa pod, releasing a pulp that has an intense tropical flavour that's halfway between lemonade and a custard apple. Known as baba de cacao, it's sweet, acidic and very sticky. The beans and pulp are then sweated and allowed to ferment for several days before being dried and roasted.

Roasting releases a range of chemical compounds including 3-methylbutanoic acid, which on its own has a sweaty rancid odour, and dimethyl trisulfide, the smell of over-cooked cabbage. The combination of these and other aroma molecules creates a unique chemical signature that our brains love.

But the rich, chocolaty smells and the happy memories of youth that those smells provoke, are just part of chocolate's attraction.

Chocolate contains a number of interesting psychoactive chemicals. These include anandamide, a neurotransmitter whose name comes from the Sanskrit - "ananda", meaning "joy, bliss, delight". Anandamides stimulate the brain in much the same way that cannabis does. It also contains tyramine and phenylethylamine, both of which have similar effects to amphetamines.

Finally, if you look hard enough, you will find small traces of theobromine and caffeine, both of which are well-known stimulants.

For a while, some food scientists got very excited about the discovery but to be honest, although chocolate contains these substances, we now know they are only there in trace amounts. Your brain is not going to get much of a chemical rush from eating a few squares. None the less, they may play a small part in seducing our senses.

Sugars plus fats

So what else does chocolate have going for it?

Well, it also has a creamy viscosity. When you take it out of its wrapper and put a bit in your mouth without biting, you will notice that it rapidly melts on your tongue, leaving a lingering sensation of smoothness. Special touch receptors on our tongues detect this textural change, which then stimulates feelings of pleasure.

But the thing that really transformed the cocoa from a bitter and watery drink into the snack we adore today was the addition of sugar and fat.

The addition of just the right amount of each is crucial to our enjoyment of chocolate. Look at the side of a packet of milk chocolate and you will see that it is normally contains around 20-25% fat and 40-50% sugar. In nature such high levels of sugar and fat are rarely found, or at least not together.

You can get lots of natural sugars from fruits and roots, and there is plenty of fat to be found in nuts or a tasty chunk of salmon, but one of the few places where you will find both together is in milk.

Human breast milk is particularly rich in natural sugars, mainly lactose. Roughly 4% of human breast milk is fat, while about 8% is

made up of sugars. Formula milk, which is fed to babies, contains a similar ratio of fats to sugars.

This ratio, 1g of fat to 2g of sugars, is the same ratio of fats to sugars that you find in milk chocolate. And in biscuits, doughnuts, ice cream. In fact this particular ratio is reflected in many of the foods that we find hard to resist.

So why do I love chocolate? For a whole host of reasons. But it may also be that I, and chocoholics like me, are trying to recapture the taste and sense of closeness we got from the first food we ever sampled; human breast milk.

The Secrets of Your Food begins on BBC2 at 2100GMT on Friday February 24th.

<http://bit.ly/2mGfZCX>

Do you look like your name? People can match names to faces of strangers with surprising accuracy

Computers can also be programmed to match names and faces, study says

WASHINGTON -- If your name is Fred, do you look like a Fred? You might -- and others might think so, too. New research published by the American Psychological Association has found that people appear to be better than chance at correctly matching people's names to their faces, and it may have something to do with cultural stereotypes we attach to names.

In the study, published in the *Journal of Personality and Social Psychology*, lead author Yonat Zwebner, a PhD candidate at The Hebrew University of Jerusalem at the time of the research, and colleagues conducted a series of experiments involving hundreds of participants in Israel and France. In each experiment, participants were shown a photograph and asked to select the given name that corresponded to the face from a list of four or five names. In every experiment, the participants were significantly better (25 to 40 percent accurate) at matching the name to the face than random chance (20 or 25 percent accurate depending on the experiment) even when ethnicity, age and other socioeconomic variables were controlled for.

The researchers theorize the effect may be, in part, due to cultural stereotypes associated with names as they found the effect to be culture-specific. In one experiment conducted with students in both France and Israel, participants were given a mix of French and Israeli faces and names. The French students were better than random chance at matching only French names and faces and Israeli students were better at matching only Hebrew names and Israeli faces.

In another experiment, the researchers trained a computer, using a learning algorithm, to match names to faces. In this experiment, which included over 94,000 facial images, the computer was also significantly more likely (54 to 64 percent accuracy) to be successful than random chance (50 percent accuracy).

This manifestation of the name in a face might be due to people subconsciously altering their appearance to conform to cultural norms and cues associated with their names, according to Zwebner.

"We are familiar with such a process from other stereotypes, like ethnicity and gender where sometimes the stereotypical expectations of others affect who we become," said Zwebner. "Prior research has shown there are cultural stereotypes attached to names, including how someone should look. For instance, people are more likely to imagine a person named Bob to have a rounder face than a person named Tim. We believe these stereotypes can, over time, affect people's facial appearance."

This was supported by findings of one experiment showing that areas of the face that can be controlled by the individual, such as hairstyle, were sufficient to produce the effect.

"Together, these findings suggest that facial appearance represents social expectations of how a person with a particular name should look. In this way, a social tag may influence one's facial appearance," said co-author Ruth Mayo, PhD, also from The Hebrew University of Jerusalem. "We are subject to social structuring from the minute we are born, not only by gender, ethnicity and socioeconomic status, but by the simple choice others make in giving us our name."

Article: "We Look Like Our Names: The Manifestation of Name Stereotypes in Facial Appearance," by Yonat Zwebner MBA, The Wharton School; Anne-Laure Sellier, PhD, HEC Paris; Jacob Goldenberg, PhD, Interdisciplinary Center and Columbia University; Nir Rosenfeld, MSc, and Ruth Mayo, PhD, The Hebrew University of Jerusalem; *Journal of Personality and Social Psychology*, published online Feb. 27, 2017.

Full text of the article is available from the APA Public Affairs Office and at <http://www.apa.org/pubs/journals/releases/psp-ppsa0000076.pdf>.

<http://bit.ly/2ljE29K>

Given the choice, patients will reach for cannabis over prescribed opioids

Chronic pain sufferers and those taking mental health meds would rather turn to cannabis instead of their prescribed opioid medication

Chronic pain sufferers and those taking mental health meds would rather turn to cannabis instead of their prescribed opioid medication, according to new research by the University of British Columbia and University of Victoria.

"This study is one of the first to track medical cannabis use under the new system of licensed producers, meaning that all participants had physician authorization to access cannabis in addition to their prescription medicines," says UBC Assoc. Prof. Zach Walsh, co-author of the study.

The study tracked more than 250 patients with prescribed medical cannabis--people treated for conditions such as chronic pain, mental health and gastrointestinal issues. Overall, 63 per cent of respondents reported using cannabis instead of their prescription drugs, which included opioids (to treat pain), benzodiazepines (sedatives) and anti-depressants.

Study lead Philippe Lucas is vice-president of Patient Research and Access at Tilray, a federally authorized medical cannabis production and research company, and a graduate fellow at the University of Victoria Centre for Addictions Research of BC. Lucas suggests the main reasons for the switch to cannabis from prescribed meds is due to reduced side effects, better symptom management and a feeling that cannabis is safer than prescription drugs.

Walsh goes on to suggest cannabis may have an important role to play in addressing the problematic use of pharmaceutical medications such as opioids.

In 2001, Canada became one of the first nations to develop a program to allow access to cannabis for medical purposes. As of August 2016 more than 30 federally authorized licensed producers of cannabis provided product to more than 65,000 patients.

"Further research into how well cannabis works compared to the accepted front-line treatments is warranted," says Walsh.

"Additionally, long-term research into the potential impact of the cannabis substitution on the quality of patient's lives is ongoing."

The study, published in *International Journal of Drug Policy*, was funded by Tilray.

<http://bit.ly/2mzT5Op>

First Solid Sign that Matter Doesn't Behave Like Antimatter

One of the biggest questions that keep physicists up at night is why there is more matter than antimatter in the universe.

By Jesse Emspak, Live Science Contributor

One of the biggest mysteries in physics is why there's matter in the universe at all. This week, a group of physicists at the world's largest atom smasher, the Large Hadron Collider, might be closer to an answer: They found that particles in the same family as the protons and neutrons that make up familiar objects behave in a slightly different way from their antimatter counterparts.

While matter and antimatter have all of the same properties, antimatter particles carry charges that are the opposite of those in matter. In a block of iron, for example, the protons are positively charged and the electrons are negatively charged. A block of antimatter iron would have negatively charged antiprotons and positively charged antielectrons (known as positrons).

If matter and antimatter come in contact, they annihilate each other and turn into photons (or occasionally, a few lightweight particles

such as neutrinos). Other than that, a piece of matter and antimatter should behave in the same way, and even look the same — a phenomenon called charge-parity (CP) symmetry.

Besides the identical behavior, CP symmetry also implies that the amount of matter and antimatter that was formed at the Big Bang, some 13.7 billion years ago, should have been equal. Clearly it was not, because if that were the case, then all the matter and antimatter in the universe would have been annihilated at the start, and even humans wouldn't be here.

But if there were a violation to this symmetry — meaning some bit of antimatter were to behave in a way that was different from its matter counterpart — perhaps that difference could explain why matter exists today.

To look for this violation, physicists at the Large Hadron Collider, a 17-mile-long (27 kilometers) ring beneath Switzerland and France, observed a particle called a lambda-b baryon.

Baryons include the class of particles that make up ordinary matter; protons and neutrons are baryons. Baryons are made of quarks, and antimatter baryons are made of antiquarks. Both quarks and antiquarks come in six "flavors": up, down, top, bottom (or beauty), strange and charm, as scientists call the different varieties. A lambda-b is made of one up, one down and one bottom quark. (A proton is made of two up and one down, while a neutron consists of two down and one up quark.)

If the lambda and its antimatter sibling show CP symmetry, then they would be expected to decay in the same way. Instead, the team found that the lambda-b and antilambda-b particles decayed differently. Lambdas decay in two ways: into a proton and two charged particles called pi mesons (or pions), or into a proton and two K mesons (or kaons).

When particles decay, they throw off their daughter particles at a certain set of angles. The matter and antimatter lambdas did that, but the angles were different.

This is not the first time matter and antimatter have behaved differently. In the 1960s, scientists studied kaons themselves, which also decayed in a way that was different from their antimatter counterparts. B mesons — which consist of a bottom quark and an up, down, strange or charm quark — have also shown similar "violating" behavior.

Mesons, though, are not quite like baryons. Mesons are pairs of quarks and antiquarks. Baryons are made of ordinary quarks only, and antibaryons are made of antiquarks only. Discrepancies between baryon and antibaryon decays had never been observed before.

"Now we have something for baryons," Marcin Kucharczyk, an associate professor at the Institute of Nuclear Physics of the Polish Academy of Sciences, which collaborated on the LHC experiment, told Live Science. "When you'd observed mesons, it was not obvious that for baryons it was the same."

While tantalizing, the results were not quite solid enough to count as a discovery. For physicists, the measure of statistical significance, which is a way of checking whether one's data could happen by chance, is 5 sigma. Sigma refers to standard deviations, and a 5 means that there is only a 1 in 3.5 million chance that the results would occur by chance.

This experiment got to 3.3 sigma — good, but not quite there yet. (That is, 3.3 sigma means that there's about a 1 in 4,200 chance that the observation would have occurred randomly, or about a 99-percent confidence level.)

The findings are not a complete answer to the mystery of why matter dominates the universe, Kucharczyk said.

"It cannot explain the asymmetry fully," he said. "In the future, we will have more statistics, and maybe for other baryons."

The findings are detailed in the Jan. 30 issue of the journal Nature Physics.

<http://bit.ly/2l7PxGn>

Here's How Much Less Sleep Women Get Once They Have Kids

For moms with kids at home, it's not in your head: You are getting less sleep than your husband.

By Sara G. Miller, Staff Writer | February 27, 2017 10:20am ET

A new study finds that less than half of women who have children in the house get enough sleep, while men report that their sleep isn't affected by having kids in the house.

In the study, researcher Kelly Sullivan, an assistant professor of epidemiology at Georgia Southern University, wanted to understand the factors that affect adults' sleep. [5 Surprising Sleep Discoveries]

"It's important to learn what is keeping people from getting the rest they need so we can help them work toward better health," Sullivan said in a statement. "Getting enough sleep is a key component of overall health and can impact the heart, mind and weight," she said.

Sullivan analyzed data on sleep from the 2012 Behavioral Risk Factor Surveillance System, an annual telephone survey conducted across the country. Nearly 3,000 men and 3,000 women were included in the analysis.

The people in the survey reported how much sleep they got, on average, each night. Between seven and nine hours a night was considered an optimum amount of sleep, and less than six hours a night was considered insufficient, according to the study. In addition, the people reported how many days in the previous month they felt unrested.

The researchers compared people's reports of their sleep with a number of factors known to affect sleep, including the number of children in the house, people's exercise levels and whether they also reported snoring.

For women ages 45 and under, the only factor that affected their sleep was having children in the house, Sullivan found. Each kid increased a woman's risk of getting insufficient sleep by 46 percent, she found.

In addition, 48 percent of women in this age group with kids reported getting at least seven hours of sleep a night on average, compared with 62 percent of women of the same age who did not have kids in the house.

For men ages 45 and under, however, kids had no effect on the amount of sleep they got each night, according to the study. Rather, education seemed to make a difference. Men who had less than a high school education were more likely to report insufficient sleep than men who had graduated from college. In addition, men who reported snoring were less likely to get enough sleep, Sullivan found.

Having kids in the house also affected the number of days in the past month that women reported feeling unrested, but kids' presence in the house had no effect on this number among the men, the study found.

A previous study, published in 2016, found that more women than men reported having difficulty falling asleep and more difficulty staying asleep.

The study abstract was published on Feb. 26 by the American Academy of Neurology. The full findings will be presented at the American Academy of Neurology's annual meeting in Boston in April.

<http://bit.ly/2mKIa3T>

Autism risk genes linked to evolving brain

Genetic variants linked to autism spectrum disorders (ASD) may have been positively selected during human evolution because they also contribute to enhanced cognition, a new Yale study suggests.

A genome-wide association study of ASD of more than 5,000 cases and an analysis of evolutionary gene selection showed that inherited variants linked to ASD were found under positive selection in larger numbers than would have been expected by chance.

The final version of the paper was published Feb. 27 in the journal PLOS Genetics.

Variants that have a large negative impact on reproductive success are generally eliminated from the population quickly. However, common variants that occur with high frequency but small effect can

cumulatively have big impacts on complex inherited traits -- both positive and negative. If variants provide a better chance of survival, they are positively selected, or tend to stay in the genome through generations.

"In this case, we found a strong positive signal that, along with autism spectrum disorder, these variants are also associated with intellectual achievement," said Renato Polimanti, associate research scientist at Yale School of Medicine and VA Connecticut Health Center in West Haven, and first author of the paper.

For instance, many of the positively selected variants associated with ASD identified by the researchers were enriched for molecular functions related to creation of new neurons.

"It might be difficult to imagine why the large number of gene variants that together give rise to traits like ASD are retained in human populations -- why aren't they just eliminated by evolution?" said Joel Gelernter, the Foundations Fund Professor of Psychiatry, professor of genetics and of neuroscience, and co-author. "The idea is that during evolution these variants that have positive effects on cognitive function were selected, but at a cost -- in this case an increased risk of autism spectrum disorders."

The work was funded by National Institutes of Health grants and a NARSAD Young Investigator Award from the Brain & Behavior Research Foundation.

<http://bit.ly/2mt1JBz>

Inactivity, excess weight linked to hard-to-treat heart failures

Lack of exercise and excessive weight are strongly associated with a type of heart failure that has a particularly poor prognosis

DALLAS - Lack of exercise and excessive weight are strongly associated with a type of heart failure that has a particularly poor prognosis, UT Southwestern Medical Center researchers determined in an analysis of data from three large studies.

Heart failure is a chronic condition in which the heart is unable to supply enough oxygenated blood to meet the demands of the body.

Heart failure is approximately equally divided between two subtypes: heart failure with preserved ejection fraction (HFpEF) and heart failure with reduced ejection fraction (HFrEF). Ejection fraction refers to the percentage of the blood that exits the heart with each contraction.

"Previous studies have consistently found an association between low levels of physical activity, high BMI, and overall risk of heart failure, but this study shows that the association is more pronounced for heart failure with preserved ejection fraction, the type of heart failure that is the most challenging to treat," said preventive cardiologist Dr. Jarett Berry, Associate Professor of Internal Medicine at UT Southwestern, and the study's senior author.

The study appears in the *Journal of the American College of Cardiology*.

In heart failure with preserved ejection fraction, the heart stiffens. Instead of being soft, it's rigid and it resists expansion. Cardiologists often explain the difference between the two types of heart failure by saying that in heart failure with preserved ejection fraction, the heart doesn't relax enough, while in heart failure with reduced ejection fraction the heart doesn't squeeze enough. Many treatments have been developed for treating the latter but there are no evidence-based treatments for the former.

"The five-year survival rate among heart failure with preserved ejection fraction patients is around 30 to 40 percent. While heart failure with reduced ejection fraction survival has improved significantly over the years, heart failure with preserved ejection fraction prognosis is little changed," said Dr. Ambarish Pandey, a cardiology fellow in Internal Medicine at UT Southwestern Medical Center and first author of the study.

The pooled analysis looked at data from 51,000 participants in three cohort studies, the Women's Health Initiative, the Multiethnic Study of Atherosclerosis (MESA), and the Cardiovascular Health Study. Among the 51,000 participants, there were 3,180 individuals who

developed heart failure. Of these, 39 percent were heart failure with preserved ejection fraction, 29 percent were heart failure with reduced ejection fraction, and 32 percent had not been classified when the data was gathered.

The incidence of heart failure with preserved ejection fraction was 19 percent lower for individuals who exercised at recommended levels. Similarly, body mass index (BMI) had an inverse relationship with heart failure with preserved ejection fraction.

Higher BMI levels were more strongly associated with heart failure with preserved ejection fraction than with heart failure with reduced ejection fraction.

Heart failure with preserved ejection fraction is a growing problem as the population ages, and is particularly a problem among elderly women.

Medications such as ACE inhibitors, beta blockers, and aldosterone antagonists have been shown in large-scale randomized trials to reduce mortality in patients with heart failure with reduced ejection fraction. Clinical trials have not identified medications that reduce mortality in patients with heart failure with preserved ejection fraction. Heart transplant is the ultimate option for some patients with heart failure with reduced ejection fraction but is not an option for patients with heart failure with preserved ejection fraction, all of which means that prevention is crucial for heart failure with preserved ejection fraction.

"These findings highlight the importance of lifestyle interventions such as increasing physical activity levels and reducing weight to combat the growing burden of this disease," said Dr. Berry, Dedman Family Scholar in Clinical Care.

Other UT Southwestern researchers who contributed to this study are Colby Ayers, faculty associate, and Dr. James de Lemos, Professor of Internal Medicine and holder of the Sweetheart Ball?Kern Wildenthal, M.D., Ph.D. Distinguished Chair in Cardiology.

Funding for this study was provided by the American Heart Association.

<http://bit.ly/2lyIUc1>

Dogs, toddlers show similarities in social intelligence

Most dog owners will tell you they consider their beloved pets to be members of their families. Now new research suggests that dogs may be even more like us than previously thought.

Evan MacLean, director of the Arizona Canine Cognition Center at the University of Arizona, found that dogs and 2-year-old children show similar patterns in social intelligence, much more so than human children and one of their closest relatives: chimpanzees. The findings, published in the journal *Animal Behaviour* (link to come), could help scientists better understand how humans evolved socially.

MacLean and his colleagues looked at how 2-year-olds, dogs and chimpanzees performed on comparable batteries of tests designed to measure various types of cognition. While chimps performed well on tests involving their physical environment and spatial reasoning, they did not do as well when it came to tests of cooperative communication skills, such as the ability to follow a pointing finger or human gaze.

Dogs and children similarly outperformed chimps on cooperative communication tasks, and researchers observed similar patterns of variation in performance between individual dogs and between individual children.

A growing body of research in the last decade has looked at what makes human psychology special, and scientists have said that the basic social communication skills that begin to develop around 9 months are what first seem to set humans apart from other species, said MacLean, assistant professor in the School of Anthropology in the UA College of Social and Behavioral Sciences.

"There's been a lot of research showing that you don't really find those same social skills in chimpanzees, but you do find them in dogs, so that suggested something superficially similar between dogs and kids," MacLean said. "The bigger, deeper question we wanted to explore is if that really is a superficial similarity or if there is a distinct kind of social intelligence that we see in both species."

"What we found is that there's this pattern, where dogs who are good at one of these social things tend to be good at lots of the related social things, and that's the same thing you find in kids, but you don't find it in chimpanzees," he said.

One explanation for the similarities between dogs and humans is that the two species may have evolved under similar pressures that favored "survival of the friendliest," with benefits and rewards for more cooperative social behavior.

"Our working hypothesis is that dogs and humans probably evolved some of these skills as a result of similar evolutionary processes, so probably some things that happened in human evolution were very similar to processes that happened in dog domestication," MacLean said. "So, potentially, by studying dogs and domestication we can learn something about human evolution."

The research could even have the potential to help researchers better understand human disabilities, such as autism, that may involve deficits in social skills, MacLean said.

Looking to dogs for help in understanding human evolution is a relatively new idea, since scientists most often turn to close human relatives such as chimpanzees, bonobos and gorillas for answers to evolutionary questions. Yet, it seems man's best friend may offer an important, if limited, piece of the puzzle.

"There are different kinds of intelligence, and the kind of intelligence that we think is very important to humans is social in nature, and that's the kind of intelligence that dogs have to an incredible extent," MacLean said. "But there are other aspects of cognition, like the way we reason about physical problems, where dogs are totally dissimilar to us. So we would never make the argument that dogs in general are a better model for the human mind -- it's really just this special set of social skills."

MacLean and his collaborators studied 552 dogs, including pet dogs, assistance-dogs-in-training and military explosive detection dogs, representing a variety of different breeds. The researchers assessed

social cognition through game-based tests, in which they hid treats and toys and then communicated the hiding places through nonverbal cues such as pointing or looking in a certain direction. They compared the dogs' results to data on 105 2-year-old children who previously completed a similar cognitive test battery and 106 chimpanzees assessed at wildlife sanctuaries in Africa.

<http://bit.ly/21ZM4H5>

Nasal Swab Shows Promise in Confirming Lung Cancers
Lung cancer remains by far the leading cancer killer because it is so often caught too late.

But researchers now say it may someday be possible to quickly confirm the disease after a CT scan, by using a simple nasal swab. The key is DNA-based "biomarkers" in the nasal passages that appear to reveal whether a lung lesion is cancerous or not.

"Nasal gene expression [production] contains information about the presence of cancer," explained study co-author Marc Lenburg. He believes the nasal swab "might aid in lung cancer detection."

The researchers said the test might help doctors spare some patients expensive and risky follow-up procedures. Lenburg is professor of medicine at Boston University and made his comments in a university news release. He and his colleagues published their findings Feb. 27 in the Journal of the National Cancer Institute.

As the researchers explained, physicians now rely on chest scans to look for lesions that might signal lung cancer in long-term smokers or other high-risk patients. If a scan shows an aberration, follow-up procedures such as invasive lung biopsies may then be ordered.

So, "there is a clear and growing need to develop additional diagnostic approaches for evaluating pulmonary [lung] lesions to determine which patients should undergo CT surveillance or invasive biopsy," study co-author Dr. Avrum Spira explained in the news release. He's a professor of medicine, pathology and bioinformatics at the university. The new study involved patients -- current or former smokers -- enrolled at 28 medical centers in North America and Europe. The

Boston researchers took nasal swabs from the patients, and identified a pattern of 30 genes that were active in a different way in people confirmed to have lung cancer from those who were not.

Two experts in lung cancer care said the technique does have promise. "Genomic markers have come to the forefront as a determinant for diagnosing cancer," said Dr. Len Horovitz, a pulmonary specialist at Lenox Hill Hospital in New York City.

"This test may help avoid unnecessary procedures in the diagnosis of lung cancer," he said. "This is certainly easier than [more invasive tests such as] a bronchial swab or bronchoscopy and may be as helpful at suggesting the presence or absence of lung cancer."

Dr. Nagashree Seetharamu is an oncologist at the Northwell Health Cancer Institute in Lake Success, N.Y. She stressed that this was "a well-conducted, prospective trial -- patients were enrolled before they were diagnosed with cancer."

But Seetharamu said it's unclear how widespread the test might become. "While this study could potentially help improve diagnostic accuracy, I do not think that this could replace diagnostic biopsies or invasive procedures," she said. That's because the value of the test may vary depending on where the lesion is observed via CT scan in the lungs and airways. Both Lenburg and Spira disclosed receiving fees from medical companies and Spira has related patents.

<http://bit.ly/2mwT6WJ>

Cells adapt ultra-rapidly to zero gravity

Mammalian cells are optimally adapted to gravity. But what happens in the microgravity environment of space if the earth's pull disappears?

Previously, many experiments exhibited cell changes – after hours or even days in zero gravity. Astronauts, however, returned to Earth without any severe health problems after long missions in space, which begs the question as to how capable cells are of adapting to changes in gravity. Based on real-time readings on the ISS, UZH scientists can now reveal that cells are able to respond to changes in

gravitational conditions extremely quickly and keep on functioning. Therefore, the study also provides direct evidence that certain cell functions are linked to gravity.

Test setup and measurement on the ISS

In contrast to space experiments, where analyses are conducted afterwards on Earth, the team headed by UZH scientists Oliver Ullrich and Cora Thiel opted for a different path. They geared their experimental design towards conducting direct measurements in space: From thawing the test cells to the measurements themselves, ESA astronaut Samantha Cristoforetti performed all the operations directly in the lab on the ISS. The data gathered on the space station was then transmitted to Earth. Rigorous internal and external controls excluded any influence other than gravity.

Cell adaptation in 42 seconds

The research team used the so-called oxidative burst – an old evolutionary mechanism to kill off bacteria via defense cells – to study how rat cells responded to changes in gravity. With the aid of centrifuges, Cristoforetti altered the gravitational conditions on the ISS, which enabled the team in the control center to track how the cells reacted. "Ultra-rapidly," explains Oliver Ullrich, a professor from the Institute of Anatomy at the University of Zurich. "Although the immune defense collapsed as soon as zero gravity hit, to our surprise the defense cells made a full recovery within 42 seconds." For Ullrich and Thiel, the direct evidence of a rapid and complete adaptation to zero gravity in less than a minute begs the question as to whether previous cell changes measured after hours or days were also the result of an adaptation process.

"It seems paradoxical," says Thiel: "Cells are able to adapt ultra-rapidly to zero gravity. However, they were never exposed to it in the evolution of life on Earth. Therefore, the results raise more questions regarding the robustness of life and its astonishing adaptability." In any case, as far as Ullrich is concerned the result of the ISS experiment is good news for manned space flight: "There's hope that

our cells are able to cope much better with zero gravity than we previously thought."

More information: Cora S. Thiel et al. Rapid adaptation to microgravity in mammalian macrophage cells, *Scientific Reports* (2017). DOI: 10.1038/s41598-017-00119-6

<http://bit.ly/2mdEZ7D>

Did seaweed make us who we are today?

Millions of years ago something happened, allowing early Homo sapiens to branch out from the primitive hominoid family tree. Was this crucial turn in human evolution partly driven by seaweed and its particular content of essential nutrients?

Over the past 2.5 - 2 million years human brains have gone through the most significant development, and as a result modern-day humans are left with an organ that is the source of all the qualities that define humanity. Our ancestors needed lots of energy-rich foods just to get by, and for this impressive, significant brain development they also needed certain essential nutrients.

Without nutrients like magnesium and zinc modern brains cannot function, and according to a number of scientific studies it is likely that the access to certain essential nutrients influenced the evolution of the human brain so that it could become the brain we have today.

From primitive ancestor to modern human

- Nutrients needed for this transition from a primitive ancestor to modern *Homo sapiens* were (and still are) available in seaweeds. Seaweeds could be found and harvested in abundance on shores, and for a foraging lifestyle, a rich coastal environment would be a significant source of a consistent supply of these nutrients, says Professor Ole G. Mouritsen, University of Southern Denmark.

Professor Mouritsen is an expert in molecular biophysics and author of several books about food science.

He is co-author of a newly published review in *Journal of Applied Phycology* on research highlighting the potential impact of the consumption of a variety of seaweeds (so-called large marine algae, or macroalgae) in human brain health, including benefits to early *Homo*

sapiens. Other contributors to the review are Melania Lynn Cornish and Alan T. Critchley, Acadian Seaplants, Canada.

Foraging in coastal areas

In their article the authors note that the human lineage is estimated to have diverged from our closest living relatives, the chimpanzees, around 5-7 million years ago.

- However, the changing patterns of resource distribution associated with the extensive drying and expansion of the African savannahs between 2.5 and 2 million years ago have been the impetus for a shift in foraging behavior among early members of the genus *Homo*. Foraging over longer distances for food would have contributed to bipedalism and a different body stature as increasingly larger ranges had to be traversed, and in the case of our primitive ancestors, this would undoubtedly lead to significant changes in diet, the authors write. Coastal areas may very well have attracted early hominoids in search of food.

Just as healthy for us

- Our ancestors would find foods like fish, crustaceans, snails, seaweeds, bird eggs and perhaps occasional dead marine vertebrates. But they probably did not have the necessary rudimentary understanding of seasonal tidal cycles and their influence on shellfish availability. Seaweeds of different types, on the other hand, can be found all across the intertidal zone from the high water mark to the subtidal regions and they could be readily and repeatedly harvested for food by all family members, including women and children, the authors state.

The nutrients in seaweed not only benefitted our ancestors.

- Seaweed is just as healthy and nutritious for humans today as it was millions of years ago, says Professor Ole G. Mouritsen.

Essential nutrients for brain development:

Taurine. Can be found in red algae, marine fish, shellfish and meat of mammals. Is present in large amounts in the central nervous system

and in the retina. The highest concentrations occur in the developing brain. Levels in adults are app. 1/3 of those of newborns.

Magnesium. Can be found in legumes, pumpkin and squash seeds, nuts and macroalgae. It plays an important role in neuroprotection and cognition. Important for the ability to store new information in neural networks.

Zinc. Can be found in many foods but is particularly plentiful in various cuts of meat, especially liver. Extremely abundant in oysters. Crustaceans and most seaweeds are also robust sources. Plays an important role in learning, development and memory.

Vitamin B12. Is found exclusively in animal products such as meat, eggs, fish and milk - with one exception: it is also confirmed in *Pyropia* species of seaweeds and it is quite likely in others that have yet to be adequately analyzed. B12 is important for blood flow in the brain and cognitive functions like language.

Iodine. Found abundantly in seaweed, especially in brown seaweeds. A necessary element for the synthesis of thyroid hormones, which are essential for central nervous system development.

Poly-unsaturated fatty-acids (PUFAs). The original sources of PUFAs are not, as often thought, fish and shellfish, but micro- and macroalgae like seaweed.

Ref: Consumption of seaweeds and the human brain. Journal of Applied Phycology · January 2017, DOI: 10.1007/s10811-016-1049-3.

<http://bit.ly/2m03oeI>

As radiation therapy declined so did second cancers in childhood cancer survivors

Childhood cancer survivors are living longer. Now research shows they are also less likely to develop second cancers while still young.

The decline followed a sharp drop in the use of radiation therapy for treatment of childhood cancers.

Between the 1970s and the 1990s, the percentage of pediatric cancer patients treated with radiation fell from 77 to 33 percent. The average

radiation dose also dropped. Their chance of having second cancers within 15 years of the first fell as well.

The study included 23,603 five-year survivors from the Childhood Cancer Survivor Study. The survivors were treated at 27 medical centers in the U.S. and Canada. The federally funded study is based at St. Jude. Gregory Armstrong, MD, of the St. Jude Department of Epidemiology and Cancer Control, heads the study.

"The most ominous late effect of pediatric cancer treatment is a second malignancy," he said. "This study shows efforts to reduce the late effects of treatment are paying off. "The risk of second cancers for survivors increases with age, so it is good to see the reduction emerging early in survivorship while survivors are still young."

The research is published online in the February 28 edition of the *Journal of the American Medical Association*.

<http://bit.ly/2mRKYfw>

Study finds no evidence of common herpes type virus in aggressive brain cancer tissue

'Negative' findings question earlier reports of a link between CMV and brain cancers

In a rigorous study of tumor tissue collected from 125 patients with aggressive brain cancers, researchers at Johns Hopkins say they have found no evidence of cytomegalovirus (CMV) infection and conclude that a link between the two diseases, as claimed by earlier reports, likely does not exist.

The Johns Hopkins team cautioned that studies to confirm this finding are needed to absolutely rule out any role for the common CMV in glioblastoma and other cancers that arise in neurological support cells called glial cells. But they say their study substantially weakens the likelihood of that role.

"We have found no evidence of CMV in these tissues, and if there is no virus, targeting that virus to affect cancer using antiviral drugs or tailored vaccines doesn't make biological sense," says Angelo M. De Marzo, M.D., Ph.D., professor of pathology, oncology and urology at

the Johns Hopkins Kimmel Cancer Center. A report on the research was published Dec. 29, 2016 in Clinical Cancer Research.

As early as 2002, the Johns Hopkins team says, several studies reported that tumor cells isolated within glioblastomas and other gliomas were infected with CMV, a herpes virus that infects more than half of all adults by age 40 and is related to viruses that cause chickenpox and mononucleosis.

Because other viruses are associated with some cancers, notably HPV, which causes most cervical and some head and neck cancers; and Epstein-Barr virus, which causes some lymphomas, those earlier findings generated excitement about the potential for antiviral therapies to improve the usually poor outlook for people with gliomas. However, explains Matthias Holdhoff, M.D., Ph.D., associate professor of oncology and neurosurgery at the Johns Hopkins Kimmel Cancer Center, other laboratories found no evidence of the virus in these types of tumors. "Significant resources have already gone into this field of study," he says, "making it very important to definitively answer the question of whether there's an association between CMV and gliomas or not."

To investigate, Holdhoff and De Marzo, along with Ravit Arav-Boger, M.D., associate professor of pediatrics and oncology at the Johns Hopkins University School of Medicine, and their colleagues used several techniques to test tumor and other tissues from 99 men and women and 26 children with glioblastoma and other high-grade gliomas preserved and stored in different ways. Some of the tissues were stored as fresh frozen tissue, and some in paraffin wax blocks of tissue first soaked in a preservative known as formalin (formalin-fixed/paraffin embedded or FFPE), using either standard pathology slides or a tissue microarray (a collection of several small samples placed in the same paraffin wax block).

What they called an "exhaustive" study design was crafted to determine presence of CMV in different ways, says De Marzo.

The researchers ran these samples through different analytical techniques to look for CMV. Fresh frozen and FFPE samples underwent real-time PCR (a technique used to amplify copies of CMV's viral DNA) or chromogenic in situ hybridization, a technique that looks for the presence of specific nucleic acids that make up DNA. The FFPE samples and those in a tissue microarray underwent immunohistochemistry, a process that looks for certain CMV-derived proteins. Using one or more of these techniques on all of the samples from the 125 patients, the researchers found no evidence of CMV in any of them.

Additionally, the researchers took blood samples from 18 recently diagnosed patients before they received standard radiation to treat their cancer and periodically after their treatment. The scientists tested the portion of blood called plasma of these patients using real-time PCR and their serum using a method known as the IgG avidity index, which looks for antibodies to a virus and can indicate the presence of a latent or previous infection.

Eight of 15 patients, for which blood serum was available, had signs of CMV in their serum, similar to rates in the general population. None had signs of the virus in their tumors, including those who tested positive for the virus in their serum, report the researchers.

The scientists say that more research using large numbers of tumor tissues from patients throughout the world, coordinated by independent laboratories with no stake in the presence of CMV in gliomas, will be necessary before CMV can definitely be ruled out as a player in these cancers.

There are several types of high-grade gliomas, including glioblastoma, the most common, which is a type of astrocytoma and the most common among primary brain cancers in adults. The American Brain Tumor Association predicts that more than 12,000 cases of glioblastoma will be diagnosed in the U.S. in 2017. Median survival for this disease is 14.6 months with the current standard of care, which includes radiation and chemotherapy.

Other Johns Hopkins researchers who participated in this study include Gunes Guner, Fausto J. Rodriguez, Jessica Hicks, Qizhi Zheng, Michael S. Forman, Xiaobu Ye, Stuart A. Grossman, Alan K. Meeker, Christopher M. Heaphy and Charles G. Eberhart.

This research was funded by the National Institutes of Health's National Cancer Institute (P30CA006973), Wendy Jachman, the Robert H. Gross Memorial Fund and the Retired Professional Fire Fighters Cancer Fund Inc.

<http://bit.ly/2mMsHkM>

Strong evidence supports the association between obesity and some major types of cancer

Associations for other cancers could be genuine, but substantial uncertainty remains

Strong evidence supports the association between obesity and some major types of cancer, consisting mainly of those related to digestive organs and hormone-related malignancies, reveals a large review published by The BMJ today.

There could be associations between obesity and other cancers, but substantial uncertainty remains because the quality of evidence is not strong, say the international team of researchers, led by Maria Kyrgiou and Kostas Tsilidis from Imperial College London.

They call for more research because "evidence of the strength of the associations between obesity and cancer may allow finer selection of people at high risk, who could be selected for personalised primary and secondary prevention strategies."

Cancer is a leading cause of death worldwide, and the prevalence of obesity has more than doubled over the past 40 years.

Previously published evidence supports the association between obesity and some cancers, but some may be flawed or biased due to weak study design and conduct.

Therefore, in a bid to determine the quality of evidence and the strength of these associations, the researchers conducted a comprehensive review of studies on obesity and risk of developing cancer.

After a literature search, they identified 204 studies from 49 publications that analysed the obesity measurements, such as body

mass index (BMI), weight gain, and waist circumference, and 36 cancers and their subtypes.

Of the 95 studies that included continuous obesity measures, only 13% of associations were supported by strong evidence, meaning the studies had statistically significant results and no suggestion of bias.

Strong associations were found in studies that examined BMI with risk of oesophageal, bone marrow, and colon (in men), rectal (in men), biliary tract system, pancreatic, endometrial (in premenopausal women), and kidney cancers.

Risk of developing cancer for every 5 kg increase in BMI ranged from 9% for colorectal cancer among men, to 56% for biliary tract system cancer.

Risk of postmenopausal breast cancer among women who never used hormone replacement therapy increased by 11% for each 5 kg of weight gain. Risk of endometrial cancer increased by 21% for each 0.1 increase in waist to hip ratio.

Five additional associations were supported by strong evidence when categorical measures of obesity were used. These included weight gain with risk of colorectal cancer and BMI with risk of gallbladder, gastric cardia, and ovarian cancers, and mortality from multiple myeloma.

Other studies were evaluated to have highly suggestive (18%), suggestive (25%), and weak (20%) evidence, and 25% had no evidence of an association.

This analysis involved an umbrella review of studies that used observational data, which is useful for bringing together evidence. However, no firm conclusions can be drawn about cause and effect when analysing observational studies.

In a linked editorial, Yikyung Park and Graham Colditz from Washington University School of Medicine explain that "though some specifics remain to be worked out, the unavoidable conclusion from these data is that preventing excess adult weight gain can reduce the risk of cancer."

"Given the critical role of health care providers in obesity screening and prevention, clinicians, particularly primary care clinicians, can be a powerful force to lower the burden of obesity related cancers as along with the many other chronic diseases linked to obesity such as diabetes, heart disease, and stroke," they conclude.

Research: Adiposity and cancer at major anatomical sites: umbrella review of the literature

<http://www.bmj.com/cgi/doi/10.1136/bmj.j477>

Editorial: Fresh evidence links adiposity with multiple cancers

<http://www.bmj.com/cgi/doi/10.1136/bmj.j908>

<http://bit.ly/2m16Wze>

Frogs have unique ability to see color in the dark

The night vision of frogs and toads appears to be superior to that of all other animals.

They have the ability to see colour even when it is so dark that humans are not able to see anything at all. This has been shown in a new study by researchers from Lund University in Sweden.

Most vertebrates, including humans, have two types of visual cells located in the retina, namely cones and rods. The cones enable us to see colour, but they usually require a lot of light and therefore stop working when it gets dark, in which case the rods take over so that we can at least find our way home, albeit in black and white.

In toads and frogs the rods are a bit special, however. It was previously known that toads and frogs are unique in having rods with two different sensitivities. This has not been found in other vertebrates, and it is also the reason why researchers have long suspected that frogs and toads might be able to see colour also in low-light conditions. The new study was first in proving this to be true, and the results exceeded all expectations.

"It's amazing that these animals can actually see colour in extreme darkness, down to the absolute threshold of the visual system. These results were unexpected", says Professor of Sensory Biology Almut Kelber at the Faculty of Science, Lund University.

It was during the third of three experiments that the researchers discovered that frogs are able to use their rods to distinguish colour in

extreme darkness. The researchers studied the frogs in a situation that is as serious as it is common, namely, when frogs need to find their way out in case they are trapped in conditions of complete darkness. This is potentially an everyday occurrence, taking place in dark dens and passageways on the ground. In such instances, finding the exit becomes crucial, which also means that the frog is inclined to make use of any sensory information that is available.

In the other experiments the researchers studied to what extent frogs and toads use their colour vision when searching for a mate or hunting for food. The results showed that the animals stop using their colour information fairly early when it comes to finding someone with whom to mate, whereas they continue to take advantage of their colour vision to select food in such low-light conditions that humans lose their ability to see colour.

"We have previously shown moths and geckos are also able to see colour in inferior light conditions compared to humans. However, frogs apparently have a unique ability to see colour in the dark", says Almut Kelber.

The study was conducted in collaboration with researchers from the University of Helsinki in Finland and Vladivostok in Russia. The main author, Carola Yovanovich, has been in charge of the work on the study in Almut Kelber's research group at Lund University. The findings are published in the journal Philosophical Transactions of the Royal Society B.

<http://bit.ly/2lA8zjU>

Study finds colorectal cancer rates have risen dramatically in Gen X and millennials

Three in 10 rectal cancer diagnoses now in patients under 55

ATLANTA - A new study finds that compared to people born around 1950, when colorectal cancer risk was lowest, those born in 1990 have double the risk of colon cancer and quadruple the risk of rectal cancer. The study is led by American Cancer Society scientists and appears in the Journal of the National Cancer Institute. It finds colorectal cancer (CRC) incidence rates are rising in young and middle-aged adults, including people in their early 50s, with rectal cancer rates increasing

particularly fast. As a result, three in ten rectal cancer diagnoses are now in patients younger than age 55.

Overall, CRC incidence rates have been declining in the United States since the mid-1980s, with steeper drops in the most recent decade driven by screening. Recently though, studies have reported increasing CRC incidence in adults under 50, for whom screening is not recommended for those at average risk. However, these studies did not examine incidence rates by 5-year age group or year of birth, so the scope of the increasing trend had not been fully assessed.

To get a better understanding, investigators led by Rebecca Siegel, MPH of the American Cancer Society used "age-period-cohort modeling," a quantitative tool designed to disentangle factors that influence all ages, such as changes in medical practice, from factors that vary by generation, typically due to changes in behavior. They conducted a retrospective study of all patients 20 years and older diagnosed with invasive CRC from 1974 through 2013 in the nine oldest Surveillance, Epidemiology, and End Results (SEER) program registries. There were 490,305 cases included in the analysis.

The study found that after decreasing since 1974, colon cancer incidence rates increased by 1% to 2% per year from the mid-1980s through 2013 in adults ages 20 to 39. In adults 40 to 54, rates increased by 0.5% to 1% per year from the mid-1990s through 2013.

Rectal cancer incidence rates have been increasing even longer and faster than colon cancer, rising about 3% per year from 1974 to 2013 in adults ages 20 to 29 and from 1980 to 2013 in adults ages 30 to 39. In adults ages 40 to 54, rectal cancer rates increased by 2% per year from the 1990s to 2013. In contrast, rectal cancer rates in adults age 55 and older have generally been declining for at least 40 years, well before widespread screening.

Opposing trends in young versus older adults over two decades have closed a previously wide gap in disease risk for people in their early 50s compared to those in their late 50s. Both colon and rectal cancer incidence rates in adults ages 50 to 54 were half those in adults ages

55 to 59 in the early 1990s, but in 2012 to 2013, they were just 12.4% lower for colon and were equal for rectal cancer.

"Trends in young people are a bellwether for the future disease burden," said Siegel. "Our finding that colorectal cancer risk for millennials has escalated back to the level of those born in the late 1800s is very sobering. Educational campaigns are needed to alert clinicians and the general public about this increase to help reduce delays in diagnosis, which are so prevalent in young people, but also to encourage healthier eating and more active lifestyles to try to reverse this trend."

In addition, the authors suggest that the age to initiate screening people at average risk may need to be reconsidered. They point out that in 2013, 10,400 new cases of CRC were diagnosed in people in their 40s, with an additional 12,800 cases diagnosed in people in their early 50s. "These numbers are similar to the total number of cervical cancers diagnosed, for which we recommend screening for the 95 million women ages 21 to 65 years," said Siegel.

Article: Colorectal cancer incidence patterns in the United States, 1974-2013; J Natl Cancer Inst (2017) 109(8): DOI: 10.1093/jnci/djw322

<http://bit.ly/2m1VX6R>

Early warning signs might have been missed in 1 in 6 heart attack deaths in England

More research is urgently needed to establish whether it is possible to predict the risk of fatal heart attacks in patients

The authors, from Imperial College London, say more research is urgently needed to establish whether it is possible to predict the risk of fatal heart attacks in patients for whom this condition was not recorded as the main reason for hospital admission.

The research is published today in *The Lancet Public Health*. Heart disease is one of the leading killers in the UK. According to the British Heart Foundation, heart attacks lead to one hospital visit every three minutes.

They are caused by a decrease in blood flow to the heart, usually as a result of coronary heart disease. Symptoms may include sudden chest pain or a 'crushing' sensation that might spread down either arm. Patients might also experience nausea or shortness of breath. However, some heart attacks have more subtle symptoms and may therefore be missed or overlooked.

In this study, the researchers examined records of all 446,744 NHS hospital stays in England between 2006 and 2010 that recorded heart attacks, as well as the hospitalisation history of all 135,950 heart attack deaths.

The records included whether or not patients who died of a heart attack had been admitted to hospital in the past four weeks and if so, whether signs of heart attack were recorded as the main cause of admission (primary diagnosis), additional to the main reason (secondary diagnosis), or not recorded at all.

Of the 135,950 patients who died from heart attack, around half died without a hospital admission in the prior four weeks, and around half died within four weeks of having been in hospital.

21,677 (16 per cent, or one in six) of the patients who died from heart attack had been hospitalised during the four weeks prior, but heart attack symptoms were not mentioned on their hospital records (see figure 2 of paper.)

The authors say there are certain symptoms, such as fainting, shortness of breath and chest pain, that were apparent up to a month before death in some of these patients, but doctors may not have been alert to the possibility that these signalled an upcoming fatal heart attack, possibly because there was no obvious damage to the heart at the time.

These results suggest that possible signs of upcoming fatal heart attack may have been missed. The authors' next step is to look into why this pattern emerged, and to try to prevent more heart attack deaths.

The researchers also found that of all patients admitted with a heart attack, those whose heart attack was recorded as secondary to the

main condition were two to three times more likely to die than patients whose records stated heart attack as the main condition.

Lead author Dr Perviz Asaria, from the School of Public Health at Imperial, said: "Doctors are very good at treating heart attacks when they are the main cause of admission, but we don't do very well treating secondary heart attacks or at picking up subtle signs which might point to a heart attack death in the near future."

"Unfortunately in the four weeks following a hospital stay, nearly as many heart attack deaths occur in people for whom heart attack is not recorded as a primary cause, as occur after an admission for heart attack."

The authors say that more detailed investigation must be done to identify reasons for these results so that more deaths from heart attack can be prevented.

Co-author Professor Majid Ezzati, from the School of Public Health at Imperial, said: "We cannot yet say why these signs are being missed, which is why more detailed research must be conducted to make recommendations for change. This might include updated guidance for healthcare professionals, changes in clinical culture, or allowing doctors more time to examine patients and look at their previous records."

"What we are now asking is, if symptoms are being missed where they could have been discovered using the available information, how should care now be organised and what changes need to be made to prevent unnecessary deaths."

Co-author Professor Paul Elliott from Imperial's School of Public Health added: "In addition to these findings for people who entered hospital but for whom a diagnosis of heart attack was not made, heart attack deaths are still occurring in large numbers among people who never reach hospital. This highlights the need for continued emphasis on prevention as well as better diagnosis and treatment."

This study was funded by Wellcome Trust, Medical Research Council, Public Health England, and National Institute for Health Research.

<http://bit.ly/2m27pzy>

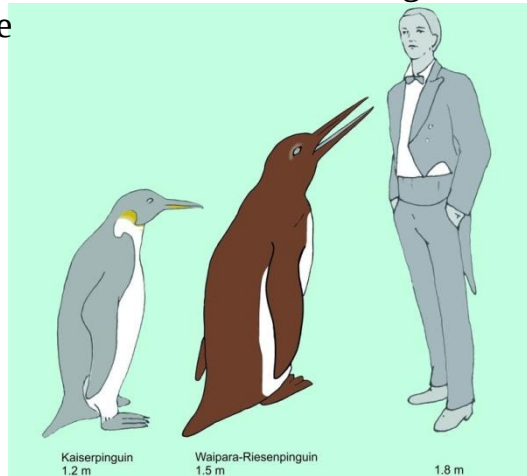
Giant Prehistoric Penguins Evolved During the Dinosaur Age

Penguins that walked the Earth 61 million years ago might have been giants, growing to nearly 5 feet tall, according to the oldest penguin fossils unearthed to date.

By Charles Q. Choi, Live Science Contributor

Perhaps even more impressive, these oversize waddlers might have evolved alongside dinosaurs, the researchers report in a new study.

Penguins are flightless, but they can swim at speeds of up to 22 mph (35 km/h). The biggest living penguin, the [emperor penguin](#), can grow to be about 3.9 feet (1.2 meters) tall, but previously unearthed fossils revealed that [extinct penguins](#) could get as large as 5.4 feet (1.65 m) tall.



The Waipara giant penguin compared to an emperor penguin (the largest living penguin species) and a human. Credit: copyright Senckenberg Nature Research

Although [penguins](#) are flightless, their anatomy suggests that [their ancestors could fly](#), just as other modern birds can. For example, some wing bones in living penguins are fused together in the same way as those in flying birds, said study co-author Paul Scofield, a paleontologist at the Canterbury Museum in Christchurch, New Zealand.

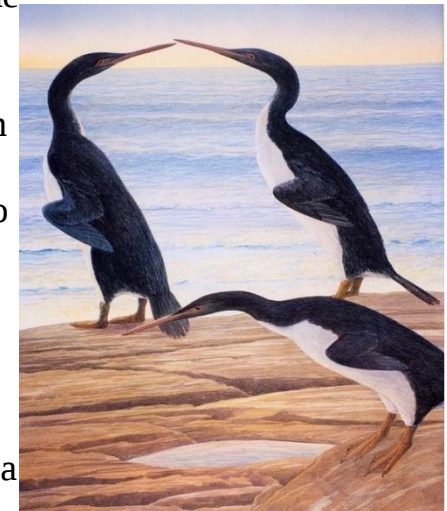
In addition, modern penguins have air sacs in their bodies just as flying birds do, although in flying birds, these air sacs help reduce weight for flight, whereas in penguins, they help the birds control their buoyancy, Scofield told Live Science.

Ancient penguin bones "are among the oldest fossils of modern birds known from anywhere in the world," said study lead author Gerald Mayr, an ornithologist at the Senckenberg Research Institute and Natural History Museum Frankfurt in Germany. As such, investigating penguin fossils can help address "ongoing debates on when exactly modern birds appeared," Mayr told Live Science.

The researchers analyzed fossils of leg bones excavated along the Waipara River in New Zealand's Canterbury region. Previous research unearthed many avian fossils there, which got embedded in marine sand about 4 million years after the end of the dinosaur age about 65 million years ago.

"The fossil was found by an amateur collector named Leigh Love," Mayr said, adding that Love has been collecting fossils there for several years and has already made some significant findings.

The scientists discovered that these penguin leg bones were about 61 million years old. They belonged to a bird the same age as the oldest known penguin to date, *Waimanu manneringi*, Mayr said. Moreover, the newfound penguin reached a size of about 4.9 feet (1.5 m) — nearly as large as the biggest known extinct penguin, *Anthropornis nordenskjoldi*, which lived in Antarctica about 45 million to 33 million years ago.



Artistic illustration of the Waimanu penguin on the beach. Until now, only the remains of this very original penguin had been found at the New Zealand site.

Credit: copyright Chris Gaskin/Geology Museum University of Otago

These findings reveal that "penguins reached a giant size very early in their evolution," Mayr said. He added that giant penguins were likely driven extinct by the emergence of marine mammals such as seals and toothed whales.

These newfound 61-million-year-old bones differ significantly from other penguin fossils of the same age. For instance, this new penguin likely had the upright, waddling gait typical of modern penguins, whereas *Waimanu manneringi* had a more stooped gait.

The new findings suggest that, for ancient penguins to evolve the level of diversity now seen in their body plans, the ancestors of all penguins would have originated millions of years beforehand, likely during the dinosaur age, the researchers said. This contradicts some previous suggestions that penguins diverged from other birds only 62 million years ago.

The newfound penguin is currently unnamed. "We need slightly more material before we can give the species a name," Scofield said. "Hopefully, in the next few years, we'll find more fossils."

Mayr, Scofield and their colleague Vanesa De Pietri of the Canterbury Museum detailed their findings online Feb. 23 in the journal [The Science of Nature](#).

<http://bit.ly/2ml45lK>

Tiptoeing termites bang their heads to mimic ant footsteps

It pays to tread lightly. Termites have evolved super-soft footsteps and sharp hearing to evade their noisy enemies.

By Alice Klein

Ants are major predators of termites, but they often fail to notice that hungry termites are foraging for food just millimetres away.

This is because termites can tiptoe around, says Sebastian Oberst at the University of Technology Sydney in Australia. His team has shown that termite footsteps are up to 100 times quieter than those of ants.

Termites are blind, but their hearing is finely tuned to detect the stomping of ant feet, says Oberst. This allows them to keep track of their enemy's location and dodge them if they get too close.

To test this ability, the researchers placed termites in boxes with multiple chambers separated by wood partitions. The termites

burrowed through the partitions into adjacent chambers if they were empty or contained dead ants. But they avoided chambers that contained live ants as well as empty chambers that were playing audio recordings of ant footsteps.

In addition, the termites reinforced the wooden partitions with clay if they could hear ants pacing around in the adjacent chamber.

The findings suggest that termites detect ants via footstep vibrations rather than chemical signals, because ant pheromones cannot penetrate through the wooden partitions. "Pheromones don't travel as far as vibrations, so it makes sense for termites to detect vibrations," says Nathan Lo at the University of Sydney, Australia, who was not involved in the study.

Raising the alarm

The researchers also found that termites seem to imitate the sound of ant footsteps when they are under threat. They bang their heads or shake their bodies to produce similar vibration patterns. "We think this alarm signal has evolved to mimic the walking signal of ants," says Oberst.

Termite footsteps are not all the same, either. *Macrognathotermes sunteri*, for example, has the softest footfall – so soft that can go undetected by other termites and is known to steal food.

Oberst is now hoping to use the findings to improve pest control. One possibility is to play the sound of ant footsteps to flush termites out, he says.

Lo agrees that the idea is feasible. "You might be able to rig up a vibration system to the structural timber inside a house," he says. "If you could then mimic the vibrations of an ant species that is known to eat the offending termites, you might be able to deter them."

This would remove the need for toxic chemicals, but the effect may be short-lived, says Lo: "I have the feeling they might wise up to it fairly quickly. Termites are pretty clever when they're hungry."

Journal reference: Ecology Letters, DOI: 10.1111/ele.12727

<http://bbc.in/2m110GV>

Facebook artificial intelligence spots suicidal users

Facebook has begun using artificial intelligence to identify members that may be at risk of killing themselves.

By Leo Kelion Technology desk editor

The social network has developed algorithms that spot warning signs in users' posts and the comments their friends leave in response.

After confirmation by Facebook's human review team, the company contacts those thought to be at risk of self-harm to suggest ways they can seek help.

A suicide helpline chief said the move was "not just helpful but critical". The tool is being tested only in the US at present.

It marks the first use of AI technology to review messages on the network since founder Mark Zuckerberg [announced last month](#) that he also hoped to use algorithms to identify posts by terrorists, among other concerning content.

Facebook also announced new ways to tackle suicidal behaviour on its Facebook Live broadcast tool and has partnered with several US mental health organisations to let vulnerable users contact them via its Messenger platform.

Pattern recognition

Facebook has offered advice to users thought to be at risk of suicide for years, but until now it had relied on other users to bring the matter to its attention by clicking on a post's report button.

It has now developed pattern-recognition algorithms to recognise if someone is struggling, by training them with examples of the posts that have previously been flagged.

Talk of sadness and pain, for example, would be one signal.

Responses from friends with phrases such as "Are you OK?" or "I'm worried about you," would be another. Once a post has been identified, it is sent for rapid review to the network's community operations team.

"We know that speed is critical when things are urgent," Facebook product manager Vanessa Callison-Burch told the BBC.

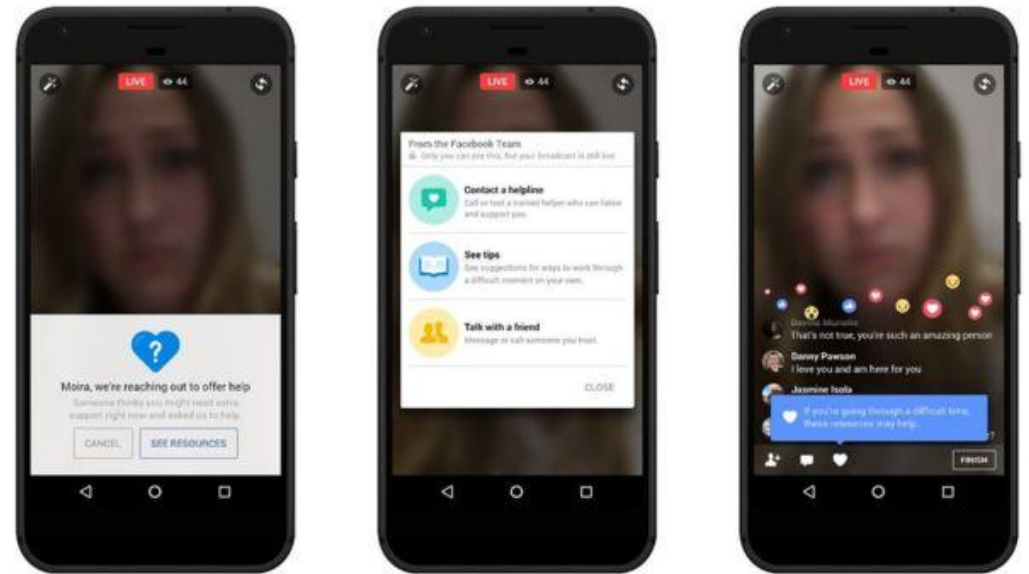
The director of the US National Suicide Prevention Lifeline praised the effort, but said he hoped Facebook would eventually do more than give advice, by also contacting those that could help.

"It's something that we have been discussing with Facebook," said Dr John Draper. "The more we can mobilise the support network of an individual in distress to help them, the more likely they are to get help.

"The question is how we can do that in a way that doesn't feel invasive. "I would say though that what they are now offering is a huge step forward."

Ms Callison-Burch acknowledged that contact from friends or family was typically more effective than a message from Facebook, but added that it would not always be appropriate for it to inform them.

"We're sensitive to privacy and I think we don't always know the personal dynamics between people and their friends in that way, so we're trying to do something that offers support and options," she said.

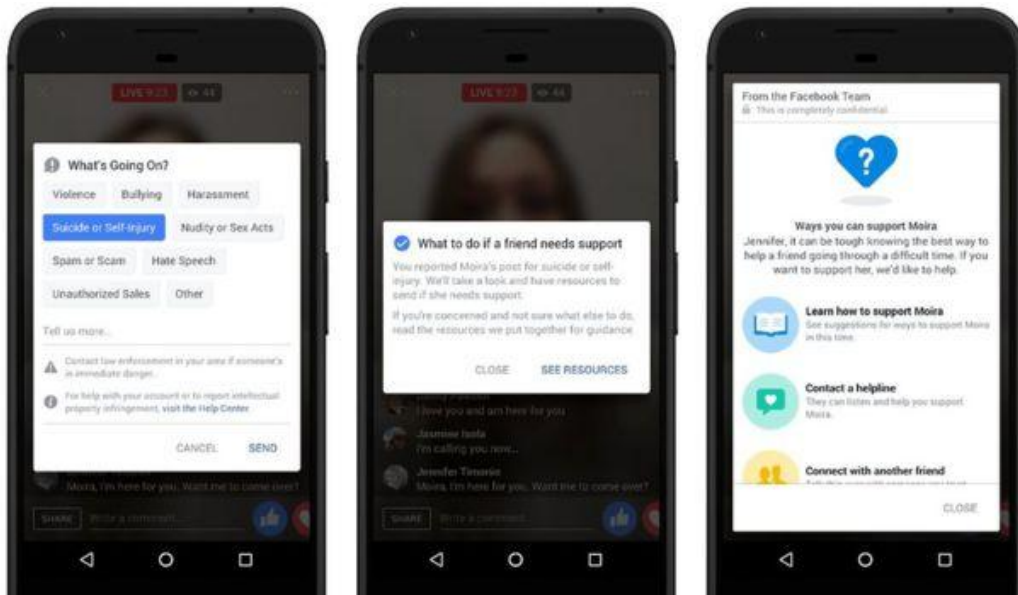


Facebook Live users who discuss killing themselves will be given advice but will not have their stream interrupted Facebook

The latest effort to help Facebook Live users follows the death of a 14-year-old-girl in Miami, who livestreamed her suicide on the platform in January.

However, the company said it had already begun work on its new tools before the tragedy. The goal is to help at-risk users while they are broadcasting, rather than wait until their completed video has been reviewed some time later.

Now, when someone watching the stream clicks a menu option to declare they are concerned, Facebook displays advice to the viewer about ways they can support the broadcaster. The stream is also flagged for immediate review by Facebook's own team, who then overlay a message with their own suggestions if appropriate.



Users watching a Facebook Live stream will be advised how to help a user they are concerned about Facebook

"Some might say we should cut off the stream of the video the moment there is a hint of somebody talking about suicide," said Jennifer Guadagno, Facebook's lead researcher on the project.

"But what the experts emphasised was that cutting off the stream too early would remove the opportunity for people to reach out and offer

support. "So, this opens up the ability for friends and family to reach out to a person in distress at the time they may really need it the most." The new system is being rolled out worldwide.

A new option to contact a choice of crisis counsellor helplines via Facebook's Messenger tool, however, is limited to the US for now.

Facebook said it needed to check whether other organisations would be able to cope with demand before it expanded the facility.

"Their ongoing and future efforts give me great hope for saving more lives globally from the tragedy of suicide," said Dr Dan Reiden executive director of Save.org, which is involved in the initiative.

"The opportunity for prevention, even with Facebook Live, is better now than ever before."

<http://bit.ly/2mhLruz>

Groundbreaking technology successfully rewarms large-scale tissues preserved at low temperatures

Discovery is major step forward in increased availability of organs and tissues for transplantation

A research team, led by the University of Minnesota, has discovered a groundbreaking process to successfully rewarm large-scale animal heart valves and blood vessels preserved at very low temperatures. The discovery is a major step forward in saving millions of human lives by increasing the availability of organs and tissues for transplantation through the establishment of tissue and organ banks.

The research was published today in *Science Translational Medicine*, a peer-reviewed research journal published by the American Association for the Advancement of Sciences (AAAS). The University of Minnesota holds two patents related to this discovery.

"This is the first time that anyone has been able to scale up to a larger biological system and demonstrate successful, fast, and uniform warming of hundreds of degrees Celsius per minute of preserved tissue without damaging the tissue," said University of Minnesota mechanical engineering and biomedical engineering professor John Bischof, the senior author of the study.

Bischof said in the past, researchers were only able to show success at about 1 milliliter of tissue and solution. This study scales up to 50 milliliters, which means there is a strong possibility they could scale up to even larger systems, like organs.

Currently, more than 60 percent of the hearts and lungs donated for transplantation must be discarded each year because these tissues cannot be kept on ice for longer than four hours. According to recent estimates, if only half of unused organs were successfully transplanted, transplant waiting lists could be eliminated within two years.

Long-term preservation methods, like vitrification, that cool biological samples to an ice-free glassy state using very low temperatures between -160 and -196 degrees Celsius have been around for decades. However, the biggest problem has been with the rewarming. Tissues often suffer major damage during the rewarming process making them unusable, especially at larger scales.

In this new study, the researchers addressed this rewarming problem by developing a revolutionary new method using silica-coated iron oxide nanoparticles dispersed throughout a cryoprotectant solution that included the tissue. The iron oxide nanoparticles act as tiny heaters around the tissue when they are activated using noninvasive electromagnetic waves to rapidly and uniformly warm tissue at rates of 100 to 200 degrees Celsius per minute, 10 to 100 times faster than previous methods.

After rewarming and testing for viability, the results showed that none of the tissues displayed signs of harm, unlike control samples rewarmed slowly over ice or those using convection heating. The researchers were also able to successfully wash away the iron oxide nanoparticles from the sample following the warming.

Bischof said the discovery is the result of his team's research in many different fields to preserve or destroy cells and tissue at either ultra high temperatures or ultra low temperatures.

"We've gone to the limits of what we can do at very high temperatures and very low temperatures in these different areas," Bischof said.

"Usually when you go to the limits, you end up finding out something new and interesting. These results are very exciting and could have a huge societal benefit if we could someday bank organs for transplant." Although scaling up the system to accommodate entire organs will require further optimization, the authors are optimistic. They plan to start with rodent organs (such as rat and rabbit) and then scale up to pig organs and then, hopefully, human organs. The technology might also be applied beyond cryogenics, including delivering lethal pulses of heat to cancer cells.

The research was funded by the National Science Foundation (NSF), National Institutes of Health (NIH), U.S. Army Medical Research and Materiel Command, Minnesota Futures Grant from the University of Minnesota, and the University of Minnesota Carl and Janet Kuhrmeyer Chair in Mechanical Engineering.

In addition to Bischof, the study authors from the University of Minnesota include postdoctoral researchers Navid Manuchehrabadi, Zhe Gao, Jin Jin Zhang, Hattie Ring, and Qi Shao; graduate student Feng Liu; undergraduate student Michael McDermott; Dentistry Professor Alex Fok; Radiology Professor Michael Garwood; Chemistry Professor Christy Haynes. Other team members include Mechanical Engineering Professor Yoed Rabin at Carnegie Mellon University and Bioengineering Professor Kelvin Brockbank at Clemson University and Tissue Testing Technologies LLC.

To read the complete study entitled "[Nanowarming for Regenerative Medicine: Improving Tissue Cryopreservation by Inductive Heating of Magnetic Nanoparticles](#)," visit the [Science Translational Medicine website](#).

<http://bit.ly/2mT9Tzm>

Magic cover crop carpet?

Cover crop prevents weeds, protects soil

Organic farmers have to make hard choices between protecting soil from erosion and controlling weeds. For example, large-scale organic farming relies heavily on tillage. Tilling breaks up the soil to kill weeds and prepare for planting. But intense tillage can compact soil, cause erosion, and deplete nutrients. As a result, some organic farmers are turning to cover crops for weed control.

Cover crops are planted after harvest as an in-between crop. Cover crops improve the soil with living roots that protect it from erosion and add nutrients. Cover crops are usually plowed down, but another option is flattening the cover crop to form a thick carpet, or mat. They

do this with a roller crimper--a heavy, rolling drum attached to a tractor.

The farmer then uses a no-till planter to plant seeds into the flattened mat for the next season. The new crop grows through the cover crop residue, which helps suppress weeds.

This method--called cover crop-based organic rotational no-till--allows farmers to skip spring tillage and weeding. By simply flattening a cover crop, farmers don't have to disturb the soil for a new crop. The flattened cover crop suppresses weeds and retains soil moisture.

However, like many farming practices, this method has trade-offs. For example, if you flatten it too late, the cover crop might produce seeds. The result is a volunteer, or weedy, cover crop competing with next season's cash crop. And if you flatten the cover crop too early, it may regrow. It's all in the timing, says crop scientist Clair Keene. Keene is a researcher at The Pennsylvania State University.

Keene and her colleagues wanted to find that perfect timing. So they planted an experiment in three different states: Delaware, Maryland, and Pennsylvania. For three years, they planted cover crops like hairy vetch-triticale and cereal rye, followed by cash crops like corn and soybeans.

The researchers flattened the cover crops at different stages of growth to find the right combination. Was it possible to have a cover crop that was big enough to suppress weeds, but not too big that it produced seeds?

They found that generally, letting the cover crop grow longer produces the best, if not perfect, results. "There's always trade-offs," said Keene. "A bigger cover crop is better at suppressing weeds as a mulch, but that comes with the cost of letting that crop grow longer, restricting the growing season for the corn or soybean."

Farmers want to plant their cash crop as early as possible, especially in northern states. If the cover crop is too small to be flattened, then they have to till it under, which defeats the purpose of improving soil

quality. But if a cover crop reigns in a field for too long, it might start to produce seeds.

Every cover crop is a little different. For instance, the group found that cereal rye needs to be rolled in the middle of grain fill so that it doesn't produce seed and show up when it isn't wanted. And although hairy vetch is great at adding nitrogen to the soil, it can survive the roller crimper and compete with cash crops.

The researchers also found rolling the cover crops twice instead of once helped ensure the cover crops were killed.

Despite the tricky timing, Keene says rolling cover crops to form a mat has a lot of potential. Without it, "you'd have to plow the field multiple times, harrow it, plant it, and do a lot of weeding," she warns. "That's a lot of time in the tractor and a lot of diesel fuel."

[Read the full results of their experiment in Agronomy Journal.](#) Funding for the reduced-tillage organic systems experiment was provided by USDA Organic Research and Extension Initiative.

<http://bit.ly/2m3bbZr>

Desk jobs are bad for your heart and your waist
Study finds link between sedentary work, larger waist circumference & risk of heart disease. People with no risk factors for heart disease walk at least seven miles per day or spend seven hours per day upright.

A new study shows further evidence for the view that spending too much time sitting down is bad for our health and our waistline.

Research led by Dr William Tigbe, Warwick Medical School, University of Warwick found workers who have a desk-bound job have bigger waists and increased risk of heart disease. It supports advice to sit less and be more active; as much as seven hours a day on your feet, and walking seven miles, may be needed to avoid heart disease.

Dr Tigbe kitted out 111 healthy Glaswegian postal workers with activity monitors for seven days; 55 were office workers and 56 delivered post for a living. The study revealed differences between the two groups. Those who had desk jobs had a bigger waist

circumference -- 97 cm compared to 94 cm -- and approximately one BMI unit difference. They also had a higher risk of cardiovascular disease -- 2.2% compared to 1.6% over ten years.

The new study suggests that waist circumference increases by two centimetres, and risk of cardiovascular diseases by 0.2%, for every additional hour of sitting on top of five hours.

Furthermore, bad cholesterol (LDL) increases and good cholesterol (HDL) decreases with each additional hour of sitting from five hours a day.

Dr Tigbe said: "Longer time spent in sedentary posture is significantly associated with larger waist circumference, higher triglycerides (fat in the blood) and lower HDL cholesterol, all adding up to worse risk of heart disease. The levels associated with zero risk factors were walking more than 15,000 steps per day, which is equivalent to walking seven to eight miles, or spending seven hours per day upright.

"Our findings could be used as the basis of new public health targets for sitting, lying, standing and stepping to avoid metabolic risks.

"However the levels suggested in our research would be very challenging to achieve unless incorporated into people's occupations."

The study participants wore a tiny physical activity and position monitor called activPAL, invented by co-authors from Glasgow Caledonian University, strapped to their thigh for seven days, except during activities that risk it being in contact with water, e.g. bathing or swimming. They also had their weight, height and blood pressure measured, and provided blood samples. Cardiovascular risks were assessed using the PROCAM risk calculator which takes into account age, sex, family history, blood pressure and metabolic measures.

The study took place between took place between September 2006 and September 2007 and volunteers were recruited from the Royal Mail in Glasgow. Only apparently healthy, non-smokers, with no personal history of myocardial infarction (heart attack), stroke, coronary heart disease, hypertension or diabetes were included. None

of the participants was on any lipid, blood pressure or glucose lowering medication.

Fellow researcher Professor Mike Lean of the University of Glasgow's School of Medicine said: "In this research we have learned important information, relevant to health in modern working lives, by studying the activity patterns of postal workers, one of the last physically active occupations left in UK."

"Our evolution, to become the human species, did not equip us well to spending all day sitting down. We probably adapted to be healthiest spending seven to eight hours every day on our feet, as hunters or gatherers. "

"Our new research supports that idea. The 'bottom' line is that if you want to be sure of having no risks of heart disease, you must keep off your bottom!"

The researchers urge further study of this topic is conducted in order to inform health policy makers. Time spent in sedentary posture is associated with waist circumference and cardiovascular risk is recently been published in the International Journal of Obesity. The research was part of Dr Tigbe's PhD project.

Notes to Editors

Time spent in sedentary posture is associated with waist circumference and cardiovascular risk has been published in the International Journal of Obesity doi:10.1038/ijo.2017.30.

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Funding

This research was funded by Glasgow Caledonian University as part of Dr Tigbe's PhD project. Professor Malcolm Granat is a director of PAL Technologies Ltd, (this research is not intended to promote the activPAL monitor or the company). Professor Naveed Sattar's research is supported by the British Heart Foundation and Diabetes UK. Professor Mike Lean's research is supported by Diabetes UK and by Counterweight Ltd.

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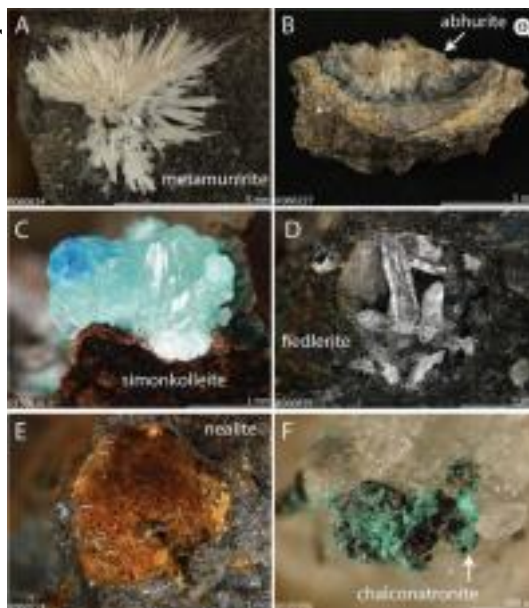
Rock solid evidence of Anthropocene seen in 208 minerals we made

The evidence of humans changing the planet is solid as rock.

By Chelsea Whyte

A new catalogue of minerals counts 208 that result solely or primarily from human activity, says Robert Hazen of the Carnegie Institution for Science in the US, who led the study. Accounting for almost 4 per cent of the 5200 minerals formally recognised by the International Mineralogical Association, the contribution humans have made is significant.

Most minerals came about 2 billion years ago during the Great Oxidation, when free oxygen produced by photosynthetic bacteria appeared in Earth's atmosphere. At that time, minerals spiked from just over 2000 varieties to more than 4000.



Anthropogenic minerals from the RRUFF collection (Downs 2006). (a) Tan-colored divergent radial spray of bladed crystals of metamunirite (NaV_5O_3), Big Gypsum Valley, San Miguel County, Colorado. (b) Aggregate of tan-colored platy crystals of abhurite Embedded Image from the wreck of the SS Cheerful, 14 miles NNW of St. Ives, Cornwall, England. (c) Colorless hexagonal tabular crystals of simonkolleite [$\text{Zn}_5(\text{OH})_8\text{Cl}_2 \cdot \text{H}_2\text{O}$] associated with blue platy crystals of composition $\text{CuZnCl}(\text{OH})_3$ on a copper mining artifact, Rowley mine, Maricopa County, Arizona. (d) Colorless prismatic crystals of fiedlerite [$\text{Pb}_3\text{Cl}_4\text{F}(\text{OH}) \cdot \text{H}_2\text{O}$] associated with phosgenite, polytype 1A, from a Lavrion slag locality, Greece. (e) Reddish brown acicular crystals of nealite [$\text{Pb}_4\text{Fe}(\text{AsO}_3)_2\text{Cl}_4 \cdot 2\text{H}_2\text{O}$] coating a vug, from an Oxygen slag locality, Lavrion, Greece. (f) Blue fine-grained crust of chalconatronite [$\text{Na}_2\text{Cu}(\text{CO}_3)_2 \cdot 3\text{H}_2\text{O}$], Mont Saint-Hilaire, Quebec, Canada.

“After that, it really was a kind of plateau,” says Jan Zalasiewicz at the University of Leicester. “The next big jump is what humans have been doing, and particularly in the recent decades.”

Most minerals are a result of life-led processes. Life created abundant atmospheric oxygen that allowed for oxidation and the formation of a swathe of metal-rich minerals, such as iron oxides. And hard-bodied marine organisms, for example, created thick deposits of carbonate minerals, such as aragonite, when they died and settled on the seabed. But the pace at which humans have added new minerals over the past few hundred years is quicker than the pace at which mineral diversity increased during the last jump thousands of years ago.

Animal, vegetable, mineral

Humans have created minerals in several ways. For example, by manufacturing synthetic mineral-like compounds, such as silicon chips used for semiconductors, or bricks, porcelain and metal alloys. New minerals may also be forming in places such as solid waste dumps where old batteries, electronics, appliances and other high-tech discards are exposed to weathering.

“There are probably all sorts of things forming as a result of old silicon chips or batteries,” Hazen says. “TVs have all these exotic phosphors they use, and magnets and all sorts of high-tech materials. When you start hydrating and oxidising them, you’re going to start finding a lot of exotic new materials.”

Mine shafts are another place where human influence can lead to new minerals. Excavations expose rock that may never have seen the light of day, subjecting it to humidity and heat.

It’s not just that these new minerals exist, but how they are distributed and how they will persist. Our activity has led to large scale movement of rocks, sediments, and minerals, thanks to mining, transport and infrastructure, as well as global redistribution of highly valued natural minerals such as diamonds and gold. And there are substances in things like cement and bricks that are rare in nature but are now widespread across the globe.

“These are mineral-like and they will form a marker layer for all geologic time,” Hazen says.

Unnatural neighbours

Identifying these minerals bolsters the scientific argument to officially designate a new geological time interval distinguished by the impact of human activities: the Anthropocene Epoch.

“The evidence of these crystalline compounds that never existed before is one line of support for calling the Anthropocene a new geologic time period,” says Hazen. Millions of years in the future, what will the mineral record look like from this period?

Think of large gem collections in museums. Those mineral samples wouldn’t occur naturally in close proximity, but they are likely to get buried together and cemented in the record as neighbors.

Picture also places like Arlington National Cemetery in Virginia. That ordered array of headstones isn’t likely to occur naturally, without human influence. The mineral record will reveal not only our technological processes, but also our culture.

Zalasiewicz says that whether or not the Anthropocene is formally recognised, this catalogue of minerals is a characterisation of human influence on the planet.

“There’s little that’s more fundamental than the minerals that rocks and fossils are made of,” he says. “Being able to demonstrate that there indeed has been this large step in mineral diversity helps us understand what the Anthropocene is as a phenomenon.”

Journal reference: American Mineralogy, DOI: 10.2138/am-2017-5875

<http://nyti.ms/2m5Nhg2>

China’s Bird Flu Surge Is a Low Epidemic Threat, W.H.O. Says

Flu specialists from around the world met in Geneva this week to assess the global influenza situation.

By DONALD G. McNEIL Jr.

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Although there has been a surge in human infections with H7N9 avian flu in China this winter, the risk of an epidemic remains low, a World Health Organization official said on Wednesday.

But the virus — which has killed about a third of the people known to have caught it — has now split into two distinct strains.

That will probably force development of a second small stockpile of emergency vaccine to be rolled out if the virus becomes more transmissible and threatens to turn into a pandemic, a scientist at the Centers for Disease Control and Prevention said.

Flu specialists from around the world gathered in Geneva this week to assess the global influenza situation and discuss with vaccine companies which viral strains should be in next winter’s flu shots.

China has had 460 lab-confirmed human cases of H7N9 bird flu this winter, said Dr. Wenqing Zhang, head of the W.H.O.’s global influenza program. That is the most in any flu season since the first human case was found in 2013.

The new strain kills more birds, which may make China’s poultry industry more willing to shut live bird markets and do more to protect poultry farms from infection. Almost all cases have been caught directly from birds. A few cases have been passed from a victim to a family member or caregiver, but there is no evidence of “sustained human-to-human transmission,” Dr. Zhang said.

Viruses designated H1, H2 or H3, along with a separate B lineage, have caused virtually all seasonal flu cases in humans. H5N1, a strain that sparked widespread fear of bird flu in 2003, still occasionally kills a few people each year, and another, H5N8, is widely circulating in poultry in Europe and the Middle East. But no H5 or H7 strain has ever been transmitted easily among humans.

New cases of H7N9 are declining, so this winter’s outbreak appears to have peaked, said Yuelong Shu, an influenza expert at China’s Center for Disease Control and Prevention.

About 7 percent of the cases were resistant to drugs like Tamiflu. But that percentage, Dr. Shu added, has not increased substantially since

2013, and almost all resistant cases were in people who had already been treated with antivirals. Resistance probably arose individually in each patient, making it less likely that a drug-resistant strain is circulating in birds, he said.

As a precaution, American scientists have been making an H7N9 seed vaccine from which an emergency stockpile could be brewed if the virus became both lethal and highly transmissible, said Jacqueline Katz, deputy director of the C.D.C.'s flu division.

Now that the virus has split into two strains, the agency is discussing making a second seed vaccine, Dr. Katz said.

<http://bit.ly/2IHYDVI>

Gene therapy 'cures' boy of blood disease that affects millions

So far, gene therapy has only treated rare disorders. Now, for the first time, it has been used to treat a boy with sickle cell disease, a common genetic disease

By Andy Coghlan

A TEENAGE boy with an inherited disease that affects millions worldwide seems to have been cured using gene therapy. The treatment appears to have stopped the painful symptoms of sickle cell disease, demonstrating the potential for gene therapy to treat common genetic diseases.

"All the blood tests we performed show that the teenager has been cured of sickle cell disease"

The idea of gene therapy – using strands of DNA to compensate for a person's malfunctioning genes – is almost three decades old. However, the approach has so far mostly been used to treat very rare diseases. In contrast, sickle cell disease affects 100,000 people in the US alone. If the treatment proves successful in larger trials, it could bring gene therapy into widespread use.

"It could be a game changer," says Deborah Gill at the University of Oxford. "The fact the team has a patient with real clinical benefit, and biological markers to prove it, is a very big deal."

People with sickle cell disease make abnormal versions of haemoglobin, the blood protein that carries oxygen around the body. This can be caused by mutations in the gene that makes a subunit of haemoglobin, called beta-globin. The mutations cause haemoglobin to clump together, distorting red blood cells into a sickle-shape that can get stuck in blood vessels around the body.

People with the disorder are given blood transfusions to clear these painful blockages and prevent new ones. Bone marrow transplants can treat the disease, but matching donors can only be found for around 10 per cent of people with the condition.

Now a team in France seems to have developed a treatment that would work for everyone with the disorder. First, the team took bone marrow stem cells from the boy when he was 13, and gave them extra, mutated versions of the gene that codes for beta-globin. These were designed to make beta-globin that would interfere with the boy's faulty proteins, stopping them from clumping together.

The researchers then put these stem cells back into the boy's body. After around three months, he began producing large quantities of haemoglobin that behaves normally ([New England Journal of Medicine, DOI: 10.1056/NEJMoa1609677](http://www.nejm.org/doi/10.1056/NEJMoa1609677)). "The patient is now 15 years old and free of all previous medication," says Marina Cavazzana at the Necker Children's Hospital in Paris, who led the team. "He has been free of pain from blood vessel blockages, and has given up taking opioid painkillers."

Cavazzana is confident these benefits will last. "All the tests we performed on his blood show that he's been cured, but more certainty can only come from long-term follow-up." She says her team has treated seven other patients, who are showing "promising" progress.

"We are all very excited by the work, and this success provides support for this and other genetic strategies targeting this horrible disease," says John Tisdale at the US National Heart, Lung, and Blood Institute in Maryland.

David Williams, at Boston Children's Hospital in Massachusetts, suggests that the boy may still occasionally experience blockages, because his own original genes are still able to produce faulty haemoglobin. "It's important to see what happens over time, and how many other patients see similar benefits."

However, should the gene therapy prove to be effective in larger trials, its expense may limit its use to richer nations. "We should be realistic in remembering that there are hundreds of thousands of sickle cell patients in less developed countries, and that the therapy is not easily exportable or adaptable to countries with less well-developed health systems," says Stuart Orkin at Harvard Medical School.

Long road to success

Twenty years ago, gene therapy was touted as a cure for everything from cancer to cystic fibrosis. Now it is finally starting to fulfil its promise.

In 2012, Glybera became the first gene therapy to be approved, for people with a rare disorder that makes them unable to process dietary fat. Last year, the first commercial gene therapy that alters a person's DNA was approved for children with a severe immune disorder. Gene therapies for rare forms of blindness are also showing promise.

But these conditions all affect very small numbers of people. Research into sickle cell disease, beta thalassaemia, haemophilia and cystic fibrosis mean gene therapy may not be too far from becoming mainstream medicine for the most common genetic diseases.

<http://bit.ly/2m7GqwK>

Assassins may have made a binary weapon of Kim Jong-nam's face

Man murdered at Kuala Lumpur airport last week, without the collateral damage that would normally be expected with such a deadly chemical

By Debora MacKenzie

There has been a twist in the mystery of how the super-deadly nerve gas VX turned up on a man murdered at Kuala Lumpur airport last

week, without the collateral damage that would normally be expected with such a deadly chemical.

The attackers seem to have made a binary chemical weapon out of Kim Jong-nam's face.

Kim Jong-nam was the half-brother of North Korean dictator Kim Jong Un. He died last week in an ambulance after falling ill at Kuala Lumpur airport.

Two women were seen on CCTV wiping his face with their hands before he sought medical help. Malaysian authorities later announced there were traces of VX gas on Kim's face.

VX is so lethal that minute amounts can sicken and kill. Yet the attackers survived, and no one in the airport or ambulance reported symptoms, mystifying chemical weapons experts.

But with reports that one of the two attackers vomited afterwards, a possible cunning scheme is beginning to emerge.

Because VX is so dangerous, chemical artillery shells and bombs meant to deliver it normally contain two separate chemicals, sulphur, and a complex but non-toxic compound called QL.

Two-part weapon

In such "binary" weapons, these are blended at the last minute to make VX. The US and Russia both have stockpiles of such weapons which they are destroying under the Chemical Weapons Treaty.

Vipin Narang at the Massachusetts Institute of Technology has suggested that this is why two people were needed to attack Kim, and only one was ill afterwards.

The first would have wiped a sulphur-containing liquid on his face. The second applied QL – and so would have picked up a little of the just-formed VX herself, even though both women immediately washed their hands.

Vomiting is a classic symptom of such brief, minute exposure. The convulsions with which Kim later died are also consistent with a lethal exposure to VX.

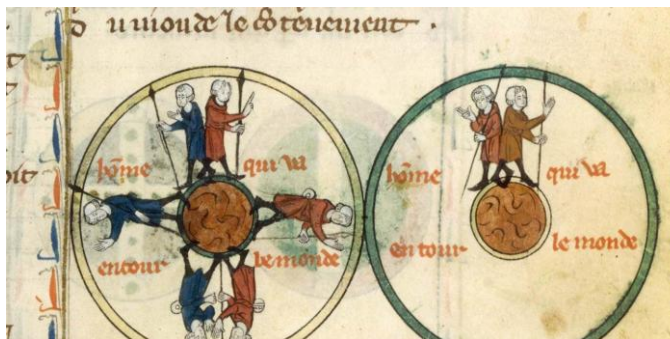
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The next scientific breakthrough could come from the history books

The idea that science isn't a process of constant progress might make some modern scientists feel a bit twitchy.

by Giles Gasper, Hannah Smithson And Tom Mcleish,

Surely we know more now than we did 100 years ago? We've sequenced the genome, explored space and considerably lengthened the average human lifespan. We've invented aircraft, computers and nuclear energy. We've developed theories of relativity and quantum mechanics to explain how the universe works.



However, treating the history of science as a linear story of progression doesn't reflect wholly how ideas emerge and are adapted, forgotten, rediscovered or ignored. While we are happy with the notion that the [arts can return to old ideas](#), for example in neoclassicism, this idea is not commonly recognised in science. Is this constraint really present in principle? Or is it more a comment on received practice or, worse, on the general ignorance of the scientific community of its own intellectual history?

For one thing, not all lines of scientific enquiry are pursued to conclusion. For example, a few years ago, historian of science Hasok Chang undertook [a careful examination of notebooks](#) from scientists working in the 19th century. He unearthed notes from experiments in electrochemistry whose results received no explanation at the time. After repeating the experiments himself, Chang [showed the results still don't have a full explanation](#) today. These research programmes had not been completed, simply put to one side and forgotten.

New perspectives on old investigations might turn out to be promising routes to radical research. Most current research programmes represent attempts to make incremental advances, nurtured and supported by a conservative system of peer review. But the generation of really fresh ideas requires methods that don't just rely on linear progression.

Sometimes this non-linearity comes from new experiments or theories. For example, Albert Einstein developed his theory of special relativity in 1905 from studying a series of [thought experiments](#) he had devised. The Nobel Prize-winning Dutch physicist Heike Kamerlingh Onnes's experimental prowess while studying how metals behaved at very low temperatures led to his [discovery of superconductivity](#). But looping back into forgotten scientific history might also provide an alternative, regenerative way of thinking that doesn't rely on what has come immediately before it.

Collaborating with an international team of colleagues, we have taken this hypothesis further by bringing scientists into close contact with scientific treatises from the early 13th century. The treatises were composed by the English polymath Robert Grosseteste – who later became Bishop of Lincoln – between 1195 and 1230. They cover a wide range of topics we would recognise as key to modern physics, including sound, light, colour, comets, the planets, the origin of the cosmos and more.

We have worked with paleographers (handwriting experts) and Latinists to decipher Grosseteste's manuscripts, and with philosophers, theologians, historians and scientists to provide intellectual interpretation and context to his work. As a result, we've discovered that scientific and mathematical minds today still resonate with Grosseteste's deeply physical and structured thinking.

Our first intuition and hope was that the scientists might bring a new analytic perspective to these very technical texts. And so it proved: the deep mathematical structure of a small treatise on colour, the De

colore, was shown to describe what we would now call a three-dimensional abstract co-ordinate space for colour.

But more was true. During the examination of each treatise, at some point one of the group would say: "Did anyone ever try doing ...?" or "What would happen if we followed through with this calculation, supposing he meant ...". Responding to this thinker from eight centuries ago has, to our delight and surprise, inspired new scientific work of a rather fresh cut. It isn't connected in a linear way to current research programmes, but sheds light on them from new directions.

Take, for example, Grosseteste's application of his colour theory to the rainbow, carried out in his final treatise. In explaining the differences of colours between and within rainbows on three axes related to his colour theory, Grosseteste put forward the basis of a coordinate system for colour embedded in nature.

It was only by looking at his discussion of rainbows recreated by [modern physics](#) that we could interpret his colour qualities in terms we use today. It's the medieval equivalent of the way televisions combine coloured light, but written in the clouds with sunlight rather than on flat screens with [liquid crystal displays](#). The finding also resonates with [open research questions](#) on why some colours seem closer to others in our perception.

One way of looking at the creative processes at work in this scientific dialogue with the 13th century is that it is just the kind of neoclassical (or neomedieval) science that some have assumed is impossible. We've found scientific ideas addressing current thinking in fresh ways in every treatise by Grosseteste we've examined so far, proving it's not exceptional.

History is important. And through our collaboration through time with Grosseteste, we've shown it can undermine some of the brittle narratives told about modern science. We may be alone in space with our thoughts of communicating with the intelligence of other civilisations, but we need not be alone in time.

[The Conversation](#)

<http://bit.ly/2IKuUuZ>

Ancient peoples shaped the Amazon rainforest

Trees domesticated by pre-Columbian peoples remain more common in forests near ancient settlements

We often think of the Amazon rainforest as a vast expanse of nature untouched by humans. But a new study in *Science* suggests that's not true--in fact, today's rainforest is shaped by trees that were cultivated by indigenous peoples thousands of years ago.

"Some of the tree species that are abundant in Amazonian forests today, like cacao, açai, and Brazil nut, are probably common because they were planted by people who lived there long before the arrival of European colonists," says Nigel Pitman, the Mellon Senior Conservation Ecologist at Chicago's Field Museum and a co-author of the study.

The team made the discovery by overlaying data from more than 1,000 forest surveys on a map of more than 3,000 archaeological sites across the Amazon. By comparing forest composition at varying distances from archaeological sites, the analysis generated the first Amazon-wide picture of how pre-Columbian peoples influenced Amazonian biodiversity. The study focused on 85 tree species known to have been domesticated by Amazonian peoples for food, shelter, or other uses over the last several thousand years. The researchers found that throughout the Amazon basin, these species were five times more likely to be common in mature upland forests than non-domesticated species. In some parts of the basin, domesticated species were found to be both more common and more diverse in forests closer to archaeological sites.

"That's even the case for some really remote, mature forests that we'd typically assumed to be pristine and undisturbed," says Pitman.

The finding promises to heat up a long-simmering debate among scientists about how thousands of years of human settlement in the Amazon basin have influenced modern-day patterns of Amazonian biodiversity. The immense size of Amazonian forests has historically

hampered archaeological research and given the impression of an untouched landscape, but a large number of new archaeological sites have been discovered in recent years.

The team, made up by hundreds of ecologists and social scientists worldwide, was led by Carolina Levis, a PhD student at Brazil's National Institute for Amazonian Research and Wageningen University and Research in the Netherlands. "For many years, ecological studies ignored the influence of pre-Columbian peoples on the forests we see today. We found that a quarter of these domesticated tree species are widely distributed in the basin and dominate large expanses of forest. These species are vital for the livelihood and economy of Amazonian peoples and indicate that the Amazonian flora is in part a surviving heritage of its former inhabitants," says Levis.

The study also pinpointed regions of the Amazon that today concentrate especially high diversities and large populations of domesticated species. Southwestern Amazonia, where large stands of Brazil nut trees remain a foundation of local residents' livelihoods, is one such example. Other regions showed fewer domesticated species, or a weaker relationship between domesticated species and archeological sites, highlighting the need for more research on the history of Amazonian settlement. The degree to which the recent history of Amazonian settlement has affected the distribution and abundance of domesticated species in the Amazon also remains to be studied.

While the small number of domesticated species used in the study was sufficient to reveal a strong human signal in modern forests, the authors point out that the signal may be even stronger than they documented, since hundreds of other Amazonian tree species were used by pre-Colombian peoples and also deserve study. Untangling the complex interplay of historical, environmental, and ecological factors structuring the 16,000-species Amazonian tree flora remains a focus of the team's work.

"The questions are pressing," says Pitman, "since both types of pre-Columbian heritage--archeological sites and the forests that surround them--are at risk from road-building, mining, and other threats to the Amazon."

<http://bit.ly/2mp3uiA>

Woolly mammoths experienced a genomic meltdown just before extinction

Genome comparison study has implications for animal conservation and evolutionary theory

Dwindling populations created a "mutational meltdown" in the genomes of the last woolly mammoths, which had survived on an isolated island until a few thousand years ago. Rebekah Rogers and Montgomery Slatkin of the University of California, Berkeley, report these findings in a study published March 2nd, 2017 in PLOS Genetics.

Woolly mammoths were one of the most common large herbivores in North America, Siberia, and Beringia until a warming climate and human hunters led to their extinction on the mainland about 10,000 years ago.

Small island populations persisted until about 3,700 years ago before the species finally disappeared. Researchers compared existing genomes from a mainland mammoth that dates back to 45,000 years ago, when the animal was plentiful, to one that lived about 4,300 years ago. The recent genome came from a mammoth that had lived in a group of about 300 animals on Wrangel Island in the Arctic Ocean. The analysis showed that the island mammoth had accumulated multiple harmful mutations in its genome, which interfered with gene functions. The animals had lost many olfactory receptors, which detect odors, as well as urinary proteins, which can impact social status and mate choice. The genome also revealed that the island mammoth had specific mutations that likely created an unusual translucent satin coat.

The comparison gives researchers the rare opportunity to see what happens to the genome as a population declines, and supports existing theories of genome deterioration stemming from small population sizes.

The study also offers a warning to conservationists: preserving a small group of isolated animals is not sufficient to stop negative effects of inbreeding and genomic meltdown. For those interested in woolly mammoth "de-extinction," the study demonstrates that some mammoth genomes carry an overabundance of negative mutations.

Rebekah Rogers adds: "When I first started this project, I was excited to be working with the new woolly mammoth sequences, published by Love Dalen's lab. It was even more exciting when we found an excess of what looked like bad mutations in the mammoth from Wrangel Island.

There is a long history of theoretical work about how genomes might change in small populations. Here we got a rare chance to look at snapshots of genomes 'before' and 'after' a population decline in a single species. The results we found were consistent with this theory that had been discussed for decades.

The mammoth genome analysis was also a great project to do with Monty Slatkin. He has spent his career developing mathematical models of how genomes will look different when population conditions change. With only two specimens to look at, these mathematical models were important to show that the differences between the two mammoths are too extreme to be explained by other factors."

In your coverage please use this URL to provide access to the freely available article in PLOS Genetics: <http://journals.plos.org/plosgenetics/article?id=10.1371/journal.pgen.1006601>

Citation: Rogers RL, Slatkin M (2017) Excess of genomic defects in a woolly mammoth on Wrangel island. PLoS Genet 13(3): e1006601. doi:10.1371/journal.pgen.1006601

Funding: RLR and MS are funded by grant R01-GM40282 from the National Institutes of Health to MS. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

<http://bit.ly/2maaZcu>

City of Hope researchers discover how breast cancer spreads to the brain

Breast cancer cells express brain proteins to avoid natural defenses

DUARTE, Calif. -- Ninety percent of cancer deaths are from cancer spread. Breast cancer patients, for example, typically do not die because cancer returns in their breast, they die because it spreads to other parts of their body. The most dangerous of which is the brain. Approximately 40 percent of all women with HER2-positive breast cancer will develop brain metastases. Now City of Hope researchers have found how this happens.

Breast cancer cells wrap themselves in reelin -- a protein typically found only in the brain -- that allows the cells to disguise themselves as "friend and not foe," avoiding a system in the brain designed to detect enemy cells. From these disguised cells, new deadly brain tumors form.

"More women than ever are surviving breast cancer only to die from breast tumors growing in their brains years after they've been declared cancer-free," said City of Hope dual trained neurosurgeon and scientist Rahul Jandial, M.D., Ph.D., who led the study available online and slated for the upcoming print publication of the Clinical & Experimental Metastasis, the journal for the Metastases Research Society. "I wanted to understand why women with HER2-positive breast cancer (around 20 percent of all breast cancers) have higher rates of brain metastases than women with other breast cancer subtypes and in turn, find their biological Achilles heel to develop new medicines."

After performing brain surgery, Jandial and his team took leftover tissue samples and compared them to breast cancer tissue removed from mastectomies in the same women. They compared the expression of proteins and found that reelin expression was low in primary breast cancer tissue. However, its expression was

significantly higher in HER2-positive breast cancer metastasizing to the brain.

"The cells are essentially able to act as spies that look like citizens," said Jandial. "They release a mesh of protein and escape the brain's natural defense weapons, causing tumors to grow in the brain."

Understanding these mechanisms is an important step in developing new therapies to treat brain cancers -- especially for metastatic cancers. Metastases are responsible for 90 percent of all cancer deaths, and patients diagnosed with brain metastases only have a 20 percent chance of surviving a year after diagnosis.

Collaborating authors include Cecilia Choy, Ph.D., Danielle M. Levy, Ph.D., Mike Y. Chen, M.D., Ph.D. and Khairul I. Ansari, Ph.D., all of Beckman Research Institute of City of Hope. Funding for this research is supported by Department of Defense Grant BC142323, The Margaret E. Early Medical Research Trust, National Institutes of Health Grant K12 CA001927-16A1 and National Cancer Institute Grant P30 CA033572.

<http://bit.ly/2mrqNbM>

The evolution of Japanese color vocabulary over the past 30 years

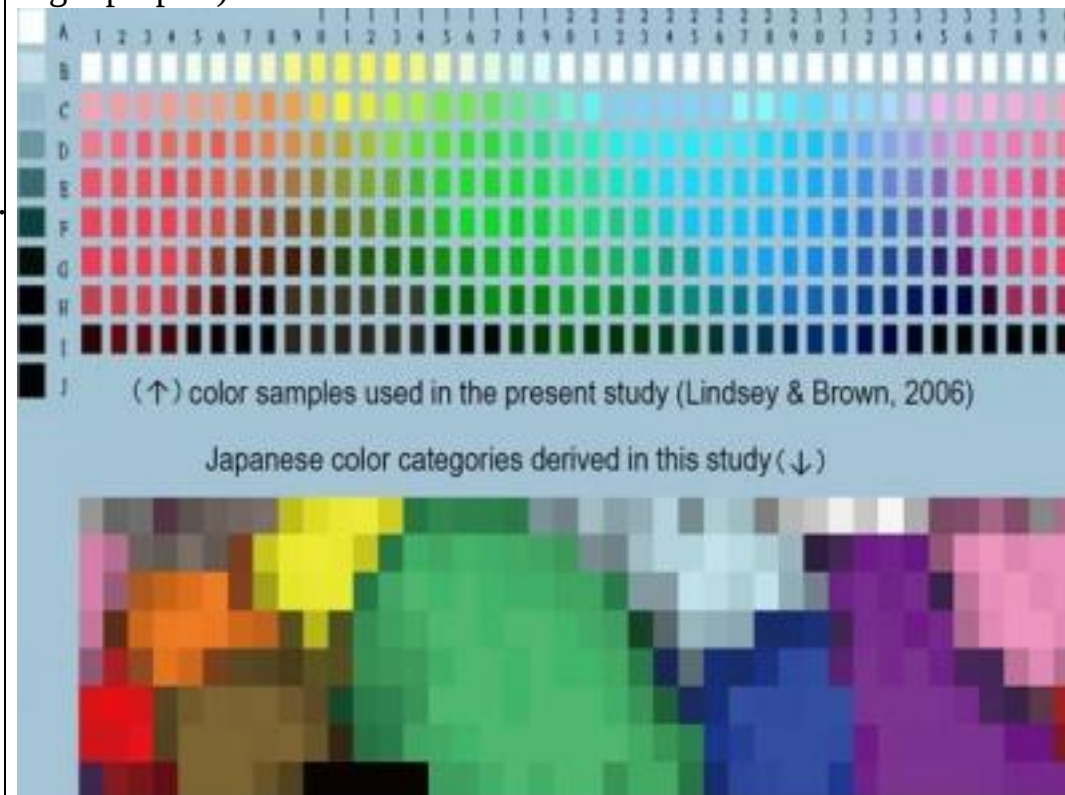
Color terms change over time as a language evolves, and the Japanese language is no exception

Color plays an important role in conveying visual information. For example, color can help the observer find an object in a cluttered environment. Although the human eye can distinguish millions of colors, human languages have only a few color terms, such as "red," "green," "blue" and "yellow," which speakers can use to communicate about colors in everyday life. These color terms change over time as a language evolves, and the Japanese language is no exception.

This became clear through the work of an international collaboration between researchers at Tohoku University, their colleagues at Tokyo Institute of Technology and Ohio State University.

The researchers investigated the number of color categories (such as aka, midori, ao, ki, etc.) that are commonly used by native Japanese speakers. They asked 52 participants to name 320 color samples of various hues and lightness (plus black, white and several grays) using

only single color words without modifiers (no "greenish yellow" or "light purple").



(Top) color samples were used in the present study. (Bottom) optimal number of clusters in Japanese color names derived by k-means analysis with Gap statistic.

Ichiro Kuriki

Statistical analysis of the results revealed 19 common Japanese categories. There were the 11 basic color categories common to most modern industrialized cultures (red, green, blue, yellow, purple, pink, brown, orange, white, gray and black), plus eight additional named color categories. These were: mizu ("water")/light blue, hada ("skin tone")/peach, matcha ("ceremonial green tea")/yellow-green, oudo ("mud")/mustard, enji/maroon, yamabuki ("goldflower")/gold and cream. Of these additional terms, mizu was used by 98% of informants, making it a strong candidate for a 12th Japanese basic color category.

Thirty years ago, a study of Japanese color categories (Uchikawa & Boynton, 1987) did not reveal mizu as a basic color category, because the informants in that earlier study often used mizu ("water") and ao (blue) interchangeably. Conversely, Uchikawa & Boynton found that kusa ("grass") was a very popular term for yellow-green, whereas, in the present study, kusa has been largely replaced with matcha ("ceremonial green tea"). These results illustrate that color terms, like many other aspects of language, change over time.

In contrast to these recent changes, there is one tradition that has not changed over the past millennium: the mixed use of green and blue. Careful study of classic Japanese poems before the 10th century showed that ao ("blue") was used to name both things that were clearly blue and also things that were clearly green; the same was true of midori ("green"). Even today, modern Japanese people refer to the color of the green traffic light, lush green leaves and green vegetables, as ao ("blue"). However, the use of ao and midori are otherwise quite distinct.

The transition from a single category encompassing both blue and green ("grue") to distinct blue and green categories is considered to be a landmark in the typical evolution of color lexicons around the world. For example, the Middle English term "hœwen" was used to denote a grue category until 13th century, but modern English, like modern Japanese, has distinct terms for separate blue and green color categories. These investigators showed that, in addition to distinct color terms for blue and green, modern Japanese has recently added a new intermediate color term "mizu" for lighter bluish and greenish samples.

This study showed that although modern Japanese is not a "grue" language - since blue and green are distinct color categories - Japanese people have nonetheless retained traditional expressions from the classic poetic tradition of a thousand years ago.

<http://bit.ly/2mpfPTU>

Unique photo-catalyst material turns CO₂ emissions into renewable hydrocarbon fuels

Turning one of our most potent pollutants and greenhouse gasses, carbon dioxide, into hydrocarbon fuels

March 3, 2017 by Robert (Chris) Scoggins

Researchers with the Department of Mechanical Engineering at Texas A&M University are making the best use of our energy waste—turning one of our most potent pollutants and greenhouse gasses, carbon dioxide (CO₂), into hydrocarbon fuels that can help the environment and solve growing energy needs.

"We're essentially trying to convert CO₂ and water, with the use of the sun, into solar fuels in a process called artificial photosynthesis," said Dr. Ying Li, associate professor of mechanical engineering and principal investigator. "In this process, the photo-catalyst material has some unique properties and acts as a semiconductor, absorbing the sunlight which excites the electrons in the semiconductor and gives them the electric potential to reduce water and CO₂ into carbon monoxide and hydrogen, which together can be converted to liquid hydrocarbon fuels."

The first step of the process involves capturing CO₂ from emissions sources such as power plants that contribute to one-third of the global carbon emissions. As of yet, there is no technology capable of capturing the CO₂, and at the same time re-converting it back into a fuel source that isn't expensive. The material, which is a hybrid of titanium oxide and magnesium oxide, uses the magnesium oxide to absorb the CO₂ and the titanium oxide to act as the photo-catalyst, generating electrons through sunlight that interact with the absorbed CO₂ and water to generate the fuel.

The project is still in the fundamental research stage. One of the challenges with this technology is that the current conversion efficiency of converting CO₂ and water into renewable solar fuels remains low, less than a few percent. According to Li, the conversion

process also takes considerable time and the material can only absorb a fraction of the emitted sunlight. For Li and his team, solving these issues revolves around engineering more efficient materials with nano-scale structures and advancing the reactor design so that the materials placed within the reactor can absorb sunlight in the most efficient manner.

"There are also other considerations," said doctoral student Huilei Zhao, a student contributing to the ongoing research in Li's research group. "Concentrated sunlight exposure can lead to a higher conversion efficiency and we've found that if we operate at a higher temperature with this reaction, the conversion efficiency can be dramatically increased."

The project is a part of a five-year research grant and CAREER Award for Li from the National Science Foundation, and is currently in its third year. By the end of the project, Li hopes to have developed a higher level of conversion efficiency and determine if the process can be commercially viable.

"There are two different ways to quantify the efficiency," said Li. "What is the fraction of the solar energy we are storing into fuels, or what is the fraction of CO₂ being converted to fuels? In either case, we need to achieve a near 10-percent efficiency to make the process economically competitive."

Li explains that the commercial viability of this material is crucial, and while fossil fuels such as oil and natural gas remain cheap, low conversion rates do not serve to make the material attractive in meeting national energy needs. He says, however, that too many people are thinking in the short term.

"We may think in the current stage that this technology is not competitive with fossil fuels," Li said. "But, if we think in the long run, our fossil fuels can only support our energy needs for maybe a couple hundred years if we use them at the current rate. What will happen after that? We will still need these liquid hydrocarbon fuels to power our machines, vehicles and airplanes. Electricity made through

renewable resources alone will not be enough because we cannot store and transport it effectively. Therefore, we believe this new technology of producing renewable hydrocarbon fuels is important in dealing with both global climate issues and our need for sustainable energy."

<http://bit.ly/2n20TYQ>

Drug used to treat weak bones associated with micro-cracks

A type of drug used to treat weak bones is associated with an increased risk of 'micro-cracks' in bone, according to new research

A type of drug used to treat weak bones is associated with an increased risk of 'micro-cracks' in bone, according to new research.

The early-stage research, by scientists at Imperial College London, suggests these microcracks may reduce mechanical strength of the bone. In the study, published in the journal Scientific Reports, researchers studied bone samples from 16 people who had been diagnosed with the weak bone condition osteoporosis.

All of the patients had suffered a broken hip, and half of the patients had been taking a type of commonly-prescribed drug called bisphosphonate. The team then used X-rays from the Diamond synchrotron to visualize the structure of bone at a high resolution.

They found that the bones of people taking the drugs not only had a larger number of tiny cracks, but also had less mechanical strength.

The team said there is now an urgent need to further investigate these findings - though they stressed that patients should not stop taking the medication if they have been prescribed the drugs by their doctor.

Dr Richard Abel, lead author of the research from the Department of Surgery and Cancer at Imperial, said: "Although this is a very small, early-stage study, the results are quite startling, and justify follow-up studies. "These microcracks are like the small cracks that emerge when you repeatedly flex a plastic ruler - they gradually weaken the structure and may potentially make it more prone to breaking."

Osteoporosis causes bones to weaken, making them more fragile and prone to breaks. The condition, which affects 3 million people in the

U.K. and 200 million worldwide, usually strikes the over-65s. The most common fractures are of the hip, wrist and spine.

Bone is regularly renewed throughout life, and constantly broken down and remade. But in osteoporosis, breakdown outpaces rebuilding. This is due to the cells that break down bone, called osteoclasts, becoming over-active and burrowing holes, or perforations, into the bone. Bisphosphonates slow the rate at which bone is broken down, by reducing osteoclast activity.

These drugs, for which there are thought to be around 6.5 million prescriptions every year in the UK and 190 million globally, have been found to prevent the risk of fracture by 30-50 per cent.

However, in recent years doctors have become increasingly concerned that the drugs may prevent breakdown to such an extent that in rare cases it may actually increase the risk of fracture. This is because osteoclasts are needed to remove old, damaged bone so that it can be replaced with new bone.

However, if these cells become too sluggish, bones aren't refreshed as often as they should be - which leaves them more prone to damage.

To investigate this, the researchers in the current paper analysed the cracks and perforations in the microstructure of bone, which have rarely been studied.

This microscale structure of bone is not visible using standard X-ray equipment in labs or hospitals - which is the conventional way bone thinning is detected. Therefore, the researchers used a particle accelerator - the Diamond Light Source in Oxford - to analyse samples of bone.

They studied eight hip bone samples from patients who had suffered a fracture while taking bisphosphonates, and eight samples from patients who had suffered a fracture but had not been taking the medication. These samples had been collected from patients during hip replacement procedures. The patients were between 60-90 years old. The team also studied hip bone samples from patients who did not have osteoporosis and had not experienced a hip fracture.

They also tested the mechanical strength of the bone samples. The results revealed that the bones of people who had been taking bisphosphonates had 24 per cent more microcracks than the bones of people who had not been taking the drugs, and 54 per cent more than healthy ageing bone. However, as expected, the bones of people who were taking bisphosphonates were also found to have fewer holes.

But despite this, the bones from patients treated with bisphosphonates were also found to be 33 per cent weaker than people who had suffered fractures but were not taking bisphosphonates.

The researchers used various mathematical models to confirm the differences were statistically significant.

Dr Abel explained: "This research suggests that, in a small number of patients, rather than protecting against fractures bisphosphonates may actually make bones more fragile. We now urgently need larger studies to confirm this finding."

He added that further studies would also provide insight into whether there is an ideal length of time to prescribe the drugs.

"There may be a crucial time point between holes in the bone being prevented, and microcracks beginning to form. If we can find this, we may be able to ensure bisphosphonates provide maximum protection against fractures by personalising the duration of treatment. "Long term we may need to develop other therapies that treat osteoporosis by building new bone rather than slowing the breakdown of old bone".

He said the team will now investigate whether microcracks form in patients who have taken bisphosphonates but not sustained fractures.

"Not only did we look at a very small number of samples in our study, but we also looked solely at patients who had suffered a broken hip. Further work needs to investigate whether the bones of osteoporosis patients who have not had a fracture also have these microcracks."

The study was funded by the Science and Technology Facilities Council, the Engineering and Physical Sciences Research Council, the Wellcome Trust and the Michael Uren Foundation.

"It is great to see how our visualization tools have provided an insight into the microcracks" says Professor Lauren Chapon, Director of Physical Sciences, Diamond Light Source.

"The X-rays used to map these usually help people engineering or environmental problems, so it is good to see how physical sciences' tools have benefited medical research."

<http://bit.ly/2mpyeQm>

Reprogrammed blood vessels promote cancer spread

Blood vessels play a critical role in the growth and spread of cancer.

The cells lining the inner wall of blood vessels (endothelial cells) and cancer cells are in close contact to each other and mutually influence each other. Andreas Fischer and his colleagues are studying these interactions. Fischer, a medical researcher, leads a Helmholtz University Junior Research Group at the German Cancer Research Center (Deutsches Krebsforschungszentrum, DKFZ) and the Medical Faculty Mannheim of Heidelberg University.

Fischer and his team had found surprisingly high levels of the activated form of a signaling molecule called Notch in blood vessels of tumors. In vessel lining cells from lung, breast and bowel tumors, they found significantly higher levels of the activated receptor than they did in the healthy organs. The researchers observed that the higher the levels of Notch activation were in the tumor endothelium, the more the cancer had already spread and the poorer was the prognosis for the patients.

Activation of the receptor protein Notch by its binding partners is a key communication pathway for signal exchange between neighboring cells. Starting from nematodes over insects through to man, Notch regulates the development of organs during embryonic development. In adults, the signaling protein regulates, among other things, the activity of blood stem cells.

A couple of years ago, cancer researchers were already able to show that aberrant Notch signaling can turn cells cancerous, for example, white blood cells into leukemia cells. In the present study, Fischer and

colleagues have now demonstrated for the first time that the Notch activity of cells in the tumor microenvironment also has an influence on cancer.

Fischer and his co-workers have demonstrated in mice that the tumor cells themselves are responsible for Notch activation in immediate contact with endothelial cells. They reprogram the vascular wall cells for their own purposes, thus apparently paving the way for their spread in the body. The more activated Notch is in the tumor endothelium, the more cancer cells make their way into the bloodstream and the more lung metastases form.

Surprisingly, Notch activation in tumor-bearing mice was not restricted to the blood vessels in the tumor; it also affected the endothelial cells in the lung. The tumor appears to release signaling substances that prepare the soil for colonization by its metastases.

As a result of Notch activation, endothelial cells increase their production of a contact molecule called VCAM1. This protein acts like a snap fastener that enables the cancer cells to attach to the vessel wall and prepare the passage. In addition, activated Notch makes it easier for cancer cells to get into the bloodstream by making certain structures with sealing function between endothelial cells more permeable. Finally, activated Notch also causes the endothelial cells to produce chemical messengers that recruit tumor-promoting immune cells into the tumor.

"Taken together, the results show a very clear picture: The tumor cells promote their spread in the body in multiple ways by activating Notch and thus reprogramming endothelial cells for their own purposes," Fischer summed up. "We therefore wanted to find out if we could interrupt this disastrous mechanism."

The scientists blocked Notch in mice using an antibody that is currently being tested in early preclinical trials and thus were able to reduce the colonization of the lung by cancer cells. A blockade of the contact molecule VCAM1 with an antibody also resulted in less

metastases in the lung and lowered the invasion of the tumor by cancer-promoting immune cells.

"Notch is a universal signaling molecule and this makes it difficult to exert therapeutic influence on it without interfering with vital processes," Fischer said. "But a targeted short-time use of blocking antibodies might be a promising approach for suppressing the dangerous spread of tumors. This is what we aim to explore in our further research."

Elfriede Wieland, Juan Rodriguez-Vita, Sven S. Liebler, Carolin Mogler, Iris Moll, Stefanie E. Herberich, Elisa Espinet, Esther Herpel, Amitai Menuchin, Jenny Chang-Claude, Michael Hoffmeister, Christoffer Gebhardt, Hermann Brenner, Andreas Trumpp, Christian W. Siebel, Markus Hecker, Jochen Utikal, David Sprinzak, Andreas Fischer: Endothelial Notch1 activity facilitates metastasis. Cancer Cell 2017, DOI: <http://dx.doi.org/10.1016/j.ccell.2017.01.007>

<http://bit.ly/2mTcgTJ>

Evidence disproving tropical 'thermostat' theory: global warming can breach limits for life

New research findings show that as the world warmed millions of years ago, conditions in the tropics may have made it so hot some organisms couldn't survive.

Longstanding theories dating to the 1980s suggest that as the rest of the earth warms, the tropical temperatures would be strictly limited, or regulated by an internal 'thermostat.' These theories are controversial, but the debate is of great importance because the tropics and subtropics comprise half of the earth's surface area, greater than half of the earth's biodiversity, as well as over half the earth's human population. But new geological and climate-based research indicates the tropics may have reached a temperature 56 million years ago that was, indeed, too hot for living organisms to survive in parts of the tropics.

That conclusion is detailed in the article "Extreme Warmth and Heat-Stressed Plankton in the Tropics during the Paleocene-Eocene Thermal Maximum," published by the online journal Science Advances and co-authored by Matthew Huber, professor in the Earth, Atmospheric, and Planetary Sciences Department at Purdue

University and member of the Purdue Climate Change Research Center. Huber's contribution focused on climate modeling and interpreting paleoclimate data within the context of modern theoretical understanding. Part of this work was performed while Huber was also at the University of New Hampshire.

The Paleocene-Eocene Thermal Maximum (PETM) period occurred 56 million years ago and is considered the warmest period during the past 100 million years. Global temperatures rapidly warmed by about 5 degrees Celsius (9 F), from an already steamy baseline temperature, and this study provides the first convincing evidence that the tropics also warmed by about 3 degrees Celsius (5 F) during that time.

"The records produced in this study indicate that when the tropics warmed that last little bit, a threshold was passed and parts of the tropical biosphere seems to have died," Huber said. "This is the first time that we've found really good information, in a very detailed way, where we saw major changes in the tropics directly associated with warming past a key threshold in the past 60 million years."

The study is unique because of the quality of the geological records utilized. Geological records from the PETM are difficult to find, especially from an area of the tropics, Huber said. The research was based on a shallow marine sedimentary section deposited in Nigeria.

"We don't find 50-million-year-old thermometers at the bottom of the ocean," Huber said. "What we do find are shells, and we use the isotopes of carbon and oxygen within the shells, complemented by temperature proxies from organic material, to say something about the carbon cycle and about the temperature in the past."

Two research methods were used to judge the temperature during the PETM, one utilizing isotopes in shells, while the other examined organic residues in deep-sea sediments. The biotic records left behind from living organisms indicate they were dying at the same time the conditions were warming.

If the tropics are not able to control its temperature and do not possess an internal thermostat, that should reshape future thinking about climate change, Huber said.

"If you say there's no tropical thermostat, then half of the world's biodiversity—over half of the world's population, the tropical rainforests, the reefs, India, Brazil—these populous and very important countries have nothing to prevent them from warming up substantially above conditions that humans have been used to," he said. The trends in temperature increases in the tropics are similar to those found in other parts of the world, but other records have been very sparse and limited until now.

More information: Extreme warmth and heat-stressed plankton in the tropics during the Paleocene-Eocene Thermal Maximum, Science Advances 03 Mar 2017: Vol. 3, no. 3, e1600891, DOI: 10.1126/sciadv.1600891, <http://advances.sciencemag.org/content/3/3/e1600891>

<http://bit.ly/2mpxsmn>

Can tilapia skin be used to bandage burns?

Doctors are testing the skin of the popular fish as a bandage for second- and third-degree burns

By Nadia Sussman

FORTALEZA, Brazil — In this historic city by the sea in northeast Brazil, burn patients look as if they've emerged from the waves. They are covered in fish skin — specifically strips of sterilized tilapia.

Doctors here are testing the skin of the popular fish as a bandage for second- and third-degree burns. The innovation arose from an unmet need. Animal skin has long been used in the treatment of burns in developed countries. But Brazil lacks the human skin, pig skin, and artificial alternatives that are widely available in the US.

The three functional skin banks in Brazil can meet only 1 percent of the national demand, said Dr. Edmar Maciel, a plastic surgeon and burn specialist leading the clinical trials with tilapia skin.

As a result, public health patients in Brazil are normally bandaged with gauze and silver sulfadiazine cream.

"It's a burn cream because there's silver in it, so it prevents the burns from being infected," said Dr. Jeanne Lee, interim burn director at the the regional burn center at the University of California at San Diego. "But it doesn't help in terms of debriding a burn or necessarily helping it heal."

The gauze-and-cream dressing must be changed every day, a painful process. In the burn unit at Fortaleza's José Frota Institute, patients contort as their wounds are unwrapped and washed.

Enter the humble tilapia, a fish that's widely farmed in Brazil and whose skin, until now, was considered trash. Unlike the gauze bandages, the sterilized tilapia skin goes on and stays on.

The first step in the research process was to analyze the fish skin.

"We got a great surprise when we saw that the amount of collagen proteins, types 1 and 3, which are very important for scarring, exist in large quantities in tilapia skin, even more than in human skin and other skins," Maciel said. "Another factor we discovered is that the amount of tension, of resistance in tilapia skin is much greater than in human skin. Also the amount of moisture."

In patients with superficial second-degree burns, the doctors apply the fish skin and leave it until the patient scars naturally. For deep second-degree burns, the tilapia bandages must be changed a few times over several weeks of treatment, but still far less often than the gauze with cream. The tilapia treatment also cuts down healing time by up to several days and reduces the use of pain medication, Maciel said.

Antônio dos Santos, a fisherman, was offered the tilapia treatment as part of a clinical trial after he sustained burns to his entire right arm when a gas canister on his boat exploded. He accepted.

"After they put on the tilapia skin, it really relieved the pain," he said.

"I thought it was really interesting that something like this could work."

The initial batches of tilapia skin were studied and prepared by a team of researchers at the Federal University of Ceará. Lab technicians used various sterilizing agents, then sent the skins for radiation in São

Paulo to kill viruses, before packaging and refrigerating the skins. Once cleaned and treated, they can last for up to two years.

In the US, animal-based skin substitutes require levels of scrutiny from the Food and Drug Administration and animal rights groups that can drive up costs, Lee said. Given the substantial supply of donated human skin, tilapia skin is unlikely to arrive at American hospitals anytime soon. But it may be a boon in developing countries.

"I'm willing to use anything that might actually help a patient," Lee said. "It may be a good option depending on what country you're talking about. But I also think the problem is that you need to find places that have the resources to actually process the skin and sterilize it, and make sure it doesn't have diseases."

In Brazil, in addition to the clinical trials, researchers are currently conducting histological studies that compare the composition of human, tilapia, pig, and frog skins. They are also conducting studies on the comparative costs of tilapia skin and conventional burn treatments. If clinical trials show continued success, doctors hope a company will process the skins on an industrial scale and sell it to the public health system.

<http://bbc.in/2mpEoQt>

Newborns at risk from deadly Group B Strep bacteria

Early onset Group B Streptococcus can lead to a range of serious illnesses within the first week of a baby's life

By Adrian Goldberg Presenter, 5 live Investigates

"When the midwife came to the house, Aimee went floppy and unresponsive and the midwife called for an ambulance straight away. "It all happened very quickly. They told me that she had a 5% chance of surviving."

Charlotte Heath, 28 and from Cheslyn Hay near Walsall, fights back the tears as she recalls the moment she was warned her five-day-old daughter may die. Little Aimee had been infected with early onset Group B Streptococcus (or GBS) which, while harmless in most cases,

can lead to a range of serious illnesses, including septicaemia, pneumonia and meningitis within the first week of a baby's life.

The bacteria - carried by an estimated one-in-four pregnant women - is passed from mother to baby. In the majority of cases, babies can be protected if the mother is given intravenous antibiotics during labour. But Charlotte did not know she was a carrier. Despite the bleak outlook, Aimee survived but has been left with quadriplegic spastic cerebral palsy which means that she cannot sit unaided, walk or talk.

Charlotte said: "I know people will probably look at me and say, 'you know, she's got all these problems, you're fantastic, I don't know how you cope', but you do, you just get on with it because you know it could've been different. "We feel lucky to have her."

Public Health England, which collates data for England, Wales and Northern Ireland told 5 live Investigates that the number of babies being made ill by the infection has increased by 12% between 2011 and 2015.

According to the British Paediatric Surveillance Unit, 518 newborn babies in the UK and Ireland were made ill as a result of the bacteria, 27 died and dozens more like Aimee were left with disabilities in the year to April 2015.

He died 20 minutes later

Craig White and Lynsey Dalvarez's son Frankie did not survive. Like Charlotte, Lynsey, 29, was unaware she was a carrier of the bacteria and was not tested or given the antibiotics which may have saved her son. "I'd never heard of it before," she said. "We didn't understand how sick he was. Saturday and Sunday they tried their best.

"On Sunday night he had gone into multiple organ failure and he'd started having seizures. They said they'd try one more thing and if not we'd have to withdraw care. "They did a brain scan and it showed damage, so they took us into a room and removed support and he died 20 minutes later in my arms on the Monday. It was very quick."

Both Lynsey and Charlotte feel very strongly that every mother should be tested for the condition.

While this is done in some European countries and the US, routine screening is not done in the UK. The decision on whether to introduce it in this country is down to the Department of Health, which takes expert advice from the National Screening Committee.

The screening committee is currently looking at this, but has said in the past that it does not think there is a case for routine screening here because it does not believe it is accurate enough.

Dr Anne Mackie, Director of Programmes for the UK National Screening Committee (UK NSC), said: "The UK independent expert screening committee's last review of screening for group B strep carriage found testing in late pregnancy unreliable.

"This is because the test cannot distinguish between women whose babies will be affected by early onset group B strep and those who would not. This could lead to a high number of mothers and babies being exposed to unnecessary antibiotic use."

'Trauma'

Campaigners disagree with the screening committee and say concerns about the overuse of antibiotics should not prevent mothers from being routinely screened.

Jane Plumb from the charity Group B Strep Support, said: "Screening will save babies' lives, stop families going through the trauma of seeing their baby suffer preventable infection and ease the burden on our overworked NHS."

They point to a clinical trial undertaken at London's Northwick Park Hospital in which more than 5,000 women were screened, with those testing positive offered antibiotics in labour. Full trial results are expected to be detailed in the British Medical Journal soon but preliminary results given after the first 18 months showed an 80% reduction in the number of babies infected with the bacteria.

More than 250,000 people recently signed a petition calling on the Department of Health to introduce routine testing in the UK. The Department of Health declined to comment until after the screening committee report, which is expected some time this month.