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Brush your teeth -- postpone Alzheimer's

You don't only avoid holes in your teeth by keeping good oral hygiene, Norwegian researchers have discovered a clear connection between gum disease and Alzheimer's disease

The researchers have determined that gum disease (gingivitis) plays a decisive role in whether a person develops Alzheimer´s or not.

"We discovered DNA-based proof that the bacteria causing gingivitis can move from the mouth to the brain," says researcher Piotr Mydel at Broegelmanns Research Laboratory, Department of Clinical Science, University of Bergen (UiB).

The bacteria produces a protein that destroys nerve cells in the brain, which in turn leads to loss of memory and ultimately, Alzheimer´s.

Brush your teeth for better memory

Mydel points out that the bacteria is not causing Alzheimer´s alone, but the presence of these bacteria raise the risk for developing the disease substantially and are also implicated in a more rapid progression of the disease. However, the good news is that this study shows that there are some things you can do yourself to slow down Alzheimer´s.

"Brush your teeth and use floss". Mydel adds that it is important, if you have established gingivitis and have Alzheimer´s in your family, to go to your dentist regularly and clean your teeth properly.

New medicine being developed

Researchers have previously discovered that the bacteria causing gingivitis can move from the mouth to the brain where the harmful enzymes they excrete can destroy the nerve cells in the brain. Now, for the first time, Mydel has DNA-evidence for this process from human brains. Mydel and his colleagues examined 53 persons with Alzheimer´s and discovered the enzyme in 96 per cent of the cases. According to Mydel, this knowledge gives researchers a possible new approach for attacking Alzheimer´s disease.

"We have managed to develop a drug that blocks the harmful enzymes from the bacteria, postponing the development of Alzheimer´s. We are planning to test this drug later this year, says Piotr Mydel.

Facts: Gingivitis

The bacteria Porphyromonas gingivalis (P.gingivalis) is one of the main causes to infection in the gums.

The bacteria causes chronic infection in the gums, but can move to the brain where it can damage nerve cells in the brain.

Circa 50 per cent of the population have this bacteria in one or another form.

Circa 10 per cent of the ones having this bacteria will develop serious gum disease, loose teeth, and have an increased risk of developing Alzheimer´s disease.

In addition to Alzheimers, the bacteria is linked to rheumatism, COPD and esophageal cancer.

http://bit.ly/2F0zJwM

Feathers came first, then birds

New research, led by the University of Bristol, suggests that feathers arose 100 million years before birds - changing how we look at dinosaurs, birds, and pterosaurs, the flying reptiles.

It also changes our understanding of feathers themselves, their functions and their role in some of the largest events in evolution.

The new work, published today in the journal Trends in Ecology & Evolution combines new information from palaeontology and molecular developmental biology.

Reconstruction of the studied pterosaur, with four different feather types over its head, neck, body, and wings, and a generally ginger-brown colour.
Credit: Reconstruction by Yuan Zhang.

The key discovery came earlier in 2019, when feathers were reported in pterosaurs - if the pterosaurs really carried feathers, then it means these structures arose deep in the evolutionary tree, much deeper than at the point when birds originated.

Lead author, Professor Mike Benton, from the University of Bristol's School of Earth Sciences, said: "The oldest bird is still Archaeopteryx first found in the Late Jurassic of southern Germany in 1861, although some species from China are a little older.

"Those fossils all show a diversity of feathers - down feathers over the body and long, vaned feathers on the wings. But, since 1994, palaeontologists have been contending with the perturbing discovery, based on hundreds of amazing specimens from China, that many dinosaurs also had feathers."

Co-author, Baoyu Jiang from the University of Nanjing, added: "At first, the dinosaurs with feathers were close to the origin of birds in the evolutionary tree.

"This was not so hard to believe. So, the origin of feathers was pushed back at least to the origin of those bird-like dinosaurs, maybe 200 million years ago."

Dr Maria McNamara, co-author from University College Cork, said: "Then, we had the good fortune to work on a new dinosaur from Russia, Kulindadromeus.

"This dinosaur showed amazingly well-preserved skin covered with scales on the legs and tail, and strange whiskery feathers all over its body.

"What surprised people was that this was a dinosaur that was as far from birds in the evolutionary tree as could be imagined. Perhaps feathers were present in the very first dinosaurs."

Danielle Dhouailly from the University of Grenoble, also a co-author, works on the development of feathers in baby birds, especially their genomic control. She said: "Modern birds like chickens often have scales on their legs or necks, and we showed these were reversals: what had once been feathers had reversed to be scales.

"In fact, we have shown that the same genome regulatory network drives the development of reptile scales, bird feathers, and mammal hairs. Feathers could have evolved very early."

Baoyu Jiang continued: "The breakthrough came when we were studying two new pterosaurs from China.

"We saw that many of their whiskers were branched. We expected single strands - monofilaments - but what we saw were tufts and down feathers. Pterosaurs had feathers."

Professor Benton added: "This drives the origin of feathers back to 250 million years ago at least.

"The point of origin of pterosaurs, dinosaurs and their relatives. The Early Triassic world then was recovering from the most devastating mass extinction ever, and life on land had come back from near-total wipe-out.

"Palaeontologists had already noted that the new reptiles walked upright instead of sprawling, that their bone structure suggested fast growth and maybe even warm-bloodedness, and the mammal ancestors probably had hair by then.

"So, the dinosaurs, pterosaurs and their ancestors had feathers too. Feathers then probably arose to aid this speeding up of physiology and ecology, purely for insulation. The other functions of feathers, for display and of course for flight, came much later."

http://bit.ly/2ZqdD1a

Hearing through your fingers: Device that converts speech

A new proof-of-concept study provides the first evidence that a speech-to-touch sensory substitution device can improve hearing in the hearing-impaired without any training, report scientists in Restorative Neurology and Neuroscience

Amsterdam, NL - A novel study published in *Restorative Neurology and Neuroscience* provides the first evidence that a simple and inexpensive non-invasive speech-to-touch sensory substitution device has the potential to improve hearing in hearing-impaired cochlear implant patients, as well as individuals with normal hearing, to better discern speech in various situations like learning a second language or trying to deal with the "cocktail party effect." The device can provide immediate multisensory enhancement without any training.

"Despite recent advancements in hearing aid and cochlear implants, the most widespread surgical implant to restore audition, hearing-impaired users still encounter significant practical and social challenges with or without aids," explained lead investigator Amir Amedi, PhD, Department of Medical Neurobiology, Institute for Medical Research Israel-Canada, Faculty of Medicine, Hebrew University of Jerusalem, Hadassah Ein-Kerem, and The Cognitive Science Program, The Hebrew University of Jerusalem, Jerusalem, Israel. "In particular, they all struggle with understanding speech in challenging, noisy acoustic environments, especially in presence of a competing speaker."

The number of sensory deprived patients and auditory deprived patients is expected to rise so it is crucial to develop efficient techniques for auditory recovery designed to convey the missing information to patients. "We live in a world that is becoming steadily more multisensory and we really need to understand the mechanisms underlying multisensory perception and integration. Providing relevant information using the sense of touch can significantly help hearing," commented Dr. Amedi.

In this current proof-of-concept study investigators hypothesized that they would be able to improve speech understanding under challenging conditions by exploiting the ability of the brain to integrate information coming simultaneously from different senses. They designed a minimalistic auditory-to-tactile sensory substitution device (SSD) that transforms low-frequency speech signals into tactile vibrations delivered on two fingertips. They asked a group of non-native English speakers to repeat a series of sentences, which was degraded by embedding them in speech-like noise.

As expected, when participants could rely only on audition, their understanding of such sentences was poor. Crucially, however, their sentence understanding significantly improved when they paired the degraded speech signal with complementary vibration delivered on the participants fingertips. The vibration conveyed a specific set of frequencies known as fundamental frequencies that characterize speech signals.

The reported improvement at the group level was 6 dB - a major difference considering that an increase of 10 dB represents a doubling of the perceived loudness. These results are especially relevant when compared to earlier SSD studies showing effects in behavior only after demanding cognitive training.

"Our results carry important implications for further research, as well as possible clinical and practical solutions," noted co-author Tomasz Wolak, PhD Eng, Head of the Bioimaging Research Center, Institute of Physiology and Pathology of Hearing, World Hearing Center, Warsaw, Poland. "The ability to 'hear through one's fingers can significantly help hearing. Our approach suggests that multisensory stimulations providing the same type of information (in this case spoken language conveyed through touch in addition to hearing) should be processed in the same brain region (in this case spoken language centers), ultimately then predicting that multisensory stimulations (both sounds and touch) should enhance perception.

According to lead author Katarzyna Cieśla, PhD, World Hearing Center, Warsaw, and Hebrew University of Jerusalem, "The most

compelling aspect of our study is the fact that learning to use such speech-to-touch sensory substitution device did not require any training. We believe it can also serve as an aid for the elderly population, which finds it challenging to follow extensive training regimes. This might be the first study showing such immediate relevant enhancement of a sensory substitution device and suggests the brain is much more multisensory than the common wisdom."

"This study is a major step forward to introduce multisensory plasticity of the brain as an innovative paradigm to maximize the potential of patients to compensate for their sensory loss," commented Bernhard Sabel, PhD, Editor-in-Chief of *Restorative Neurology and Neuroscience*.

Next the team plans to further improve the device and training regimes in order to reach the goal of 10 dB enhancement and to test for human brain mechanisms using an MRI-compatible version of the device in various populations (both hearing and hearing-impaired people).

http://bit.ly/2ZjLB4X

Woman Had a Huge Tapeworm 'Egg' Encased in Her Brain. Why She's Super Happy About It.

When is it a huge relief to hear you have a parasite lurking in your brain?

When it's not a cancerous brain tumor.

By Rachael Rettner, Senior Writer | June 3, 2019 04:23pm ET

That was the recent experience of a woman in New York, 42-year-old Rachel Palma, who had gone to the doctor's office for some odd symptoms. For example, she had trouble remembering words, and would suddenly drop items like her coffee mug, according to local news outlet WABC-TV.

When doctors scanned her brain with an MRI, they saw a lesion that was very odd-looking, said Dr. Jonathan Rasouli, a neurosurgery resident at Mount Sinai Health System in New York, who treated the patient. Based on this scan and the woman's symptoms "we were concerned...that that lesion could potentially be cancerous," Rasouli told Live Science. Specifically, doctors suspected she had a malignant brain tumor, an aggressive type of cancer that could be life-threatening.

An image of the pork tapeworm *Taenia solium*. CDC/ Dr. Mae Melvin

But when doctors performed surgery to remove the lesion, they found a huge surprise. Instead of seeing the soft tissue typical of a brain tumor, they saw something that looked more like a rock or a quail egg, Rasouli said. "What we saw in surgery was not at all what we were expecting," Rasouli said.

They removed the lesion, placed it under a microscope and cut into the tissue. That's when they saw a baby tapeworm emerge.

"It was such a relief to see that instead of having a malignant brain tumor" she had tapeworm, Rasouli said.

Palma was diagnosed with neurocysticercosis, a parasitic disease that occurs when a person ingests microscopic eggs from a pork tapeworm (*Taenia solium*). When the eggs hatch, the larvae can travel throughout the body, including to the brain, muscles, skin and eyes, where they form cysts, according to the World Health Organization.

Although the larvae can travel anywhere in the body, they have a particular affinity for the brain because of the organ's robust blood supply, Rasouli said. Once the parasitic cyst was removed, Palma didn't need any more treatment for the condition.

Although rare in the U.S., this tapeworm is common in developing nations, including countries in Latin America, Africa and Asia.

But one big mystery still remains: How did Palma contract the parasite? She appears to have no risk factors for neurocysticercosis — she hadn't traveled out of the country or eaten undercooked meat.

The mystery may never be solved, but Palma has decided to stop wondering about it. "I stopped asking questions and started celebrating and making the most out of life," Palma told WABC-TV.

https://nyti.ms/2MDzVsh

He Was Looking for Opals. Instead He Found a New Dinosaur Species.

What he thought might be a horse hoof but turned out to be the vertebrae of a dinosaur that was previously unknown

By Jamie Tarabay and Genevieve Jia Ling Finn

A toe bone of Fostoria dhimbangunmal, preserved in opal. **Robert A. Smith, via Australian Opal Center**

SYDNEY, Australia — Lightning Ridge is a town about 450 miles inland from Australia's eastern coast, yet as he mined for opal there 35 years ago, Bob Foster would find remnants of fish bones and mussels. Forty feet below the surface, where water might have flowed some 100 million years ago, animals died and their bones became encrusted with colorful stone.

Mr. Foster and his fellow miners would smash those bones apart to see if opal, Australia's national gemstone, lay beneath. One day he came across a semicircle-shaped bone that he thought might be a horse hoof but turned out to be the vertebrae of a dinosaur that was previously unknown. Now it is named Fostoria, after him.

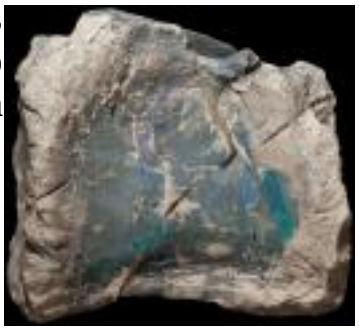
After years of studying the remains Mr. Foster found, scientists reported the discovery of the plant-eating species on Monday in the Journal of Vertebrate Paleontology.

Additionally, the remains belonged to at least four different dinosaurs, making them the first fossils from a herd or family group to be discovered in Australia. Paleontologists found that the skeletons ranged in size from juvenile to an adult of 16 feet in length.

They are also the biggest collection of dinosaur fossils preserved in opal, said Phil Bell, a paleontologist at the University of New England in Armidale and leader of the study. In the last decade or so, we've seen an explosion in the number of discoveries," Dr. Bell said. Mr. Foster's fossil collection "provides insight into dinosaurs and their distribution on the continent that we haven't had before."

The Fostoria species, which lived in the mid-Cretaceous period, almost went undiscovered.

Fed up with the abundance of bones he kept digging up in his mine, in 1984 Mr. Foster filled two large suitcases with the remains and made his way to Sydney, nearly 500 miles away. Back then the trip took the better part of a day.



One of the back bones of Fostoria. **Robert A. Smith, via Australian Opal Center**

At the city's Australian Museum, Mr. Foster asked to see the paleontologists who had asked members of the public to come forward with any fossils they found.

"I said, 'I'm the bloke who rang you up, I've got two bags of dinosaur bones here,' and they looked at each other like, 'Here's another one' — they get people coming in all the time," Mr. Foster recalled.

"I was a bit tired by then," he said. "I'd carried these suitcases on the train, and the bus, and up the stairs, and I opened them and threw the bones all out on the table and they were diving to catch them before they landed on the floor. They changed their approach." The museum sent army reservists to excavate the site in Lightning Ridge, removing blocks of rocks and fossils.

But the fossils were left unstudied for 15 years. One day, Mr. Foster spotted some of them in a display case at an opal store in Sydney. He reclaimed what he could, bringing them back to Lightning Ridge and donating them to the Australian Opal Center in 2015.

There, Dr. Bell began to study them.

"Bob wanted his fossils to go back to Lightning Ridge where they belonged as part of their natural heritage," he said. He believes even more discoveries will be made around Lightning Ridge, where another species, the Weewarrasaurus, was discovered last year.

"We're encouraging miners to come forward and show us what they've got," Dr. Bell said. "It's really hard and fatiguing work, so we're indebted to miners for their work."

Now 75, Mr. Foster has retired to a small town along the coast of New South Wales. His mine is now abandoned.

"It's all finished out there," he said.

And how did it feel having a dinosaur species named after him?

"It was quite good," he said. "There's no money in it though."

https://bbc.in/2I5yRcq

He Jiankui: Baby gene experiment 'foolish and dangerous'

The first people to be gene-edited - a pair of baby twin girls - may have been mutated in a way that shortens life expectancy, research suggests.

By James Gallagher Health and science correspondent, BBC News

Prof He Jiankui shocked the world when he genetically altered the twins to try to give them protection against HIV. But a study in Nature Medicine shows people who naturally have the mutation he was trying to recreate were significantly more likely to die young.

Experts said Prof He's actions were "very dangerous" and "foolish".

What was Prof He trying to do?

Prof He was targeting a gene called CCR5. It is a set of genetic instructions that are important for how the immune system functions. However, they are also the doorway that human immunodeficiency virus (HIV) walks through to infect cells.

Mutations to CCR5 essentially lock the door and give people resistance to HIV. So, Prof He made embryos in an IVF clinic and then used gene-editing technologies on them to alter the CCR5 gene.

The resulting girls - known as Lulu and Nana - were born last year.

Image copyright Getty Images Image caption The human immunodeficiency virus uses CCR5 to gain entry into cells

What does this have to do with life expectancy?

The problem is CCR5 has a bigger role in the body than just making people vulnerable to HIV. It is active in the brain and in fighting off other infections, particularly flu.

The study, at the University of California, Berkeley, looked at nearly 410,000 people in the UK. It showed those who had only the mutated version of CCR5 were 20% more likely to die before they turned 78. "In this case, it is probably not a mutation that most people would want to have," said Prof Rasmus Nielsen, from UC Berkeley. "You are actually, on average, worse off having it."

Fellow researcher Dr Xinzhu Wei said the gene-editing technology, known as Crispr, was still too risky to be using on children.

"The Crispr technology is far too dangerous to use right now for germ-line editing," she said.

What does this mean for the twins?

The implications for Lulu and Nana are still unclear. "It is impossible to predict if the mutations carried by the twin girls will have any effect," said Prof Robin Lovell-Badge, from the Francis Crick Institute. Not everyone who carried the mutations in the study died young but it was more likely. And life expectancy depends on a complex mix of the DNA you are born with and the world you live in.

To further complicate things, Prof He mutated CCR5 in a similar rather than identical way to people who have HIV resistance.

Prof Lovell-Badge said the study "shows once more that He Jiankui was foolish to choose CCR5 to mutate".

What was the reaction to Prof He doing this?

There was universal condemnation by scientists when Prof He made the announcement in November.

Some described the experiment as "monstrous".

And he was criticised for experimenting when the risks to otherwise healthy children were unclear and for acting against Chinese law.

There was also anger because HIV can be treated and there was barely any risk of it being passed from the HIV-positive father to his children. The Chinese authorities investigated and concluded that Prof He had acted illegally in pursuit of "fame and fortune".

Prof He has always defended his experiments and at a summit in Hong Kong said he was "proud" of his gene-editing work.

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For those about to rock: the birthplace of humanity's tool kit found

Stone artefacts from 2.6 million years ago are the earliest *Homo* tools ever found.

Dyani Lewis reports.

Humans are expert tool-makers, and as far back as 2.6 million years ago our stone age relatives were getting there too. That's according to an analysis of 300 stone artefacts – including sharp-edged rock flakes and the rocks they have been chipped from, known as "cores" – published in the journal *PNAS*.

The new trove of artefacts was unearthed in Ethiopia's Afar Basin, a region that rocketed to fame in 1974 when the 3.2-million-year-old remains of our ancient relative "Lucy" (*Australopithecus afarensis*) were discovered.

The new site – known as Bokol Dora 1 (BD 1) – lies just five kilometres away from the location of one of oldest fossil remains of our own genus, *Homo*, a lower jaw that is 2.8 million years old.

Stone artefacts are the best evidence available of the early cognitive abilities of prehistoric humans.

But discoveries in recent years show that other early hominins, lines that pre-dated the *Homo* lineage, got in on the act too.

Primitive stone tools from the Lomekwi 3 site in Kenya, for instance, date to 3.3 million years ago. Modern primates – chimpanzees and capuchin monkeys – are also known to fashion rudimentary tools.

Oldowan tools mark the first technology developed by humanity's distant ancestors. **Wikipedia.org**

But unlike the earlier Lomekwian tools, those from BD 1 show signs of systematic manufacture, says archaeologist David Braun from George Washington University in Washinton DC, US, who spearheaded the excavations and analysis with local archaeologists Niguss Baraki of Addis Ababa University, Blade Engda from the Ethiopian Authority for Research and Conservation of Cultural Heritage, and others.

Braun and his team compared the flakes and cores with stone artefacts from the Lomekwian site and younger locations in Africa.

He initially expected the tools to be intermediate between the older Lomekwian tools, and the more recent "Oldowan" tools used by Homo habilis. Instead, he found that they clearly belonged to the latter group.

"The material from 3.3 million years ago looks a lot more like the materials that we see even made by modern primates," says Braun. He points to capuchin monkeys that "accidentally" make tools.

Lomekwian tools were made by bashing two rocks together to create flakes with sharp edges. The BD-1 tools were, too, but they

show signs that whoever made them seemed to know what they were doing in a more repeatable way, says Braun.

"By 2.6 million years ago, they were beginning to understand the relationship between the folk physics of where to strike something, and how hard to hit it, and what angles to select," he says.

The tool-makers were also aware that not all rocks were equal when it comes to fashioning a blade, however rudimentary.

By combing through ancient cobble beds from the same time and region, Braun and his team found that suitable rocks – predominantly rhyolite – were overrepresented in the tool sample.

"They're specifically selecting those rocks that they can make these tools out of, and even though other rocks are more abundant, they are not selecting those," he says.

Archaeologist Mark Moore from the University of New England in Armidale, Australia, who was not involved in the study, commends the research.

"First-rate fieldwork and analysis like this is crucial for helping us understand what is one of the most important processes in the evolution of our species — the invention of technology," he says.

The BD 1 tools mark a point where the technology is firmly embedded in the culture and continues to improve as time goes on, according to the analysis.

What happened prior to that is still up for debate. Because the tools are so distinct from the Lomekwian ones, Braun suspects that early hominins may have invented tool-making multiple times.

"We tend to think of these things as a sort of trajectory through time, but it is quite possible that there were lots of fits and starts of technology appearing and disappearing and then appearing and disappearing," says Braun.

To really answer the question of whether the BD 1 tools – and later Oldowan artefacts – are improvements on Lomekwian tools, or an entirely independent invention, the intervening archaeological record will need to be filled.

"We really need more sites from that key period 3.3 million years ago, and from the nearly 700,000-year gap between Lomekwi 3 and BD 1," says Moore. "Those sites may exist somewhere, and they hold a key missing part of this technological story."

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'Pumping heart patch' ready for human use

A "pumping" patch containing millions of living, beating stem cells could help repair the damage caused by a heart attack, according to researchers.

Sewn on to the heart, the 3cm (1in) by 2cm patch, grown in a lab from a sample of the patient's own cells, then turns itself into healthy working muscle. It also releases chemicals that repair and regenerate existing heart cells.

Tests in rabbits show it appears safe, Imperial College London experts told a leading heart conference in Manchester.

Patient trials should start in the next two years, the British Cardiovascular Society meeting heard.

A heart attack happens when a clogged artery blocks blood flow to the heart muscle, starving it of oxygen and nutrients. This can damage the heart's pumping power and lead to incurable heart failure. Heart failure affects about 920,000 people in the UK.

Researcher Dr Richard Jabbour said: "One day, we hope to add heart patches to the treatments that doctors can routinely offer people after a heart attack. "We could prescribe one of these patches alongside medicines for someone with heart failure, which you could take from a shelf and implant straight in to a person."

Prof Metin Avkiran, from the British Heart Foundation, which funded the research, said: "Heart failure is a debilitating and life-changing condition with no cure, making everyday tasks incredibly

difficult. "If we can patch the heart up and help it heal, we could transform the outlook for these people."

http://bit.ly/2I3kiWw

Eating Blueberries Daily Reduces Risk of Cardiovascular Disease: Study

Eating one cup (150 g) of blueberries daily reduces the risk of cardiovascular disease by up to 15%, according to a new study.

"Blueberries and other berries should be included in dietary strategies to reduce the risk of cardiovascular disease — particularly among at risk groups," said Professor Aedin Cassidy from the University of East Anglia and colleagues.

The researchers set out to see whether eating anthocyanin-rich blueberries had any effect on metabolic syndrome, a condition that comprises at least three of the following risk factors: high blood pressure, high blood sugar, excess body fat around the waist, low levels of 'good cholesterol' and high levels of triglycerides.

"Previous studies have indicated that people who regularly eat blueberries have a reduced risk of developing conditions including type 2 diabetes and cardiovascular disease," said Professor Cassidy, senior author of the study.

"This may be because blueberries are high in naturally occurring compounds called anthocyanins, which are the flavonoids responsible for the red and blue color in fruits."

"We wanted to find out whether eating blueberries could help people who have already been identified as being at risk of developing these sort of conditions."

The study authors investigated the effects of eating blueberries daily in 138 overweight and obese people, aged between 50 and 75, with metabolic syndrome.

They looked at the benefits of eating 150 gram portions (one cup) compared to 75 gram portions (half a cup).

The participants consumed the blueberries in freeze-dried form and a placebo group was given a purple-colored alternative made of artificial colors and flavorings.

"We found that eating one cup of blueberries per day resulted in sustained improvements in vascular function and arterial stiffness — making enough of a difference to reduce the risk of cardiovascular disease by between 12 and 15%," said study first author Dr. Peter Curtis, also from the University of East Anglia.

"The simple and attainable message is to consume one cup of blueberries daily to improve cardiovascular health."

"Unexpectedly, we found no benefit of a smaller 75 gram (half cup) daily intake of blueberries in this at-risk group. It is possible that higher daily intakes may be needed for heart health benefits in obese, at-risk populations, compared with the general population."

The study was published in the *American Journal of Clinical Nutrition*.

Peter J. Curtis et al. *2019. Blueberries improve biomarkers of cardiometabolic function in participants with metabolic syndrome — results from a 6-month, double-blind, randomized controlled trial.* American Journal of Clinical Nutrition *109 (6): 1535-1545; doi: 10.1093/ajcn/nqy380*

http://bit.ly/2I54VwV

Pathogens may have facilitated the evolution of warm-blooded animals

Fever may be less effective at repelling infections in cold-blooded creatures

Six hundred million years ago, fever appeared in animals as a response to infections: the higher body temperatures optimized their immune systems. At the time, virtually all animal species were cold-blooded. They had to sit in warm patches of habitat for extended periods of time to achieve fever-range body temperatures.

For Michael Logan, a Tupper Fellow at the Smithsonian Tropical Research Institute in Panama (STRI), pathogens may be the reason why warm-blooded creatures first emerged.

At first glance, cold-blooded creatures or 'ectotherms' seem to have it easy. Because they cannot regulate their body temperature internally, they spend 30 times less energy than warm-blooded creatures or 'endotherms' of the same size. So, while mammals and birds are constantly investing their calories in maintaining a high, stable body temperature, reptiles and amphibians can just search for a warm spot in their surrounding environment if they want to get cozy. But if ectothermy is so great, why did mammals and birds develop a different strategy that is so costly?

Over the years, scientists have proposed three different models for why endotherms evolved high, stable body temperatures. One claims that it aids physiological processes; another, that it helps animals maintain activity over longer periods of time; and the third, that it enables parents to take care of precocial offspring. However, none of these models have found strong support and the evolutionary history of endothermy remains somewhat of a mystery.

Although these various hypotheses may have some truth to them, for Logan, the trigger must have been something that profoundly impacted the ability of animals to survive and reproduce, otherwise endothermy would be too costly a strategy and would not be favored by natural selection. In a recent paper, published in the journal Ideas in Ecology and Evolution, he explains this theory.

"My hypothesis is that by keeping their bodies warm at nearly all times, mammals and birds effectively prime their immune systems to withstand virulent pathogens, and that this may be part of the reason the extremely costly strategy of endothermy evolved in the first place," Logan said.

In this context, endothermy may offer critical advantages over ectothermy. The ability to mount a rapid fever response to a pathogen means endotherms are not limited by the thermal variation in their habitats. Meanwhile, cold-blooded creatures depend on external sources of heat to reach fever-like temperatures. They are subject to fluctuations in environmental conditions, and in searching for the ideal microclimate required to initiate fever, they may struggle to forage or mate and may be exposed to predators.

"This hypothesis has emerged from recent discoveries in the fields of immunology and animal physiology, but we still need to rigorously test it with data and experiments," Logan said. "For example, my model predicts that species that maintain the warmest, most stable body temperatures (all else remaining equal) should also experience the highest frequency of disease outbreaks or the most virulent pathogens."

http://bit.ly/2MC0SfJ

Study of marathon runners reveals a ‘hard limit’ on human endurance

Athletes who can run the equivalent of 117 marathons in just months might seem unstoppable. The biggest obstacle, it turns out, is their own bodies.

By Michael Price

A new study quantifies for the first time an unsurpassable “ceiling” for endurance activities such as long-distance running and biking—and it also finds that pregnancy’s metabolic toll resembles that of an ultramarathon.

“It’s very cool data,” says Harvard University evolutionary biologist Daniel Lieberman, who wasn’t involved with work. “It makes a very convincing case that at the extremes of human endurance, there’s a hard limit.”

Physiologists and athletes alike have long been interested in just how far the human body can push itself. When exercising over a few hours, a wealth of evidence suggests most people—and mammals—max out at about five times their basal metabolic rate (BMR), or the amount of energy they expend while they’re at rest. How humans use energy during longer endurance activities is

another question entirely, says Herman Pontzer, an evolutionary anthropologist at Duke University in Durham, North Carolina.

Pontzer saw an opportunity to answer that question when Bryce Carlson, an endurance athlete and former anthropologist at Purdue University in West Lafayette, Indiana, organized the Race Across the USA in 2015. Runners covered 4957 kilometers over the course of 20 weeks in a series of marathons stretching from Los Angeles, California, to Washington, D.C.

To find out how many calories the athletes in the study burned, Pontzer, Carlson, and colleagues replaced the normal hydrogen and oxygen in their drinking water with harmless, uncommon isotopes of those elements—deuterium and oxygen-18. By chemically tracing how these isotopes flush out in urine, sweat, and exhaled breath, scientists can calculate how much carbon dioxide an athlete produces—a measure that directly relates to how many calories they burn.

Pontzer's team measured the initial BMRs of six runners, five men and one woman. Then they collected energy expenditure data over the course of the race to see how many calories they burned per day. The researchers plotted those data over time and analyzed them along with previously collected metabolic data from other endurance events, including triathlons, 160-kilometer ultramarathons, long-distance cycling races like the Tour de France, and Arctic expeditions.

They found that no matter the event, energy expenditure sharply leveled off after about 20 days, eventually plateauing at about 2.5 times an athlete's BMR. At that point, the body is burning calories more quickly than it can absorb food and convert it into energy, representing a biologically determined ceiling on human performance, the researchers report today in *Science Advances*. After an athlete hits this ceiling, their body must dip into fat reserves for energy. "It was just one of those beautiful moments of discovery that as a scientist you just live for," Pontzer says. "We ended up plotting out the very limits of human endurance, the envelope for what humans can do."

Brent Ruby, an exercise physiologist at the University of Montana in Missoula who wasn't involved in the study, says the new findings demonstrate how ultraendurance athletes can expend energy over long periods without losing body weight.

In a second finding, the authors report that human pregnancy—the energy expenditure of which has been measured in earlier studies—demands about the same level of energy as long athletic endurance events. It is also governed by the same metabolic constraints.

"To think about pregnancy in the same terms that we think about Tour de France cyclists and triathletes makes you realize how incredibly demanding pregnancy is on the body," Pontzer says.

Some researchers, including Lieberman, have hypothesized that humans evolved bodies that can run long distances in order to hunt down large, calorie-rich animals, and that those same metabolic adaptations could have allowed human mothers to birth larger babies with bigger brains.

Given that pregnancy and endurance activities operate under the same metabolic rules, it could have been the other way around, Pontzer argues: Perhaps humans evolved to have bigger-brained babies, which then afforded our species more endurance.

On that point, Lieberman isn't convinced. "That's a pretty big leap to make and would need a lot more evidence to support it," he says. "Let's take it one step at a time—just like a marathon."

***Correction, 7 June, 12:20 p.m.:** The original version of this article incorrectly noted that Brent Ruby implied that athletes should load up on fat before endurance events. He actually said that the findings show that athletes' bodies adapt to endurance events so they don't need to dip into their fat stores.*

http://bit.ly/2WUka3R

Human Civilization Will Crumble by 2050 If We Don't Stop Climate Change Now, New Paper Claims

Australian think tank claims the risks of climate change are actually much, much worse than anyone can imagine

By Brandon Specktor, Senior Writer

It seems every week there's a scary new report about how man-made climate change is going to cause the collapse of the world's ice sheets, result in the extinction of up to 1 million animal species and — if that wasn't bad enough — make our beer very, very expensive. This week, a new policy paper from an Australian think tank claims that those other reports are slightly off; the risks of climate change are actually much, much worse than anyone can imagine.

According to the paper, climate change poses a "near- to mid-term existential threat to human civilization," and there's a good chance society could collapse as soon as 2050 if serious mitigation actions aren't taken in the next decade.

Published by the Breakthrough National Centre for Climate Restoration in Melbourne (an independent think tank focused on climate policy) and authored by a climate researcher and a former fossil fuel executive, the paper's central thesis is that climate scientists are too restrained in their predictions of how climate change will affect the planet in the near future.

The current climate crisis, they say, is larger and more complex than any humans have ever dealt with before. General climate models — like the one that the United Nations' Panel on Climate Change (IPCC) used in 2018 to predict that a global temperature increase of 3.6 degrees Fahrenheit (2 degrees Celsius) could put hundreds of millions of people at risk — fail to account for the sheer complexity of Earth's many interlinked geological processes; as such, they fail to adequately predict the scale of the potential consequences. The truth, the authors wrote, is probably far worse than any models can fathom.

How the world ends

What might an accurate worst-case picture of the planet's climate-addled future actually look like, then? The authors provide one particularly grim scenario that begins with world governments "politely ignoring" the advice of scientists and the will of the public to decarbonize the economy (finding alternative energy sources), resulting in a global temperature increase 5.4 F (3 C) by the year 2050. At this point, the world's ice sheets vanish; brutal droughts kill many of the trees in the Amazon rainforest (removing one of the world's largest carbon offsets); and the planet plunges into a feedback loop of ever-hotter, ever-deadlier conditions.

"Thirty-five percent of the global land area, and 55 percent of the global population, are subject to more than 20 days a year of lethal heat conditions, beyond the threshold of human survivability," the authors hypothesized.

Meanwhile, droughts, floods and wildfires regularly ravage the land. Nearly one-third of the world's land surface turns to desert. Entire ecosystems collapse, beginning with the planet's coral reefs, the rainforest and the Arctic ice sheets. The world's tropics are hit hardest by these new climate extremes, destroying the region's agriculture and turning more than 1 billion people into refugees.

This mass movement of refugees — coupled with shrinking coastlines and severe drops in food and water availability — begin to stress the fabric of the world's largest nations, including the United States. Armed conflicts over resources, perhaps culminating in nuclear war, are likely.

The result, according to the new paper, is "outright chaos" and perhaps "the end of human global civilization as we know it."

How can this catastrophic vision of the future be prevented? Only with the people of the world accepting climate change for the

emergency it is and getting to work — immediately. According to the paper's authors, the human race has about one decade left to mount a global movement to transition the world economy to a zero-carbon-emissions system. (Achieving zero-carbon emissions requires either not emitting carbon or balancing carbon emissions with carbon removal.) The effort required to do so "would be akin in scale to the World War II emergency mobilization," the authors wrote.

The new policy paper was endorsed with a foreword by Adm. Chris Barrie, a retired Australian defense chief and senior royal navy commander who has testified before the Australian Senate about the devastating possibilities climate change poses to national security and overall human well-being.

"I told the [Senate] Inquiry that, after nuclear war, human-induced global warming is the greatest threat to human life on the planet," Barrie wrote in the new paper. "Human life on Earth may be on the way to extinction, in the most horrible way."

http://bit.ly/2WteqCy

Diet supplements should never be used by children

Researchers find high number of deaths and hospitalisations linked to supplement use by young people.

Nick Carne reports.

Dietary supplements are a dangerously bad idea for children and young people, a new US study suggests.

Whether used for losing weight, building muscle or boosting energy, they are linked with two to three times more severe medical outcomes than vitamins, according to researchers at the Harvard TH Chan School of Public Health in Boston. Not surprisingly, this has prompted a call for greater efforts to limit their availability to young people, including warnings at point of sale.

Lead author Flora Or says the US Food and Drug Administration (FDA) has issued countless warnings about supplements, yet “we know these products are widely marketed to and used by young people”. “So, what are the consequences for their health? That's the question we wanted to answer."

Or and colleagues looked at reports from between January 2004 and April 2015 in the FDA’s Adverse Event Reporting System (AERS), analysing the relative risk for severe medical events in individuals aged zero to 25 years who used supplements.

They found 977 such events, with about 40% involving severe medical outcomes, including death or hospitalisation.

Supplements sold for weight loss, muscle building, and energy were associated with almost three times the risk of severe medical outcomes compared to vitamins. For supplements sold for sexual function and colon cleansing, it was approximately twice as high.

Senior author Bryn Austin says reputable physicians do not recommend the type of dietary supplements analysed in this study, many of which have been found to be adulterated with prescription pharmaceuticals, banned substances, heavy metals, pesticides, and other dangerous chemicals.

Other studies have linked weight-loss and muscle-building supplements with stroke, testicular cancer and liver damage. “It is well past time for policymakers and retailers to take meaningful action to protect children and consumers of all ages,” Austin adds.

The findings are published in the *Journal of Adolescent Health.*

https://go.nature.com/2ItZl69

Japanese hospital uncovers flood of research ethics violations

In nearly 160 cases, researchers failed to give patients a way to opt out of studies.

Mark Zastrow

A brain and heart hospital and research centre in Japan has found 158 cases of studies being done in violation of ethics standards since 2013.

Hisao Ogawa, the president of the National Cerebral and Cardiovascular Center (NCVC) in Suita, apologized to the people affected and their families at a press conference on 30 May.

An internal investigation found that researchers involved in two cardiac studies said that the research had been approved by an ethics review board when it had not, the NCVC said in a statement. According to the daily newspaper *Mainichi Shimbun*, the researchers told the investigators that they had thought that approval for previous research also applied to those studies.

In a further 156 cases, participants weren't given the option to opt out of a study once they had left hospital. In some of these cases, researchers had wrongly assumed that administrative staff would inform the participants of the procedures to opt out by post or through the institute's website.

The NCVC said that the authors of two papers that resulted from the cardiac studies without ethics approval would be seeking retractions. The institute will also commission an independent investigation and consider disciplinary action, it said in its statement.

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http://bit.ly/2I6sFRj

Rapidly removing fluid from ICU patients in kidney failure linked to increased death risk

The faster fluid is removed using continuous dialysis from patients with failing kidneys, the higher the likelihood they will die in the next several months

PITTSBURGH - The faster fluid is removed using continuous dialysis from patients with failing kidneys, the higher the likelihood they will die in the next several months, according to a study published today in JAMA Network Open by University of Pittsburgh School of Medicine researchers.

Nearly two-thirds of critically ill patients with acute kidney injury have extra fluid accumulating in their bodies, which can put pressure on their lungs and cause injury to other organs. To relieve that pressure, clinicians routinely remove the excess fluid from the blood while performing dialysis in the intensive care unit. But there is no guidance on how fast that fluid should be removed.

"We want to get this excess fluid out of our patients before it causes damage but, in removing it, we're actually causing a controlled loss of fluid that can sometimes cause stress on the heart and lead to dangerously low blood pressure," said lead author Raghavan Murugan, M.D., M.S., associate professor in Pitt's Department of Critical Care Medicine and UPMC physician. "So the question--how rapidly to remove fluid?--has been asked in the critical care community for many years, but there's been no good answer."

Previous studies in outpatients who are not critically ill found that routine dialysis--a procedure to remove waste, toxins, salt and extra water from the blood of people whose kidneys have failed--when performed too quickly, is associated with increased risk of death.

Murugan partnered with senior author Rinaldo Bellomo, M.D., Ph.D., a professor of intensive care medicine at the University of Melbourne in Australia to find out if that finding extends to critically ill patients. Their team examined data from 1,434 patients that Bellomo had previously collected for the Randomized Evaluation of Normal vs. Augmented Level of Renal Replacement Therapy trial, which was conducted between December 30, 2005 and November 28, 2008 in 35 intensive care units in Australia and New Zealand.

The research team found that for every 0.5 milliliter increase in fluid removed per kilogram of the patient's weight per hour (0.5 mL/kg/hr), their risk of death increases. That translates to a 51% to 66% higher risk of death in the next three months for critically ill patients for whom excess fluid is removed at a rate greater than

1.75 mL/kg/hr, compared to patients for whom excess fluid is removed at a rate less than 1.01 mL/kg/hr.

For the average older American male, that's a difference of removing a gallon of fluid in about one day versus a little under two days.

Murugan is quick to point out that his analysis shows association, not causation; until a clinical trial is performed to specifically test the effects of removing fluid faster versus slower, he cannot say for sure that removing fluid slowly is better for the patient. And, in some cases, such as imminent heart failure, Murugan says a more rapid removal of fluid might be warranted to prevent sudden death.

"You have to balance the pros and the cons, and decide how fast to remove fluid based on your patient's clinical condition," said Murugan, who also is a member of Pitt's Clinical Research, Investigation, and Systems Modeling of Acute Illness Center and the Center for Critical Care Nephrology. "But in a patient where I can't find an immediate need to get fluid out quickly, I'll be removing fluid at a slower rate until we get definitive results and guidance from a clinical trial."

Co-authors on this research are Samantha J. Kerti, M.S., Chung-Chou H. Chang, Ph.D., Gilles Clermont, M.D., M.Sc., and John A. Kellum, M.D., M.C.C.M., all of Pitt; Martin Gallagher, M.D., Ph.D., of The George Institute for Global Health and University of Sydney, in Australia; and Paul M. Palevsky, M.D., of Pitt and the VA Pittsburgh Healthcare System.

This research did not receive outside funding.

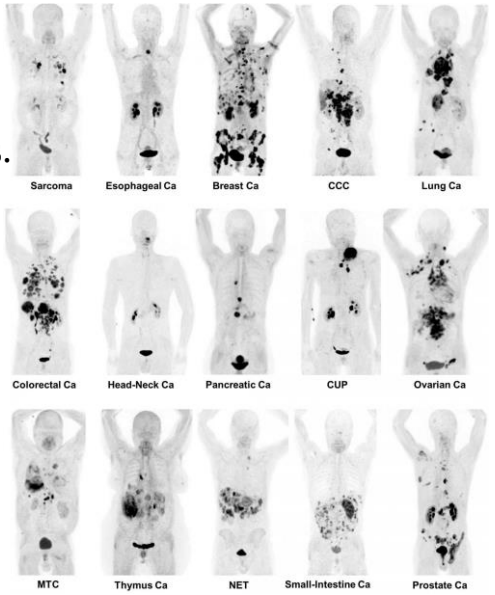
http://bit.ly/2WtlXsy

New radiotracer can identify nearly 30 types of cancer

Future potential for therapeutic application

A novel class of radiopharmaceuticals has proven effective in non-invasively identifying nearly 30 types of malignant tumors, according to research published in the June issue of The Journal of Nuclear Medicine. Using 68Ga-FAPI positron emission tomography/computed tomography (PET/CT), researchers were able to image a wide variety of tumors with very high uptake and image contrast, paving the way for new applications in tumor characterization, staging and therapy.

The 68Ga-FAPI radiotracer targets cancer-associated fibroblasts, which can contribute up to 90 percent of a tumor's mass. Many cancer-associated fibroblasts differ from normal fibroblasts by their specific expression of the fibroblast activation protein, or FAP. FAP-specific inhibitors were first developed as conventional anticancer drugs; now they have been advanced into tumor-targeting radiopharmaceuticals.



Maximum-intensity projections of 68Ga-FAPI PET/CT in patients reflecting 15 different histologically proven tumor entities (sorted by uptake in descending order). Ca = cancer; CCC = cholangiocellular carcinoma; CUP = carcinoma of unknown primary; MTC = medullary thyroid cancer; NET = neuroendocrine tumor. **Kratochwil C, Flechsig P, Lindner Y, et al.**

In the retrospective study, researchers used PET/CT to image 80 patients with 28 different kinds of cancer, aiming to quantify 68Ga-FAPI uptake in primary, metastatic or recurring cancers. All patients were referred for experimental diagnostics by their treating oncologists because they were facing an unmet diagnostic challenge that could not be solved sufficiently with standard methods. The injected activity for the 68Ga-FAPI examinations was 122-312 MBq, and the PET scans were initiated one hour after injection. Tumor tracer uptake was measured by SUVmean and SUVmax.

All patients tolerated the examination well. As the overall SUV mean, median and range of 68Ga-FAPI in primary tumors and

metastatic lesions did not differ significantly, researchers analyzed all results in one group.

The highest average SUVmax (SUVmax >12) was found in sarcoma, esophageal, breast, cholangiocarcinoma and lung cancer. The lowest 68Ga-FAPI uptake (average SUVmax <6) was observed in pheochromocytoma, renal cell, differentiated thyroid, adenoid cystic and gastric cancers. The average SUVmax of hepatocellular, colorectal, head-neck, ovarian, pancreatic and prostate cancer was intermediate (SUVmax 6-12). In addition, the tumor-to-background ratios were more than three-fold in the intermediate group and more than six-fold in the high-intensity uptake group, resulting in high image contrast and excellent tumor delineation.

"The remarkably high uptake of 68Ga-FAPI makes it useful for many cancer types, especially in cases where traditional 18F-FDG PET/CT faces limitations," said Uwe Haberkorn, MD, professor of nuclear medicine at the University Hospital of Heidelberg and the German Cancer Research Center in Heidelberg, Germany. "For example, low-grade sarcomas generally have a low uptake of 18F-FDG, causing an overlap between benign and malignant lesions. In breast cancer, 18F-FDG PET/CT is commonly used in recurrence, but not generally recommended for initial staging. And for esophageal cancer, 18F-FDG PET/CT often has only a low to moderate sensitivity for lymph node staging."

In contrast to 18F-FDG PET/CT, 68Ga-FAPI PET/CT can be performed without specific patient preparation such as fasting or recline during uptake time. This is a potential operational advantage for 68Ga-FAPI PET/CT, as it stands to improve patient comfort and accelerate work-flow.

According to Haberkorn, 68Ga-FAPI offers the possibility of a theranostic approach in the future. "Cancer associated fibroblasts have been described as immunosuppressive and as conferring resistance to chemotherapy, which makes them attractive targets for combination therapies," he said. "Because the 68Ga-FAPI tracers contain the universal DOTA-chelator, it is possible to label them with therapeutic radionuclides whose half-life fits to the tumor retention time of the carrier molecule. Since the tracer has been observed to accumulate in several important tumor entities, there may be a huge field of therapeutic application to be evaluated in the future." *This study was made available online in April 2019 ahead of final publication in print in June 2019. The authors of "68Ga-FAPI PET/CT: Tracer Uptake in 28 Different Kinds of Cancer" include Clemens Kratochwil, Thomas Lindner, Labidi Abderrahim, Walter Mier, Hendrik Rathke, Manuel Röhrich and Frederik L. Giesel, Department of Nuclear Medicine, University Hospital Heidelberg, Heidelberg, Germany; Paul Flechsig, Department of Nuclear Medicine, University Hospital Heidelberg, Heidelberg, Germany, and Translational Lung Research Center Heidelberg, German Center for Lung Research, Heidelberg, Germany; Annette Altmann, Department of Nuclear Medicine, University Hospital Heidelberg, Heidelberg, Germany, and Clinical Cooperation Unit Nuclear Medicine, German Cancer Research Center, Heidelberg, Germany; Sebastian Adeberg, Department of Radiation Oncology, University Hospital Heidelberg, Heidelberg, Germany, and Heidelberg Institute for Radiation Oncology, Heidelberg, Germany; Hauke Winter, Translational Lung Research Center Heidelberg, German Center for Lung Research, Heidelberg, Germany, and Department of Surgery, Thoraxklinik at University Hospital Heidelberg, Heidelberg, Germany; Peter K. Plinkert, Department of Otorhinolaryngology, Head and Neck Surgery, University Hospital Heidelberg, Heidelberg, Germany; Frederik Marme, Department of Obstetrics and Gynecology, University Hospital Heidelberg, Heidelberg, Germany, and Department of Obstetrics and Gynecology, University Hospital Mannheim, Mannheim, Germany; Matthias Lang, Department of Surgery, University Hospital Heidelberg, Heidelberg, Germany; Hans Ulrich Kauczor, Translational Lung Research Center Heidelberg, German Center for Lung Research, Heidelberg, Germany, and Department of Diagnostic and Interventional Radiology, University Hospital Heidelberg, Heidelberg, Germany; Dirk Jäger, Department of Medical Oncology and Internal Medicine VI, National Center for Tumor Diseases, University Hospital Heidelberg, Heidelberg, Germany, and Clinical Cooperation Unit Applied Tumor Immunity, German Cancer Research Center, Heidelberg, Germany; Jürgen Debus, Department of Radiation Oncology, University Hospital Heidelberg, Heidelberg, Germany, Heidelberg Institute for Radiation Oncology, Heidelberg, Germany, and Clinical Cooperation Unit Radiation Oncology, German Cancer Research Center, Heidelberg, Germany; and Uwe Haberkorn, Department of Nuclear Medicine, University Hospital Heidelberg, Heidelberg, Germany, Translational Lung Research Center Heidelberg, German Center for Lung Research, Heidelberg, Germany, and Clinical Cooperation Unit Nuclear Medicine, German Cancer Research Center, Heidelberg, Germany.*

https://nyti.ms/31mEp9R

Who Were the Ancestors of Native Americans? A Lost People in Siberia, Scientists Say

Genetic analysis of ancient teeth and bones suggests Native Americans largely descend from a vanished group called the Ancient Paleo-Siberians.

By Carl Zimmer

A skeleton in Siberia nearly 10,000 years old has yielded DNA that reveals a striking kinship to living Native Americans, scientists reported on Wednesday. The finding, published in the journal Nature, provides an important new clue to the migrations that first brought people to the Americas.

Scientists discovered human baby teeth at a site on the Yana River in Siberia. The DNA they contained is the oldest genetic material yet retrieved from Siberia. **Sikora et al.**

"In terms of peopling of the Americas, we have found close to the missing link," said Eske Willerslev, a geneticist at the University of Copenhagen and a co-author of the new paper. "It's not the direct ancestor, but it's extremely close."

Decades of research by archaeologists and linguists suggests that people first came to the Americas at the end of the last ice age, by 14,500 years ago. The route, most experts believe, was a land bridge that connected Alaska and Siberia across what is now the Bering Sea.

But Siberia is a vast land that has been home to many cultures over thousands of years. Researchers turned to DNA in hopes of clarifying which of these were the ancestors of Native Americans.

Early studies were inconclusive: Native Americans didn't seem to have many genetic links to any living group of Siberians. Dr. Willerslev suspected that the DNA of ancient Siberians could help solve the puzzle.

Around the world, he and his colleagues have found, the people who live in a place today often have little genetic connection to those who lived there thousands of years ago.

The history of Siberia runs surprisingly deep. After humans evolved in Africa, they started moving to other continents about 70,000 years ago. About 45,000 years ago, humans had reached the northern edge of Siberia, where they hunted mammoths and other big game.

Vladimir V. Pitulko, an archaeologist at the Russian Academy of Sciences, and his colleagues provided Dr. Willerslev with two human baby teeth from a site in Siberia called Yana. His team extracted DNA from both teeth, which turned out to come from two boys.

The teeth are 31,600 years old, making the DNA they contain the oldest human genetic material retrieved from Siberia.

When Dr. Willerslev and his colleagues compared genetic variants in the Yana DNA with living and ancient people, they found that the Siberian boys belonged to a previously unknown population. The scientists call them the Ancient North Siberians.

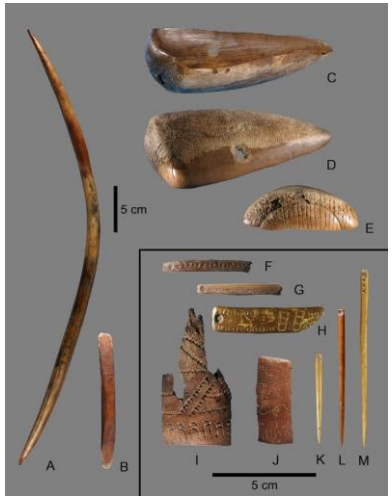
Most of their ancestry can be traced back to the early migration out of Africa — in particular, to people who would eventually spread into Europe.

Several thousand years before the Yana boys lived, the Ancient North Siberians encountered people more closely related to East Asians. People from the two populations interbred, and as a result, the Yana boys inherited a mix of the two ancestries.

To their surprise, however, the geneticists could not find any living people with significant Ancient North Siberian ancestry.

"The first people in northeastern Siberia are a people that we didn't know, and they're not Native American ancestors," Dr. Willerslev said.

What happened to the Ancient North Siberians? One clue emerged from a fragment of a skull that Dr. Pitulko and his colleagues provided Dr. Willerslev. These remains, dating back 9,800 years, were found at a site near Yana called Kolyma.



Artifacts recovered from the Yana site. **Sikora et al.**

Dr. Willerslev's team found DNA in the Kolyma skull as well. A small fraction of that individual's ancestry came from Ancient North Siberians. But most of it came from a new population. Dr. Willerslev and his colleagues call them the Ancient Paleo-Siberians.

The DNA of the Ancient Paleo-Siberians is remarkably similar to that of Native Americans. Dr. Willerslev estimates that Native Americans can trace about two-thirds of their ancestry to these previously unknown people.

One reason that the Ancient Paleo-Siberians were unknown until now is that they were mostly replaced by a third population of people with a different East Asian ancestry. This group moved into Siberia only in the past 10,000 years — and they are the progenitors of most living Siberians.

"It might have been cold and windy, but it was really rich in resources like large mammals and people wanted to get up there," Dr. Willerslev said.

The Kolyma individual lived long after the origin of the Native American branch. Dr. Willerslev estimates that the ancestors of Native Americans and Ancient Paleo-Siberians split 24,000 years ago.

The story gets more complicated: Shortly after that split, the ancestors of Native Americans encountered another population with genetic ties to Europe. All living Native Americans carry a mixture of genes from these two groups.

The new study can't pinpoint exactly where Native Americans emerged from the meeting of those two peoples. The ice age was at its peak 24,000 years ago, and so different populations across Siberia and surrounding regions may have retreated into refuges where wild game still survived.

Anne Stone, an anthropological geneticist at Arizona State University who was not involved in the new study, speculated that the Native American population may have emerged in one such refuge on the land bridge that linked Siberia and Alaska between about 34,000 and 11,000 years ago.

But testing that idea will be hard, she warned. "I think it's going to be frustratingly slow," she said. "Finding human remains of this age is truly daunting."

Making the task even more difficult is the fact that melting glaciers drowned the land bridge at the end of the ice age, submerging any human remains that might hold more DNA.

Yet the disappearance of the land bridge did not stop the movement of people between the continents. Later waves of people moved across the Bering Sea.

Teasing apart this traffic is proving difficult for scientists — and has led to debates about how the migrations shaped the origins of living Native Americans.

In its research on ancient DNA, Dr. Willerslev's team found evidence that a second wave of Ancient Paleo-Siberians reached Alaska sometime between 9,000 and 6,000 years ago. They made contact with Native Americans there and interbred.

Dr. Willerslev argues that some living Native Americans have inherited this extra Ancient Paleo-Siberian ancestry. These people, including tribes in Alaska, Canada and the Southwest, all speak a family of languages called NaDene.

But in a separate study, a team headed by Stephan Schiffels of the Max Planck Institute for the Science of Human History in Germany has come to a different conclusion. That team's analysis, also published Wednesday in Nature, traces the ancestry of NaDene speakers to an enigmatic people called the Paleo-Eskimos.

Archaeologists have known about Paleo-Eskimos for years, thanks to their distinctive tools and artifacts. They first emerged on the Arctic fringe of Siberia and Canada about 5,000 years ago, and eventually spread all the way to Greenland.

But signs of these people vanish around 1,000 years ago.

In 2010, Dr. Willerslev and his colleagues sequenced the genome of a 4,000-year-old Paleo-Eskimo from Greenland. They found that he had no genetic connection to the Inuit who live in Greenland today.

To carry out a new study on Paleo-Eskimos, Dr. Schiffels and his colleagues gained permission from tribes in Alaska and Canada to get new samples of DNA from both living people and ancient skeletons.

Their analysis indicates that after Paleo-Eskimos came to Alaska about 5,000 years ago, they split into three groups. "It's a complicated sequence of mixtures and movements," Dr. Schiffels said.

One group spread along the empty Arctic coastline until they reached Greenland. A second group moved into Alaska, where they encountered people whose ancestors had come from Siberia some 10,000 years earlier. They interbred, and NaDene speakers carry this mixed ancestry today.

Dr. Schiffels and his colleagues argue that the third group encountered another group of Native Americans on the coast of Alaska and interbred with them. These people are the ancestors of Inuits and Aleuts.

But some of them also traveled back across the Bering Strait to Siberia. And from there, about 1,000 years ago, yet another wave of people returned to North America, where they spread through the Arctic and replaced the original Paleo-Eskimos of Greenland.

Dr. Schiffels wasn't surprised that he and Dr. Willerslev came to different conclusions about such intricate migrations.

"In the next couple weeks, I think our team will analyze their data, and their team will analyze our data," Dr. Schiffels said. "I don't know whether there will be a big eureka moment then."

Dr. Willerslev hoped the new research spurred more searches for ancient DNA in Siberia and Alaska.

The migration that brought the ancestors of living Native Americans into the Americas might not have been the first. It is possible, Dr. Willerslev speculated, that the Ancient North Siberians got to Alaska or Canada thousands of years earlier.

"It opens the question, 'Should we dig deeper for older sites?'" said Dr. Willerslev. "And now we know what to look for."

http://bit.ly/2F25h5x

Millions of cardiovascular deaths attributed to not eating enough fruits and vegetables

Study tracks toll of suboptimal fruit and vegetable intake by region, age and gender

Baltimore - Preliminary findings from a new study reveal that inadequate fruit and vegetable consumption may account for millions of deaths from heart disease and strokes each year. The study estimated that roughly 1 in 7 cardiovascular deaths could be attributed to not eating enough fruit and 1 in 12 cardiovascular deaths could be attributed to not eating enough vegetables.

Low fruit intake resulted in nearly 1.8 million cardiovascular deaths in 2010, while low vegetable intake resulted in 1 million deaths,

according to researchers. Overall, the toll of suboptimal fruit intake was almost double that of vegetables. The impacts were most acute in countries with the lowest average intakes of fruits and vegetables.

"Fruits and vegetables are a modifiable component of diet that can impact preventable deaths globally," said lead study author Victoria Miller, a postdoctoral researcher at the Friedman School of Nutrition Science and Policy at Tufts University. "Our findings indicate the need for population-based efforts to increase fruit and vegetable consumption throughout the world."

Miller will present the research findings at Nutrition 2019, the American Society for Nutrition annual meeting, held June 8-11, 2019 in Baltimore.

Fruits and vegetables are good sources of fiber, potassium, magnesium, antioxidants and phenolics, which have been shown to reduce blood pressure and cholesterol. Fresh fruits and vegetables also improve the health and diversity of good bacteria in the digestive tract. People who eat more of these foods also are less likely to be overweight or obese, lowering their risk of cardiovascular disease.

"Global nutrition priorities have traditionally focused on providing sufficient calories, vitamin supplementation and reducing additives like salt and sugar," said senior study author Dariush Mozaffarian, dean of the Friedman School of Nutrition Science and Policy at Tufts University. "These findings indicate a need to expand the focus to increasing availability and consumption of protective foods like fruits, vegetables and legumes--a positive message with tremendous potential for improving global health."

Based on dietary guidelines and studies of cardiovascular risk factors, the researchers defined optimal fruit intake as 300 grams per day, equivalent to roughly two small apples. Optimal intake of vegetables, including legumes, was defined as 400 grams per day, equivalent to about three cups of raw carrots.

The researchers estimated average national intakes of fruit and vegetables from diet surveys and food availability data representing 113 countries (about 82 percent of the world's population), then combined this information with data on causes of death in each country and data on the cardiovascular risk associated with inadequate fruit and vegetable consumption. The work is part of the Global Dietary Database project funded by the Bill & Melinda Gates Foundation.

Based on data from 2010, the scientists estimated that suboptimal fruit consumption results in nearly 1.3 million deaths from stroke and more than 520,000 deaths from coronary heart disease (narrowing of the heart's arteries) worldwide each year. Suboptimal vegetable consumption was estimated to result in about 200,000 deaths from stroke and more than 800,000 deaths from coronary heart disease.

The impact of inadequate fruit and vegetable intake was greatest in countries with the lowest fruit and vegetable consumption. Countries in South Asia, East Asia and Sub-Saharan Africa had low fruit intake and high rates of associated stroke deaths. Countries in Central Asia and Oceania had low vegetable intake and high rates of associated coronary heart disease.

In the United States, suboptimal vegetable intake may account for 82,000 cardiovascular deaths while suboptimal fruit intake accounted for 57,000 deaths. Cardiovascular disease is the number one cause of death in the United States and worldwide.

By age group, suboptimal fruit and vegetable intake had the greatest perceived proportional impact on cardiovascular disease deaths among younger adults. By gender, suboptimal fruit and vegetable intake had the greatest proportional impact on cardiovascular disease deaths in men, likely because women tend to eat more fruits and vegetables, Miller noted.

https://nyti.ms/2KFVm9e

The Vampire Birds of the Galápagos Have Fascinating Inner Lives

Yes, there is such a thing as a vampire finch.

By Joshua Sokol

For half the year, a little brown bird on the northernmost islands of the Galápagos uses its wickedly sharp beak to pick at seeds, nectar and insects. But when the climate dries out, it drinks blood.

A vampiric finch drinking the blood of a Nazca booby. The finches only resort to their vampiric diet in lean times, and when they do, they put themselves at risk. **Jaime Chaves**

Yes, there is such a thing as a vampire finch.

Yes, it is what it sounds like.

Galápagos finches have been used since Darwin's time to illustrate evolution in action. Even among them, Geospiza septentrionalis is an outlier, one of the few birds in the world to intentionally draw and drink blood. And the species is only found on Wolf and Darwin islands, two of the most remote and off-limits places in the entire archipelago.

The vampire finch has a method. First, one bird hops on the back of a resting Nazca booby, pecks at the base of the seabird's wing, and drinks. Blood stains the booby's white feathers.

Other finches crowd around to wait their turn, or to watch and learn. Because adult boobies can fly away, the attacks are almost never fatal. The only casualties are chicks that flee from the finches on foot and, unable to find their way back, starve.

Drinking blood is an unusual diet, and research published last year showed that vampire finches have evolved specialized bacteria in their guts to aid digestion. Even more surprising, according to a paper this week in the journal Philosophical Transactions of the Royal Society B, is that some of these bacteria are similar to ones found in the vampire bats of Central and South America.

Se Jin Song, a biologist at the University of California San Diego and the study's lead author, had previously studied the convergent evolution of gut bacteria. Do disparate animals with the equivalent of fad diets — eating only ants and termites, for instance — develop similar gut microbiota over evolutionary time?

Vampire finches, which were first spotted in 1964, provided Dr. Song with a chance to look across the guts of blood-drinkers from different branches of the tree of life. "When I found out about vampire finches I was pretty shocked," she said.

Finches line up to drink a booby's blood. **Jaime Chaves**

Blood-drinking finches don't have it easy. They only resort to their vampiric diet in lean times, and blood is dangerously high in salt and iron — and low in essential nutrients such as B vitamins. Vampire bats face the same dietary challenges.

Dr. Song already had collected data on vampire bats. But to compare these animals to the birds, she had to turn to colleagues working in the Galápagos, who collected samples of vampire-finch poop.

When Dr. Song's team compared the bacterial genomes in vampire finch poop to the bacteria in the guts of vampire bats, they found few close similarities. But as the team showed in their paper, the two gut microbiomes did have one ingredient in common that could help with digesting blood: high levels of Peptostreptococcaceae, a group of bacteria thought to help process sodium and iron.

Given these bats and birds followed very different evolutionary paths on the way to their blood-drinking lifestyle, "it was still

interesting that we were able to find something that they did share," Dr. Song said.

"The analyses are done very well," said Rosemary and Peter Grant, biologists at Princeton University, in an email. The two have been studying Galápagos finches since the 1970s.

They've also seen another strange extension of the same feeding habits, they said. "Ground finches are sometimes observed drinking blood from the placenta of a sea-lion that has just given birth."

Back on the Galápagos, Dr. Song's co-authors, Jaime Chaves, of the University of San Francisco de Quito, in Ecuador, and Daniel Baldassare, a fellow biologist, are testing whether the finches have also evolved any of the pain-numbing or anti-clotting proteins that vampire bats use on their victims.

Dr. Chaves still marvels at the "privilege" of seeing vampire finches in the act.

"It is one of the most rewarding things for any scientist to be able to witness such unique behavior," he said.

https://wb.md/2ICvYyS

Terrifying Complications in 20 Year Olds With Type 2 Diabetes

Young people who were diagnosed with type 2 diabetes in their early teens had an "alarming" high rate of diabetes-associated complications by the time they were in their mid-20s, in new research.

Marlene Busko

SAN FRANCISCO — Moreover, among more than 500 young participants in the Longitudinal Outcomes in Youth With Type 2 Diabetes (TODAY-2) study, five died of various causes, mostly related to their diabetes within about 7.5 years of being diagnosed.

"Cardiovascular risk factors are highly prevalent in the population, target organ damage is evident, and serious cardiovascular events are occurring at rates unexpected for age [around mid-20s]," Philip S. Zeitler, MD, PhD, professor of pediatrics-endocrinology, University of Colorado School of Medicine, Aurora, lead investigator of the TODAY studies, concluded during a press briefing here at the American Diabetes Association (ADA) 2019 Scientific Sessions.

In addition, a number of the girls subsequently became pregnant — pregnancy complications were exceptionally high as was neonatal morbidity, compared with background rates for girls of the same age in the general population.

"The bottom line," Zeitler told *Medscape Medical News*, "is that many of these kids have a very rapid course both in terms of loss of glycemic control as well as development of complications."

"So as opposed to the usual pediatric approach of 'Well, let's hold off and not give additional medications'...I think we need to recognize that, in fact, in these younger kids we probably need even more aggressive management than many adults with type 2 diabetes."

"They have more aggressive disease and they're going to be living with the burden of cardiovascular disease hopefully for 50 years, so I think the take-home message is we need not hesitate to treat these kids aggressively."

The press briefing moderator, Alvin C. Powers, MD, Vanderbilt University Medical Center, Nashville, Tennessee, agreed that the findings are extremely distressing.

No one would have expected these rates of eye, heart, nerve, kidney, and pregnancy complications within a relatively short duration of diabetes, he told *Medscape Medical News*.

"It's very alarming about their health in the next 10 or 15 years," he said, "because we don't have good therapy for that and we don't [quite] know what to do."

The five deaths were from myocardial infarction, renal failure, sepsis, post-operative cardiac arrest, and an overdose, said Zeitler.

And just in the previous week, one of the study participants at their center who was just 26 years old needed triple heart bypass surgery.

"Taken together," he summarized, "these rates illustrate the serious personal and public health circumstances as these young adults enter what should be the most productive period of their lives."

Certainly, the course of type 2 diabetes diagnosed in youth is different from that diagnosed in adults, he stressed. "Research is urgently needed to better understand the reasons for the more serious trajectory in youth-onset type 2 diabetes," he said.

Heart, Kidney, Eye, Nerve, and Pregnancy Complications

Zeitler explained that the original TODAY trial enrolled 699 adolescents age 10 to 17 (mean age, 14) who were newly diagnosed with type 2 diabetes between 2004 to 2011 at 15 centers.

The participants were racially and ethnically diverse — Hispanic (40%), black (33%), white (21%), or other race/ethnicity (7%) — and two thirds were female.

The results of TODAY, published in the *New England Journal of Medicine* in 2012, showed that type 2 diabetes "was more aggressive in kids than in adults" and that the participants had a rapid loss of beta-cell function.

When the TODAY study ended in 2011, 572 participants who were a mean age of 18 entered phase 1 of the TODAY-2 follow-up study at the same study sites, which lasted 3 years.

Then 517 participants who were a mean age of 21 in 2014 stayed on in phase 2 of the TODAY-2 study during which they received care in the community.

Now in 2019, the participants are a mean age of 25 and have had type 2 diabetes for a mean of 7.5 years, and in some cases, up to 12 years.

On average, at the start of the TODAY study, participants had a body mass index (BMI) of 34.9 kg/m^2 and an HbA_{1c} of 6.0%.

At the start of TODAY-2, they had a BMI of 36.3 kg/m^2 and an HbA_{1c} of 9.3%.

The rates of complications increased steadily over the years following the initial diagnosis of youth-onset type 2 diabetes.

During the up to 12 years of follow-up, the cumulative incidence of elevated LDL cholesterol increased from 3% to 26%, and the cumulative incidence of hypertension increased from 20% to 55%.

Echocardiography performed at the end of the TODAY study and again in TODAY-2 detected abnormal results in 30% of the participants.

During follow-up there were 38 adjudicated cardiovascular events — arrhythmias, myocardial infarctions, heart failure, left ventricular dysfunction, deep vein thrombosis, vascular insufficiency, strokes, or transient ischemic attacks — in 19 patients, for a rate of 6.2 cardiovascular events/1000 patients/year.

The prevalence of abnormal albumin excretion increased from 8% at baseline to 42%, and the prevalence of hyperfiltration increased from 12% to 55%.

There were four adjudicated renal events: two patients had both chronic kidney disease and end-stage kidney disease, equal to 0.7 kidney disease events/1000 patients/year.

And among the 370 participants who had fundus photos taken in 2011 and 2018, there was "substantial" progression of diabetic retinopathy.

For example, 14% of TODAY participants had mild nonproliferative diabetic retinopathy (NPDR), but about 6 years later, 22% of participants in TODAY-2 had mild NPDR.

None of the patients in TODAY had macular edema, but 4% of patients in TODAY-2 developed it.

There were 142 adjudicated eye events — NPDR, proliferative diabetic retinopathy, macular edema, cataracts, and glaucoma — equal to 15.5 eye disease events/1000 patients/year.

Similarly, there were 14 adjudicated neuropathy events in 12 patients, equal to 2.3 neuropathy events/1000 patient-years, said Zeitler.

The prevalence of diabetic neuropathy, determined by an abnormal monofilament test, rose to 8% by year 12.

Diabetic retinopathy and neuropathy were more prevalent among participants who did not maintain glycemic control.

Disturbing Pregnancy, Maternal, and Neonatal Outcomes

From 2005 to 2019 there were 236 pregnancies with known outcomes among about 350 girls and young women.

Of these pregnancies, 11.9% ended in a miscarriage (compared with a national rate of 10%-15%), 3.8% of babies were stillborn (compared with 0.4%), and 23.7% of babies were premature (compared with 6.9%- 9.9%).

Babies' birth weights were also skewed, with 15.9% have a very low birth weight (compared with 8.3%), and conversely, 18.9% had macrosomia (birth weight > 4000 g) compared with 8.2% in the general population.

And 28.7% of babies had neonatal hypoglycemia (compared with 2.1%), 14.9% were in respiratory distress (7%), and 8.5% had a cardiac anomaly versus a rate of 1% in the general population.

In addition, 35.6% of the girls were hospitalized for maternal complications compared to 14% in the general population: 18.1% developed preeclampsia and 37.5% had maternal hypertension.

"The very high rates of maternal and offspring complications of pregnancy are disturbing," said Zeigler.

He said the TODAY researchers will be following the offspring of these girls to chart their progress.

The current study helped to inform new guidelines for managing patients with youth-onset type 2 diabetes, which acknowledge that the disease in youth is different; these were issued by ADA in December 2018, he concluded.