http://wp.me/p3Ir6n-bZ7

This Prehistoric Human Ancestor Was All Mouth

About 540 million years ago, our ancestors were insignificant creatures no more than a millimeter in size.

By Ben Guarino, WASHINGTON POST, 9/5/2017

They wriggled around in the sediments of shallow seas, gulped grey into their minuscule, bagpike bodies and expelled the water through cone-shaped spouts around their mouths.

Animals this small do not fossilize well, which is why this stage of the distant evolutionary past is so little known. A cache of 45 individuals has now been unearthed in Shaanxi Province, in central China. They are described in the Monday issue of the journal Nature by a team led by Jian Han of Northwest University in Xi'an, China.

An artist's impression of Saccorhytus, the oldest known members of an ancient group called deuterostomes. **Credit Jian Han, Northwest University, China**

The creatures are the oldest known members of an ancient group called deuterostomes, said Simon Conway Morris, a paleontologist at Cambridge University in England and a member of the team. Deuterostomes, which lie pretty close to the base of the family tree of all animals, are ancestral not just to humans but to a wide array of animals ranging from sea urchins and starfish to the vast family of vertebrates.

The deuterostomes, a name that means "mouth second" in Greek, were so called by zoologists to distinguish them from the protostomes, or "mouth firsters," the other members of a vast group of animals with bilateral symmetry. In the early embryo — a sphere of cells formed shortly after the egg is fertilized — the protostomes form the mouth first, anus second. The deuterostomes do it the other way round.

But strangely, the new deuterostome fossils seem to have no anus, presumably using the mouth for evacuation. At least the researchers cannot see one. "Our material is generally crushed, and despite the superb preservation we might have overlooked the evidence," Dr. Conway Morris said.

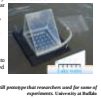
The fossils were found in rock strata, stated to be some 540 million years old in a news release issued by St. John's College, Cambridge, of which Dr. Conway Morris is a fellow. The release describes the fossils as "the earliest known prehistoric ancestor of humans," referring to their status as the earliest known deuterostomes. Although slightly older animal fossils are known, they lie on branches of the tree of life that do not lead to humans.

http://bit.ly/2k2mJ2

Move over Bear Grylls! Academics build ultimate solar-powered water purifier

The device could aid people lacking drinking water and those affected by natural disasters

BUFFALO, N.Y. – You've seen Bear Grylls turn foul water into drinking water with little more than sunlight and plastic. Now, academics have added a third element – carbon-dipped paper – that may turn this survival tactic into a highly efficient and inexpensive way to turn saltwater and contaminated water into potable water for personal use.



This is a floating solar still prototype that researchers used for some of experiments. **University at Buffalo**

The idea, which could help address global drinking water shortages, especially in developing areas and regions affected by natural disasters, is described in a study published online today (Jan. 30, 2017) in the journal Global Challenges.

"Using extremely low-cost materials, we have been able to create a system that makes near maximum use of the solar energy during evaporation. At the same time, we are minimizing the amount of heat loss during this process," says lead researcher Qiaoqiang Gan, PhD, associate professor of electrical engineering in the University at Buffalo School of Engineering and Applied Sciences.

Additional members of the research team are from UB's Department of Chemistry, Fudan University in China, the University of Wisconsin-Madison and the lab of Gan, who is a member of UB's New York State Center of Excellence in Materials Informatics and UB's RENEW Institute, an interdisciplinary institute dedicated to solving complex environmental problems.

Solar vapor generator

To conduct the research, the team built a small-scale solar still. The device, which they call a "solar vapor generator," cleans or desalinates water by using the heat converted from sunlight. Here's how it works: The sun evaporates the water. During this process, salt, bacteria or other uncounted elements are left behind as the liquid moves into a gaseous state. The water vapor then cools and returns to a liquid state, where it is collected in a separate container without the salt or contaminants.

"People lacking adequate drinking water have employed solar stills for years, however, these devices are inefficient," says Haomin Song, PhD candidate at UB and one of the study's leading co-authors. "For example, many devices lose valuable heat energy due to heating the bulk liquid during the *evaporation* process. Meanwhile, systems that require optical concentrators, such as mirrors and lenses, to concentrate the sunlight are costly."

The UB-led research team addressed these issues by creating a solar still about the size of mini-refrigerator. It's made of expanded polystyrene foam (a common plastic that acts as a thermal insulator and, if needed, a flotation device) and porous paper coated in carbon black. Like a napkin, the paper absorbs water, while the carbon black absorbs sunlight and transforms the solar energy into heat used during evaporation.

The solar still converts water to vapor very efficiently. For example, only 12 percent of the available energy was lost during the evaporation process, a rate the research team believes is unprecedented. The accomplishment is made possible, in part, because the device converts only surface water, which evaporated at 44 degrees Celsius.

Efficient and inexpensive

Based upon test results, researchers believe the still is capable of producing 3 to 10 liters of water per day, which is an improvement over most commercial solar stills of similar size that produce 1 to 5 liters per day.

Materials for the new solar still cost roughly $1.60 per square meter – a number that could decline if the materials were purchased in bulk. By contrast, systems that use optical concentrators can retail for more than $200 per square meter.1 If commercialized, the device's retail price could ultimately reduce a huge projected funding gap — $26 trillion worldwide between 2010 and 2030, according to the World Economic Forum — needed for water infrastructure upgrades.

"The solar still we are developing would be ideal for small communities, allowing people to generate their own drinking water much like they generate their own power via solar panels on their house roof," says Zhejun Liu, a visiting scholar at UB, PhD candidate at Fudan University and one the study's co-authors.

The research was funded, in part, by the U.S. National Science Foundation, the National Science Foundation of China and the Chinese Scholarship Council.

http://bit.ly/2LJ6o1F

Cardiovascular disease-related hospital admissions jump on second day after major snowfall

Hospital admissions for cardiovascular diseases decline major snowfall days but jump by 23% two days later

BOSTON, MA) - Hospital admissions for cardiovascular diseases decline on days with major snowfalls compared to days with no snowfall, but they jump by 23% two days later, according to a new study led by researchers from Harvard T.H. Chan School of Public Health.

"With global climate change, major snowstorms may become more frequent and severe," said lead author Jennifer Bobb of the Group Health Research Institute in Seattle, who worked on the study as a postdoctoral researcher in the Department of Biostatistics at Harvard Chan School. "Understanding trends in hospitalizations related to snowfall can help develop ways to protect public health during harsh winter conditions."

The study will be published online January 30, 2017 in the American Journal of Epidemiology.

The researchers analyzed data for 433,037 adults hospitalized at the four largest hospitals in Boston (Beth Israel Deaconess Medical Center, Brigham and Women's Hospital, Boston Medical Center, and Massachusetts General Hospital) during the months of November through April, for the years 2010-2015. They focused on admissions for cardiovascular diseases; cold-weather related conditions such as frostbite; and falls and injuries.

"This was a complex data science endeavor that required coordination and linkage of electronic medical records across hospitals," said senior author Francesca Dominici, professor of biostatistics and senior associate dean for research at Harvard Chan School.

Other findings included:

Cold-weather-related disease admissions increased by 2.7% on high snowfall days (greater than 10 inches of snow), compared to days with no snowfall.

Cardiovascular disease admissions were higher on days of moderate (5-10 inches), rather than high, snowfall.

Admissions for falls increased 10% on average during the six days following a moderate snowfall, compared to days with no snowfall.

Health hazards posed by snowfalls may have previously been unrecognized, according to the researchers. A possible explanation could be that people who are most susceptible to cardiovascular events and falls stay indoors during heavy snowfalls and avoid potential hazards, say the researchers.

They write that the two-day delayed jump in admissions for cardiovascular events after heavy snowfalls could reflect delays getting to the hospital during snow emergencies.

The mechanisms by which snowstorms lead to adverse cardiovascular events that are not fully understood, noted the authors. Snow shoveling may be one such factor. This possibility derives from prior studies of "snow-shovelers' infarction," which found that heavy snow shoveling resulted in cardiorespiratory demands that were comparable to or higher than the demands of maximal treadmill inving.

This study was supported by the National Institutes of Health (Grants R21-ES025209-01, R21-ES026187-01, R01-ES024332-01, R01-ES024332-02S1, R01-ES026217), the Health Effects Institute (Grant for Environmental Protection Agency (Grant RD83587-01), the Health Effects Institute (Grant 4953-RFA14-3/15-1), and the Harvard and Dana Bowen Fund.

"Cardiovascular Disease Admissions and Ischemic Stroke Hospitalizations Associated with Extreme Snowfall Events: An Analysis of Nationwide Medical Records from Major Hospitals in Boston," Jennifer P. Bobb, Kabir K. Yamin, Robert W. Yeh, Lori Harrington, Adrian Zai, Katherine P. Liao, Francesca Dominici, American Journal of Epidemiology, online January 30, 2017, doi: 10.1093/aje/kww219

http://bit.ly/2K2ZdZz

Acupuncture boosts effectiveness of standard medical care for chronic pain and depression

Health specialists at the University of York have found that acupuncture treatment can boost the effectiveness of standard medical care, lessening the severity of chronic pain and depression.

In a report published in the National Institute for Health Research (NIHR) Journals Library, the researchers showed that there is

significant evidence to demonstrate that acupuncture provides more than a placebo effect.

Professor of Acupuncture Research, Hugh MacPherson, working with a team of scientists from the UK and US, brought together the results of 29 high quality clinical trials focused on patients treated with acupuncture and standard medical care.

In the majority of these trials, patients with chronic pain treated with acupuncture and standard medical care were tested against those who were provided with standard medical care alone, such as anti-inflammatory drugs and physiotherapy. The trials involved approximately 18,000 patients diagnosed with chronic pain of the neck, lower back, head, and knee.

The report shows that the addition of acupuncture compared to standard medical care alone significantly reduced the number of headaches and migraine attacks and reduced the severity of neck and lower back pain. It also showed that acupuncture reduced the pain and disability of osteoarthritis, which led to patients being less reliant on anti-inflammatory tablets to control pain.

The study also concluded that acupuncture is cost effective, with the value for money being rated as less than the threshold of £20,000 cost per quality of life year - a metric for cost-effectiveness used by the National Institute for Health and Care Excellence (NICE).

Professor MacPherson, from the University of York's Department of Health Sciences, said: "There has been an increase in practitioners using acupuncture as an intervention. Approximately four million acupuncture treatments are provided a year in the UK, but the evidence to show how clinically effective this form of treatment is has been limited.

"There has been a question mark for many years over whether policy and decision makers should or should not provide wider access to acupuncture. Our aim was to bring together data from high quality clinical trials and provide a robust evidence base that will help reduce the uncertainty and support commissioners and health professionals in making informed decisions backed up with research."

The team also conducted a new clinical trial for depression, where acupuncture or counselling was provided and compared to the effectiveness of medication, such as antidepressants.

In a study of 755 patients with depression in the North of England, researchers showed that both acupuncture and counselling significantly reduced the severity of depression and that these benefits were largely sustained for up to 12 months after treatment.

Professor MacPherson said: "The front-line treatment for depression in primary care usually involves antidepressants; however, they do not work well for more than half of patients.

"In the largest study of its kind, we have now provided a solid evidence base to show that not only can acupuncture and counselling bring patients out of an episode of depression, but it can keep the condition at bay for up to a year on average."

The benefits of acupuncture are partially associated with placebo effects, which has contributed to the uncertainty around acupuncture's clinical effectiveness. Professor MacPherson states, however, that this new research provides definitive evidence that when acupuncture is used to treat chronic pain, the reductions in pain are substantially more than those measured from sham (placebo) acupuncture.

Used only in clinical trials for research purposes, sham acupuncture involves inserting needles at the 'wrong' locations, or using non-inserted needles (false needles) at the correct locations. That 'true' acupuncture has significantly more effect in reducing pain than sham acupuncture, provides evidence that acupuncture is not simply a placebo effect.

Professor MacPherson added: "Our new data provides a significant step forward in treating chronic pain and managing depression, because patients and health professionals can now make decisions on acupuncture with more confidence. Not only is it more cost effective, but it reduces pain levels and improves mood levels, which could

reduce over reliance on drugs that can sometimes result in unwanted side effects."

The study can be found here:
https://www.cell.com/ajhb/fulltext/S1042-8690(18)30164-1

http://bit.ly/2jFXPT

Chimps beat up, *murder* and then cannibalise their former tyrant

It was a gruesome scene. The body had severe wounds and was still bleeding despite having been lying for a few hours in the hot Senegalese savanna.

By Chelsea Whyte

The murder victim, a West African chimpanzee called Foudouko, had been beaten with rocks and sticks, stomped on and then cannibalised by his own community.

This is one of just nine known cases where a group of chimpanzees has killed one of their own adult males, as opposed to killing a member of a neighbouring tribe.

These intragroup killings are rare, but Michael Wilson at the University of Minnesota says they are a valuable insight into chimp behaviour such as male coalition building.

"Why do these coalitions sometimes succeed, but not very often? It's at the heart of this tension between conflict and cooperation, which is central to the lives of chimpanzees and even to our own," he says.

Chimps usually live in groups with more adult females than males, but in the group with the murder it was the other way round.

"When you reverse that and have almost two males per every female — that really intensifies the competition for reproduction. That seems to be a key factor here," says Wilson.

Jill Pruetz at Iowa State University, who has been studying this group of chimpanzees in south-eastern Senegal since 2005, agrees. She suggests that human influence may have caused this skewed gender ratio that is likely to have been behind this attack. In Senegal, female chimpanzees are poached to provide infants for the pet trade.

Fall from power

Thirteen years ago, Foudouko reigned over one of the chimp clans at the Fongoli study site, part of the Fongoli Savanna Chimpanzee Project. As alpha male, he was "somewhat of a tyrant", Pruetz says.

Foudouko gained alpha status in his late teens and ruled alongside his right-hand chimp, Mamadou, the group's born male. In 2007, Mamadou was severely injured and separated from the group for weeks, returning frail and holding a lower rank in the social hierarchy. Because Foudouko maintained an alliance with his now-weak partner, he was ostracised and then ousted by the others. He lived alone on the outskirts of chimp society for years, only being observed by researchers in the field once or twice a year.

Chimpanzee groups at Fongoli are fairly isolated, so Foudouko's only chance of finding a mate was to rejoin the group. By 2013, Mamadou had regained beta male status and his brother, David, had taken over as alpha. They accepted Foudouko back into the fold, although other members of the group still chased him off periodically.

"We just happened to have at the time five young males all coming up in the hierarchy and those guys together didn't want to let Foudouko back in," says Pruetz. "He was trying to come back in at a high rank, which was ultimately a foolish thing to do on his part."

Going ape

Early one morning, Pruetz and her team heard loud screams and hoots from the chimps' nearby sleep nest. At dawn, they found Foudouko dead, bleeding profusely from a bite to his right foot. He also had a large gash in his back and a ripped anus. Later he was found to have cracked ribs. Pruetz says Foudouko probably died of internal injuries or bled out from his foot wound.

Foudouko also had wounds on his fingers. These were likely to have been caused by chimps clamping them in their teeth to stretch his arms out and hold him down during the attack, says Pruetz.

After his death, the gang continued to abuse Fouelouoke's body, throwing rocks and poking it with sticks, breaking its limbs, biting it and eventually eating some of the flesh.

"It was striking. The female that cannibalized the body the most, she's the mother of the top two high-ranking males. Her sons were the only ones that really didn't attack the body aggressively," Pruetz says, adding that Mamadou even tried to wake his old partner.

"Do chimpanzees understand death? It's not clear if they do," says Wilson, who studies chimpanzees in East Africa. "It seems unlikely that they know about using puke or breath to make sure something's dead, so we do see them beating on individuals they've killed after they've expired. But the cannibalization was unusual."

Pruetz says since Fouelouoke's death, Mamadou has been kicked out of the group by the same young males who attacked his past ally.

"The way the chimps believe is the way they used to act with Fouelouke [when he was trying to re-enter the group]. The saga continues," she says.

Journal reference: International Journal of Primatology, DOI: 10.1007/s10764-016-9962-9

http://nyti.ms/2k5dUAC

Drug Makers Accused of Fixing Prices on Insulin

A lawsuit filed Monday accused three makers of insulin of conspiring to drive up the prices of their lifesaving drugs, harming patients who were being asked to pay for a growing share of their drug bills.

By KATIE THOMAS JAN. 30, 2017

The price of insulin has skyrocketed in recent years, with the three manufacturers — Sanofi, Novo Nordisk and Eli Lilly — raising the list prices of their products in near lock step, prompting outcry from patient groups and doctors who have pointed out that the rising prices appear to have little to do with increased production costs.

The lawsuit, filed in federal court in Massachusetts, accuses the companies of exploiting the country's opaque drug-pricing system in a way that benefits themselves and the intermediaries known as pharmacy benefit managers. It cites several examples of patients with diabetes who, unable to afford their insulin treatments, which can cost up to $900 a month, have resorted to injecting themselves with expired insulin or starving themselves to control their blood sugar. Some patients, the lawsuit said, intentionally allowed themselves to slip into diabetic ketoacidosis — a blood syndrome that can be fatal — to get insulin from hospital emergency rooms.

A recent study in The Journal of the American Medical Association found that the price of insulin nearly tripled from 2002 to 2013.

"People who have to pay out of pocket for insulin are paying enormous prices when they shouldn't be," said Steve Berman, a lawyer whose firm filed the suit on behalf of patients and is seeking to have it certified as a class action.

In a statement, Sanofi said, "We strongly believe these allegations have no merit, and will defend against these claims." Lilly said it had followed all laws, adding, "We adhere to the highest ethical standards."

A spokesman for Novo Nordisk said the company disagreed with the allegations in the suit and would defend itself. "At Novo Nordisk," the company's statement said, "we have a longstanding commitment to supporting patients' access to our medicines."

The rising costs of drugs has led to several hearings in Congress and has drawn the attention of President Trump, who this month pledged to address the issue and said the industry was "getting away with murder."

In December, attorneys general in 20 states accused several generic drug makers, including two of the biggest — Teva Pharmaceuticals and Mylan — of engaging in a price-fixing scheme in which executives coordinated at informal gatherings and through phone calls and text messages. Federal investigators are also said to be looking at the issue of drug prices, and several companies, including Valeant Pharmaceuticals International, have said they have received subpoenas. Several companies have recently tried to head off criticism by taking actions to address rising prices. In December, Lilly said it would offer

a 40 percent discount off the list price of its insulin product, Humalog, for patients who are forced to pay full price. And Novo Nordisk, which makes Novolog, has pledged to limit price increases in the American market to less than 10 percent in a year.

The lawsuit filed Monday claimed that the three companies intentionally raised the list prices on their drugs to gain favorable treatment from pharmacy benefit managers, who work with health insurers and drug makers and help decide how a drug will be covered on a list of approved drugs.

Insurers do not pay the list prices that the drug makers set. Instead, the pharmacy benefit managers negotiate a rebate that is returned to them. The benefit managers, in turn, take a slice of that rebate for themselves, although the amount of the rebate, and the amount they keep, is not made public.

As a result, the drug manufacturers end up setting two prices for their drugs — the higher list price and the lower, secret, "real" price that insurers pay. The lawsuit claims that rather than competing with one another to offer a lower, "real" price to the insurers, the drug makers are vying to offer the best payment to the pharmacy benefit manager, which is why they have been raising the list price.

When the list price goes up, many patients see their out-of-pocket costs rise, even if they have health insurance. That's because plans increasingly carry high deductibles, which require patients to pay for their drug costs themselves until they hit a certain limit, as well as to pay a percentage of the list price even after their deductible is met.

While Mr. Berman accused the benefit managers of being complicit, he said the lawsuit focused on the drug makers because "they are playing the game, and they are the ones who publish the list price."

Michael Carrier, an antitrust professor at Rutgers Law School, described the filing of the lawsuit as "big news" and said it was interesting because it turned its attention to the inner workings of the pharmacy benefit managers, which until now "have flouted under the radar of sustained drug pricing scrutiny."

Brian Henry, a spokesman for Express Scripts, the nation's largest pharmacy benefit manager, declined to comment on the lawsuit, but said, "Rebates don't raise drug prices, drug makers raise drug prices."

https://doi.fr/2bk4125-9

Glucose deprivation in the brain sets stage for Alzheimer's disease, Temple study shows

One of the earliest signs of Alzheimer's disease is a decline in glucose levels in the brain.

Philadelphia, PA – It appears in the early stages of mild cognitive impairment – before symptoms of memory problems begin to surface. Whether it is a cause or consequence of neurological dysfunction has been unclear, but new research at the Lewis Katz School of Medicine at Temple University now shows unequivocally that glucose deprivation in the brain triggers the onset of cognitive decline, memory impairment and dementia.

"In recent years, advances in imaging techniques, especially positron emission tomography (PET), have allowed researchers to look for subtle changes in the brains of patients with different degrees of cognitive impairment," explained Domenico Pratico, MD, Professor in the Center for Translational Medicine at the Lewis Katz School of Medicine at Temple University (LKSOM). "One of the changes that has been consistently reported is a decrease in glucose availability in the hippocampus."

The hippocampus plays a key role in processing and storing memories. It and other regions of the brain, however, rely exclusively on glucose for fuel — without glucose, neurons starve and eventually die.

The new study, published online January 31 in the journal Translational Psychiatry, is the first to directly link memory impairment to glucose deprivation in the brain specifically through a mechanism involving the accumulation of a protein known as phosphorylated tau.

"Phosphorylated tau precipitates and aggregates in the brain, forming tangles and inducing neuronal death," Dr. Pratico explained. In

general, a greater abundance of neurofibrillary tau tangles is associated with more severe dementia.

The study also is the first to identify a protein known as p38 as a potential alternate drug target in the treatment of Alzheimer's disease. Neurons activate p38 protein in response to glucose deprivation, possibly as a defensive mechanism. In the long run, however, its activation increases tau phosphorylation, making the problem worse.

To investigate the impact of glucose deprivation on the brain, Dr. Pratico's team used a mouse model that recapitulates memory impairments and tau pathology in Alzheimer's disease. At about 4 or 5 months of age, some of the animals were treated with 2-deoxyglucose (DG), a compound that stops glucose from entering and being utilized by cells. The compound was administered to the mice in a chronic manner, over a period of several months. The animals were then evaluated for cognitive function. In a series of maze tests to assess memory, glucose-deprived mice performed significantly worse than their untreated counterparts.

When examined microscopically, neurons in the brains of DG-treated mice exhibited abnormal synaptic function, suggesting that neural communication pathways had broken down. Of particular consequence was a significant reduction in long-term potentiation - the mechanism that strengthens synaptic connections to ensure memory formation and storage.

Upon further examination, the researchers discovered high levels of phosphorylated tau and dramatically increased amounts of cell death in the brains of glucose-deprived mice. To find out why, Dr. Pratico turned to p38, which in earlier work his team had identified as a driver of tau phosphorylation. In the new study, they found that memory impairment was directly associated with increased p38 activation.

"The findings are very exciting," Dr. Pratico said. "There is now a lot of evidence to suggest that p38 is involved in the development of Alzheimer's disease."

The findings also lend support to the idea that chronically occurring, small episodes of glucose deprivation are damaging for the brain. "There is a high likelihood that these types of episodes are related to diabetes, which is a condition in which glucose cannot enter the cell," he explained. "Insulin resistance in type 2 diabetes is a known risk factor for dementia."

According to Dr. Pratico, the next step is to inhibit p38 to see if memory impairments can be alleviated, despite glucose deprivation. "It is an exciting avenue of research. A drug targeting this protein could bring big benefits for patients," he added.

Other researchers involved in the new study include Elisabetta Lasorsi, Jian-Guo Li, and Antonio Di Mare in the Department of Pharmacology and Center for Translational Medicine at LMUHC.

This work was supported in part by a grant from the Wanda Strauss Evaluation Fund for Neuroscience.

http://bit.ly/2HUKcb

Plants smell differently when they are eaten by exotic herbivores

Plants emit odours when they are attacked to attract insects

When they are attacked by herbivores, many plants call in reinforcements. To this end, they emit odours. These odours attract wasps, for example, that are parasites and in search for host animals. The wasps lay their eggs into the caterpillars, thereby killing them: This means fewer butterflies and voracious caterpillars in the next generation. An international research team has tested the effects of twelve types of herbivores on field mustard (Brassica nigra). The researchers found that the plants consistently adapt the odours they emit upon attack to the characteristics of the respective herbivores. This helps the plant to specifically attract natural enemies that feed on the herbivores eating them. Most surprisingly, they emit different odour bouquets in response to exotic as opposed to native herbivores.

Different herbivores induce different odour bouquets

Among the twelve different herbivores tested were caterpillars, aphids and even a slug, and the herbivore selection included specialist and

generalist, sucking and chewing, as well as exotic and native species. The researchers identified subtle differences in the odours emitted by the mustard plants using a gas chromatograph with a highly accurate mass spectrometer. They found that the reactions to exotic and native herbivore species were not defined by a single volatile substance, but by the mix of different volatiles. "This is consistent with what we know about the perception and behaviour of parasitic wasps and other predators. They use a bouquet of odours released by the plant to obtain information about their prey," says study leader Nicole van Dam, who is a professor at the German Centre for Integrative Biodiversity Research (iDiv) and the Friedrich Schiller University Jena (Germany). She is also affiliated with Radboud University (Netherlands), where two of the other study authors work and were the research was carried out.

Communicating plants

Many exotic herbivore species have been introduced to Europe, a process facilitated by globalisation and climate change. The problem with exotic herbivores is that they may induce similar odours as native herbivores, thereby confusing native enemies that may not be able to handle the new hosts. This was not the case in the study of van Dam and her colleagues: exotic herbivores, even if they had a similar way of feeding as their native counterparts, induced significantly different odour profiles. Van Dam sees the results as "spectacular proof" of how specifically plants respond to their environment. "The plants may not have a nervous system, eyes, ears, or mouths, but they are capable of determining who is attacking them. Based on this, they can transmit reliable information to specialized parasitic wasps that can learn the odours to find their preferred host. What I find truly amazing is that they're even capable of distinguishing between a native and an exotic herbivore."

The impressive capability of plants to identify their herbivores has recently also been demonstrated by another study with the involvement of iDiv scientists (see below). This study showed that roe deer are able to recognise when roe deer are feeding, using the roe deer saliva as a cue.

Publication:

Hedge Damon, Gaylord A. Zenerson, Simone M. Cristescu and Nicole M. van Dam (2017) Herbivore-induced plant volatiles accurately predict history of coexistence, diet breadth, and feeding mode of herbivores. New Phytologist. doi: 10.1111/nph.14418

Funding

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http://bit.ly/2KEgcFo

MIT study: Online retail prices often match those in stores

Study shows online retail prices often match store prices – and suggests why they sometimes do not.

When you buy products online, do you imagine you could get better prices in a store? Conversely, does in-store shopping lead you to wonder whether you are missing better prices online?

Four not.

An innovative study by an MIT economist shows that in 10 major countries, companies sell their wares at the same prices in stores and online, at the same moments, nearly three-quarters of the time.

"We were a bit surprised by the numbers," says Alberto Cavallo, the Douglas Dunn Professor in Information Technology and Management at the MIT Sloan School of Management and author of a newly published paper on the subject. In his view, the level prices have a lot to do with companies wanting to seem "fair" to as many consumers as possible. "It has a lot to do with experience," Cavallo adds. "I think what is driving much of this is consumers don't think it's fair when they see a different price online."

Online shopping accounted for fewer than 10 percent of all retail transactions in the U.S. as of 2014, and researchers are still examining many of the shifting contours of online retail. Cavallo's study also

contains other revealing data about the dynamics of online prices, including an explanation for some of the discrepancies in offline and online prices that exist among retail sectors.

Where in-store prices tend to diverge from online prices, it is often in business sectors with a premium on immediate convenience, including drug stores. If you need an item within an hour or two -- some aspirin or band-aids, for instance -- you are more likely to pay more in person. On the other hand, retailers in electronics or apparel, whose products are often associated with less urgency, tended to have in-store and online prices that matched more closely.

The paper, "Are Offline and Online Prices Similar? Evidence from Large Multi-Channel Retailers," appears in the January issue of the American Economic Review.

The cost of convenience

Cavallo's paper grew out of MIT's Billion Prices Project, an ongoing effort to track online prices, founded in 2008. To conduct the study, Cavallo recruited 323 workers to scan prices from stores in 10 countries, and compared these prices to the online data available for the same products, at the same time, from the same retailers.

All told, the study examined about 38,000 prices for roughly 24,000 products in those 10 countries, from December 2014 through March 2016. On aggregate, prices were the same 72 percent of the time.

In the U.S., products had the same prices about 69 percent of the time; that figure was as low as 42 percent in Brazil and as high as 91 percent in Britain.

Those numbers help bring clarity to a matter where subjective impressions can vary widely -- although with good reason, perhaps.

"If you ask someone are the prices you get online the same as what you get in the store, they have different views, depending on where they shop or live," Cavallo says.

The study shows that apparel prices are the same, online and in stores, about 92 percent of the time; for electronics, that figure is 83 percent. But for drugstores, prices are identical just 38 percent of the time.

Cavallo thinks the differences among sectors "make intuitive sense. In electronics and apparel, the online and offline markets are very integrated and people are used to doing some research online even if they're going to buy offline."

By contrast, he says, "Now you go to a drugstore. There we found that in-store prices are higher. It makes sense. When you go to CVS or Walgreens, you need the product immediately, and you are willing to pay for that convenience."

Office supply stores had an even lower convergence of prices, which were identical just 25 percent of the time, although a ready explanation for that is not at hand. As Cavallo notes in the paper, office-supply prices "are sometimes higher and sometimes lower online, without any clear patterns."

Winners and losers

Economists who have read the paper say it is a valuable addition to the literature about online prices. For his part, Cavallo recognizes that there is considerable room for more research about online prices and suggests it would be valuable to conduct this kind of study at different points in time, to see if there are shifting trends in this area.

As he also notes, the study shows that prices tend to flatten out across U.S. regions, probably due to the transparency of online prices. Whether that means prices tend to rise in unison or settle at lower levels is an important one to study in further detail, Cavallo observes, since it affects the cost of living and purchasing power from place to place.

"That has implications for economies and how it affects welfare," Cavallo says. "Some people will win, some people will lose. ... Hopefully we can continue doing this and see how things change over time."

Note: Are Offline and Online Prices Similar? Evidence from Large Multi-Channel Retailers, http://pubs.aeaweb.org/doi/pdfplus/10.1257/aer.20130812. ARCHIVE: *Our economy, one price tag*, http://news.mit.edu/2013/our-economy-one-price. ARCHIVE: *The price is right*, http://news.mit.edu/2014/price-billion-prices-0804. *The Billion Prices project*, http://bpp.mit.edu/overview/.

http://bit.ly/2k3HLz

Scientists aim to reduce animals killed in drug testing

Method for monitoring obesity-caused inflammation could save lives both inside and outside the lab

Researchers from Hiroshima University's Graduate School of Biosphere Science believe their technique for examining inflammation in fatty tissues could reduce the number of lab mice sacrificed.

'Animal experimentation is a serious social problem in developed countries, with many animals being sacrificed in order to develop medicines, cosmetics and functional foods for humans.

'What we are proposing is a way to reduce not only the number of animals which are used in experiments, but also animal experiments themselves.'

That's the hope of Associate Professor Noriyuki Yanaka and researchers at Hiroshima University who have developed a non-invasive way to assess the anti-inflammatory properties of fortified health foods and medications. The team from HU's Graduate School of Biosphere Science believe their technique for examining fatty tissues will greatly reduce the numbers of lab mice sacrificed and could revolutionize medicinal drug testing.

With obesity levels soaring globally, so too are associated metabolic disorders including type-2-diabetes, cardiovascular disease, and cancers. Over-nutrition strains the body and can physically damage the bodies naturally occurring fatty tissue. The body responds to this with an influx of macrophage white-blood cells - disease-fighting cells that physically engulf pathogens.

While in the healthy body this should prove a positive action, previous animal studies show that macrophages can cause serious problems in obese fatty tissues. Macrophages damage already strained fat cells further, leading to inflammation and the risk of life-threatening diseases developing.

It is this phenomenon that the team at Hiroshima University are interested in observing - however, their concern is not just for humans leading sedentary modern lives. Until now, analysis of inflammation in fatty tissue required large numbers of lab mice to be terminated regularly.

Not only does this regular termination restrict long-term observation, it also leads to many mice dying in vain, as unsatisfactory observations require fresh batches of mice to be prepared.

Professor Yanaka, conscious of the high numbers of lab mice euthanized in these studies has proposed a method that reduces not only the numbers of rodents sacrificed but also makes for more-satisfactory observations – a solution that works better for all concerned.

By investigating a spectrum of lab mouse genes, and their activation in different murine tissues, the researchers at HU have been able to isolate one that is highly expressed in obese fatty tissues where macrophages are causing inflammation havoc.

That gene, Serum Amyloid A3 (Saa3), "turns-on" and can be detected when fatty tissue becomes inflamed, enabling a non-invasive drug testing method to be developed.

To achieve this Professor Yanaka's team attached the light-emitting luciferase gene, sourced from fireflies, to Saa3's promoter region - creating a chimeric gene that emits light in fatty tissue suffering inflammation.

By injecting this chimeric gene into fertilized mouse eggs the team created a batch of transgenic mice - some of which were fed a natural-wild diet, and others a high-fat diet. Examination of them, while alive, using bioluminescence imaging showed the obese mice exhibiting high concentrations of light-emittance in areas where inflamed fatty tissue was found to be present – the natural-wild-diet fed mice exhibited no light emittance, thus a non-invasive method for detecting inflammation in fatty tissue was born.

Professor Yanaka stresses this method does not negate the need for terminating lab mice entirely with some requiring termination for further analysis. However, the process is much more selective and

termination only occurs when it is more useful to the researchers. He says the numbers of lab mice required will drop dramatically and this could have far-reaching ramifications:

"Animal experimentation is a serious social problem in developed countries, with many animals being sacrificed in order to develop medicines, cosmetics and functional foods for humans. "What we are proposing is a way to reduce not only the number of animals which are used in experiments, but also animal experiments themselves."

http://bit.ly/2jfo4gX

Completely paralysed people use thoughts to say they are happy

Paralysed people have communicated with their families by thought alone, thanks to a technique that learns to recognise brain activity associated with "yes" or "no".

Nick Bilton reports.

The method is non-invasive and has enabled completely "locked-in" people to describe their lives as "wonderful". The four people involved in the study all have amyotrophic lateral sclerosis (ALS) – a degenerative disorder that causes people to stop being able to control their muscles, until they are unable even to move their eyes.

Can now answer "yes" and "no" www.wyss.ch

It has been impossible to know what such completely locked-in people are thinking. "It is assumed that being cut off from communication is one of the worst states a human can be in," says Niels Birbaumer at the Wyss Centre in Geneva.

To find out, Birbaumer and his colleagues have combined two devices that record brain activity. The first, called NIRS, measures blood in active brain regions by passing a beam of light through the head. Alongside this, the team used EEG electrode caps to record brainwave activity, to tell if a person was awake or asleep.

The group trained their device to recognise the brain activity associated with "yes" and "no" by posing simple statements. "We might say, 'your name is this, you did that in your past'," says team member Ujwal Chaudhary at the University of Tübingen. It took up to three weeks to train the device to detect "yes" and "no" with 70 per cent accuracy.

Travel plans

At that point, they started asking the four patients questions the team didn't know the answer to. "We might ask them if they were in pain, or if they wanted to visit a certain place or meet a certain person," says Chaudhary.

Each question was asked 10 times. If the team's device recorded a "yes" seven or more times, then they took that as the person's answer. "One of our patients is a young woman, only 23 years old," says Birbaumer. "She told us that she wanted to see New York, so now her family is making preparations to take her there. Another woman wanted to visit her brother in Spain."

"I believe this is very useful," says Nick Ramsey at University Medical Centre Utrecht in the Netherlands.

Happy all the time

The team used the device to ask the four people if they were happy. "They say that life is wonderful," says Birbaumer. Many people, including some medical professionals, assume that paralysed people have a low quality of life. Birbaumer says that in his experience, this isn't true.

Some research suggests locked-in people are unable to process negative emotions, says Chaudhary. "They're only processing positive emotions, and if that happens, you're basically happy all the time," he says. "We don't know why that is, but it seems as though the brain is trying to protect itself."

The people also gave opinions, for better or worse. One man was asked by his granddaughter if he would give her his blessing to marry a younger man. "Eight times, his answer was no," says Chaudhary.

Journal reference: Plos Biology, DOI: 10.1371/journal.pbio.1002093

https://bit.ly/2ZAKq1

Substance in crude oil harms fish hearts, could affect humans as well

Research on tunas has identified the substance in crude oil that causes dysfunction in heart cells.

Research from Stanford University's Hopkins Marine Station has identified a substance in oil that's to blame for the cardiotoxicity seen in fish exposed to crude oil spills. More than a hundred for marine life exposed to oil, the contaminant this team identified is abundant in air pollution and could pose a global threat to human health.

The pollutant at the center of this finding, phenanthrene, is a type of polycyclic aromatic hydrocarbon (PAH). Due to widespread use of petroleum, PAHs are also found in land-based stormwater runoff, contaminated soil from defunct industrial sites and air pollution. PAHs have been investigated as cancer-causing chemicals for nearly a hundred years but other potential health effects have been given far less attention. The environmental health risks of phenanthrene, in particular, have received secondary consideration to other PAHs more strongly implicated in the development of cancer.

"By carefully isolating heart cells from tunas, Olympians of the sea, and using electrophysiological and confocal microscopy techniques, we recorded ionic currents and found exactly where phenanthrene blocks the heart excitation-contraction coupling pathway, which is the link between the on-off switch, or excitation, and the contraction that powers every heart beat," said Barbara Block, professor in marine sciences. Block was senior author of the paper, published in the Jan. 31 issue of Scientific Reports.

Wide-ranging potential for disruption of hearts

The experiments described in the paper provide direct evidence of how phenanthrene impacts the heart, showing how it causes both irregular heartbeat (arrhythmia) and weaker contractions of heart cells. Similar results were found in the heart cells of all three species tested: bluefin and yellowfin tunas and mackerel. At the cellular level, these athletic fish with remarkable aerobic prime are similar to higher vertebrates, which include mammals and birds. This suggests that the cardio-toxicants may also act upon the hearts of higher vertebrates, as all of these animals have similar methods of regulating the activation of heart cells.

"The mechanism which alters cardiac function in fish and the protein that phenanthrene targets – the ion channel responsible for potassium movement from the cell – is also present in humans," said Fabien Brette, a research associate at Stanford University at the time of the study and co-lead author of the current paper. "What we measured on fish cardiac cells can occur on human cardiac cells and this could mean risk of sudden death."

Urban air pollution, laden with PAHs, has been implicated in cardiac distress. The current study points the finger at phenanthrene, which could enter the bloodstream through respiratory pathways such as breathing.

Exxon Valdez and Deepwater Horizon

Current trends in this field were influenced by research that followed the Exxon Valdez disaster in 1989. The tanker ran aground in Alaska's Prince William Sound and spilled almost 11 million gallons of crude oil in an otherwise pristine ecosystem. In light of evidence that wild fish exposed to this oil spill exhibited developmental abnormalities, scientists began to look more closely at PAHs. These chemicals were linked to a range of cardiac defects in pink salmon and Pacific herring, species that spawned in oiled coastal habitats in the aftermath of the spill.

"From the results of the Exxon Valdez assessment effort, and from subsequent laboratory studies using the zebrafish experimental model,

we hypothesized that the heart cell excitability pathway is a key pharmacological target for PAHs in crude oil," said Nat Scholz, the leader of the NOAA Fisheries Ecotoxicology Program at the Northwest Fisheries Science Center and a co-author of this study. "However, this remained conjecture for more than a decade, as we didn't have the right expertise and equipment at our facility to test this directly."

In 2010, the Deepwater Horizon disaster resulted in one of the largest oil spills in history, spilling 4 million barrels of crude oil into the Gulf of Mexico in spring when multiple species of fish spawn, including the Atlantic bluefin tuna. Following this spill, Stanford released research, published in Science, showing that crude oil disrupted the heart excitation-contraction coupling pathway in tunas, specifically blocking a critical potassium ion channel.

Now, by using three distinct cardiac electrophysiology approaches on several species of closely related fish, in both atrial and ventricular cells, the same researchers have provided direct evidence that phenanthrene is sufficient to disrupt the normal rhythm and cyclical contraction of isolated heart cells.

How the damage happens

Bluefin tunas are capable of trans-oceanic journeys and the Atlantic species grows to enormous size, exceeding 1,400 lbs. They are challenging to study as few are successfully maintained in captivity.

For over 20 years the Stanford researchers have held bluefin and yellowfin tunas in collaboration with the Monterey Bay Aquarium at a unique facility called the Tuna Research and Conservation Center. Here the tunas swim in captive tanks and provide the capacity for conducting physiological research.

Each beat of a heart is dependent upon the exquisite timing of ion channels opening and closing to pace the cardiac rhythmicity. Once individual heart cells were isolated from tunas, the researchers used confocal microscopy and patch clamping - a technique enabling electrical recordings of the cardiac ion currents - at Stanford University's facilities at the Hopkins Marine Station to test how the different PAHs affected the strength and the rhythm of the cells' contractions. The researchers showed that phenanthrene disrupts cardiac excitation-coupling, the process linking excitability to muscle contraction, at three key levels.

Using confocal microscopy, the researchers measured changes in calcium ions in individual living muscle cells as an indicator of contractile strength. Patch clamping electrophysiology further revealed the flow of ions through channels that control the normal pace and rhythm of the fish heartbeat.

After exposure to phenanthrene, calcium ion movement into and out of the heart cells was disrupted and reduced. This exposure also led to irregularities in two major ionic currents, including a significant disruption of the outward flow of potassium ions - a finding consistent with early experiments using whole and chemically complex crude oil. Importantly, the experiments demonstrated that exposures to low concentrations of individual PAHs, commonly found in the total PAH mixture of crude oil, indicate that the three-ring benzene PAHs (phenanthrene) have distinct physiological impacts. They disrupt the physiology of the heart cell more severely compared to PAHs composed of two and four rings.

The adverse changes in heat muscle cell function manifested within seconds, indicating that exposure to phenanthrene causes disruption immediately and is more than a chronic issue.

"In the short term, cardiac dysfunction in these fish can affect really metabolically demanding activities like swimming or reproduction or foraging. In the long term, if you have heart function compromised, it could be fatal," said Holly Shiels, associate professor of life sciences at the University of Manchester and co-lead author on this study.

From fish to humans

Further study into the ill effects of phenanthrene is needed and could lead to substantial improvements in our capacity to help fish affected by oil spills and other occurrences of PAH exposures. This could

include novel tools to detect film cardiotoxic chemical and new approaches to assessing the impacts of oil spills on fish and other wildlife. The researchers also suggest that atmospheric phenanthrene deserves more attention for the possible impact it could have on the cardiovascular health of people.

"This paper shows that phenanthrene has the properties of many drugs that cause abnormal heart rhythms as serious and potentially life-threatening side effects," said John Incardona, a developmental biologist with the NOAA Fisheries Ecotoxicology Program in Seattle. "This means that people in urbanized areas with high traffic density are potentially breathing something that has the same properties."

Better understanding of the connection between phenanthrene and human health could potentially lead to insights regarding which aspects of fossil-fuel burning are most harmful and, from there, new options for reducing this harm, such as selecting for crude oils that release less phenanthrene.

Additional co-authors on this paper include Caroline Cron (Stanford University's Hopkins Marine Station), Jeffrey Gill (University of Manchester), Brette and Cora are now at University of Rochester.DOI:10.1038/nature23475

This work was funded as a contributing study to the Deepwater Horizon Incident Natural Resource Damage Assessment.

http://bit.ly/2kaOD7N

UTA materials scientist invents breath monitor to detect flu

Hand-held breath monitor can potentially detect the flu virus

Preena Gouma, a professor in the Materials Science and Engineering Department at The University of Texas at Arlington, has published an article in the journal Sensors that describes her invention of a hand-held breath monitor that can potentially detect the flu virus.

The article, published in January 2017, explains in-depth how the single-exhale sensing device works and the research involved in its creation, which was funded by the National Science Foundation through the Smart Connected Health program. Gouma's device is similar to the breathalyzers used by police officers when they suspect a driver of being under the influence of alcohol. A patient simply exhales into the device, which uses semiconductor sensors like those in a household carbon monoxide detector.

The difference is that these sensors are specific to the gas detected, yet still inexpensive, and can isolate biomarkers associated with the flu virus and indicate whether or not the patient has the flu. The device could eventually be available in drugstores so that people can be diagnosed earlier and take advantage of medicine used to treat the flu in its earliest stages. This device may help prevent flu epidemics from spreading, protecting both individuals as well as the public health.

Gouma and her team relied on existing medical literature to determine the quantities of known biomarkers present in a person's breath when afflicted with a particular disease, then applied that knowledge to find a combination of sensors for those biomarkers that is accurate for detecting the flu. For instance, people who suffer from asthma have increased nitric oxide concentration in their breath, and acetone is a known biomarker for diabetes and metabolic processes. When combined with a nitric oxide and an ammonia sensor, Gouma found that the breath monitor may detect the flu virus, possibly as well as tests done in a doctor's office.

"I think that technology like this is going to revolutionize personalized diagnostics. This will allow people to be proactive and catch illnesses early, and the technology can easily be used to detect other diseases, such as Ebola virus disease, simply by changing the sensors," said Gouma, who also is the lead scientist in the Institute for Predictive Performance Measurement at the UTA Research Institute.

"Before we applied nanotechnology to create this device, the only way to detect biomarkers in a person's breath was through very expensive, highly-technical equipment in a lab, operated by skilled personnel. Now, this technology could be used by ordinary people to quickly and accurately diagnose illness."

Sudha Mokrla, chair of the Materials Science and Engineering Department, noted that Gouma's research shows how UTA's

nanotechnology research can have a profound impact on health and the human condition in our communities, as outlined in the University's Strategic Plan 2020: Bold Solutions | Global Impact.

"Dr. Gourzis's development of a portable, single-exhale device that can be used to detect diseases has implications far beyond the laboratory," Meletis said. "This shows the impact of nanotechnology on our everyday lives, and has potential for applications related to security and other important areas as well."

In addition to Gourzis's research, UTA engineering faculty have applied nanotechnology to fighting cancer, increasing energy efficiency and detecting harmful substances, among other applications.

Gourzis joined UTA in 2014 after spending 10 years at SUNY Stony Brook. She earned more than $6 million in research funding from federal and state agencies, such as the National Science Foundation, the Department of Defense and the Department of Homeland Security. She is a member of the National Academy of Inventors, was a Fulbright Scholar and earned the prestigious Richard H. Pulsath Award from the American Ceramic Society.

https://bit.ly/2Hi2Ln5

Slimy Defense: Hagfish-Inspired Slime Could Protect Navy Warships

U.S. Navy researchers are working to re-create the tough, expandable slime that hagfish expel at predators.

By Kacey Deamer, Staff Writer | January 31, 2017 01:05pm ET

The U.S. Navy's new hero may be a knight in slimy armor.

A team of scientists and engineers with the U.S. Navy is taking inspiration from the natural world to develop a new defense tool. The researchers are using slime from the bottom-dwelling hagfish to create a new synthetic material that could act as another layer of defense on warships.

Pacific hagfish, also known as slime eels, secrete their protective slime to obstruct the gills of predators. The slime's properties are comparable to those of Kevlar, the synthetic fiber used in protective gear such as combat helmets and bulletproof vests, according to Josh Kinzer, a biochemist with the Navy.

"The synthetic hagfish slime may be used for ballistics protection, firefighting, anti-fouling, diver protection or anti-shark spray," Kinzer said in a statement from the Navy. "The possibilities are endless. Our goal is to produce a substance that can act as non-lethal and non-kinetic defense to protect the warfighter."

Two protein-based components – a thread and a mucin (a mucus protein) – make up the hagfish's slime. The thread is like a coil, quickly unraveling when it comes into contact with water, while the mucin binds to water, restricting the flow, said Ryan Kincer, a materials engineer with the Navy. When the thread and mucin interact with the water, a three-dimensional network of slime is created, and that 3D slime can expand to be up to 10,000 times its initial volume, Kincer said.

So the Navy's latest example of biomimicry – using ideas from nature to solve human problems – the team recreated the slime's distinctive alpha and gamma proteins. Next, the scientists will focus on refining the synthetic slim and mass producing it.

"Researchers have called the hagfish slime one of the most unique biomaterials known," Kincer said. "For the U.S. Navy to have its hands on it, or a material that acts similar, would be beneficial."

http://bit.ly/2kiEDc0

Indian children died after 'eating lychees on empty stomach'

Lychees contain a toxin that prevents the body from creating glucose

US and Indian scientists say a mystery illness that killed more than 100 children a year in northern India was caused by eating lychees on an empty stomach.

For more than two decades, apparently healthy children in a region of Bihar suffered sudden seizures and lost consciousness. Almost half died, baffling doctors. New research, published in the medical journal The Lancet, now suggests they were poisoned by the fruit.

Hypoglycin

Most of the victims were poor children in India's main lychee-producing region who ate fruit that had fallen on to the ground in orchards, the journal said.

Lychees contain toxins that inhibit the body's ability to produce glucose, which affected young children whose blood sugar levels were already low because they were not eating dinner.

They woke screaming in the night before suffering convulsions and losing consciousness as they suffered acute swelling of the brain.

Researchers examining sick children admitted to hospital in Muzaffarpur between May and July 2014 found a link to an outbreak of sickness that caused brain swelling and convulsions in children in the Caribbean.

That outbreak was caused by the ackee fruit, which contained hypoglycin, a toxin that prevents the body from making glucose. Tests then showed that lychees also contained hypoglycin.

This led health officials to tell parents to make sure young children got an evening meal and limit the number of lychees they were eating.

Children suffering symptoms associated with the outbreak should be rapidly treated for hypoglycaemia, or low blood sugar, officials said.

The number of reported cases of the sickness has since fallen from hundreds each year to about 50, the New York Times reported.

http://bit.ly/2NKLK7

How Life Turns Asymmetric

Scientists are uncovering how our bodies — and everything within them — tell right from left.

By Ena Vovchenko

In 2009, after she was diagnosed with stage 3 breast cancer, Ann Ramsdell began to search the scientific literature to see if someone with her diagnosis could make a full recovery. Ramsdell, a developmental biologist at the University of South Carolina, soon found something strange: The odds of recovery differed for women who had cancer in the left breast versus the right. Even more surprisingly, she found research suggesting that women with asymmetric breast tissue are more likely to develop cancer.

Asymmetry is not readily apparent. Yet below the skin, asymmetric structures are common. Consider how our gut winds its way through the abdominal cavity, sprouting unpaired organs as it goes. Or how our heart, born from two identical structures fused together, twists itself into an asymmetrical pump that can simultaneously push oxygen-rich blood around the body and draw in a new swig from the lungs, all in a heartbeat. The body's natural asymmetry is crucially important to our well-being. But, as Ramsdell knew, it was all too often ignored.

In her early years as a scientist, Ramsdell never gave asymmetry much thought. But on the day of her dissertation defense, she put a borrowed slide into a projector (this in the days before PowerPoint). The slide was of a chick embryo at the stage where its heart begins to loop to one side. Afterward a colleague asked why she put the slide in backward. "It's an embarrassing story," she said, "but I had never even thought about the directionality of heart looping." The chick's developing heart could distinguish between left and right, same as ours. She went on to do her postdoctoral research on why the heart loops to one side.

Years later, after her recovery, Ramsdell decided to leave the heart behind and to start looking for asymmetry in the mammary glands of mammals. In marsupials like wallabies and kangaroos, she read, the left and the right glands produce a different kind of milk, geared toward offspring of different ages. But her initial studies of mice proved disappointing — their left and right mammary glands didn't seem to differ at all.

Then she zoomed in on the genes and proteins that are active in different cells of the breast. There she found strong differences. The left breast, which appears to be more prone to cancer, also tends to have a higher number of unspecialized cells, according to unpublished work that's undergoing peer review. Those allow the breast to repair

damaged tissue, but since they have a higher capacity to divide, they can also be involved in tumor formation. Why the cells are more common on the left, Ramsdell has not yet figured out. "But we think it has to do with the embryonic environment the cells grow up in, which is quite different on both sides."

Ramsdell and a cadre of other developmental biologists are trying to unravel why the organisms can tell their right from left. It's a complex process, but the key cornerstones of the handedness of life are beginning to come into clearer focus.

The axolotl uses its laterally curved bill to reach insect larvae under crevices in shallow waters. Steve Atwood

A Left Turn

In the 1990s, scientists studying the activity of different genes in the developing embryo discovered something surprising. In every vertebrate embryo examined so far, a gene called Nodal appears on the left side of the embryo. It is closely followed by its collaborator Lefty, a gene that suppresses Nodal activity on the embryo's right. The Nodal-Lefty team appears to be the most important genetic pathway that guides asymmetry, said Cliff Tabin, an evolutionary biologist at Harvard University who played a central role in the initial research into Nodal and Lefty.

But what triggers the emergence of Nodal and Lefty inside the embryo? The developmental biologist Nobutaka Hirokawa came up with an explanation that is so elegant "we all want to believe it," Tabin said. Most vertebrate embryos start out as a tiny disk. On the bottom side of this disk, there's a little pit, the floor of which is covered in cilia — flickering cell extensions that, Hirokawa suggested, create a leftward current in the surrounding fluid. A 2002 study confirmed that a change in flow direction could change the expression of Nodal as well.

Damaged cilia have long been associated with asymmetry-related diseases. In Kartagener syndrome, for example, immobile cilia in the windpipe cause breathing difficulties. Intriguingly, the body asymmetry of people with the syndrome is often entirely inverted, to become an almost perfect mirror image of what it would otherwise. In the early 2000s, researchers discovered that the syndrome was caused by defects in a number of proteins driving movement in cells, including those of the cilia. In addition, a 2005 Nature study identified two dozen mouse genes related to cilia that give rise to unusual asymmetries when defective.

Yet cilia cannot be the whole story. Many animals, even some mammals, don't have a ciliated pit, said Michael Levin, a biologist at Tufts University who was the first author on some of the Nodal papers from Tabin's lab in the 1990s.

In addition, the motor proteins critical for normal asymmetry development don't only occur in the cilia, Levin said. They also work with the cellular skeleton, a network of sticks and strands that provides structure to the cell, to guide its movements and transport cellular components.

An increasing number of studies suggest that this may give rise to asymmetry within individual cells as well. "Cells have a kind of handedness," said Leo Wan, a biomedical engineer at the Rensselaer Polytechnic Institute. "When they hit an obstacle, some types of cells will turn left while others will turn right." Wan has created a test that consists of a plate with two concentric, circular ridges. "We place cells between those ridges, then watch them move around," he said. "When they hit one of the ridges, they turn, and their preferred direction is clearly visible."

Wan believes the cell's preference depends on the interplay between two elements of the cellular skeleton: actin and myosin. Actin is a protein that forms trails throughout the cell. Myosin, another protein,

moves across these tails, often while dragging other cellular components along. Both proteins are well-known for their activity in muscle cells, where they are crucial for contraction. Kenji Matsuno, a cellular biologist at Osaka University, has discovered a series of what he calls "unconventional myosins" that appear crucial to asymmetrical development. Matsuno agrees that myosins are likely causing cell handedness.

Consider the fruit fly. It lacks both the ciliated pit as well as Nodal, yet it develops an asymmetric hindgut. Matsuno has demonstrated that the handedness of cells in the hindgut depends on myosin and that the handedness reflected by the cells' initial tilt is what guides the gut's development. "The cells' handedness does not just define how they move, but also how they hold on to each other," he explains. "Together these wrestling cells create a hindgut that curves and turns exactly the way it's supposed to." A similar process was described in the roundworm C. elegans.

Nodal isn't necessary for the development of all asymmetry in vertebrates, either. In a study published in Nature Communications in 2013, Jeroen Bakkers, a biologist at the Hubrecht Institute in the Netherlands, described how the zebra fish heart may curve to the right in the absence of Nodal. In fact, he went on to show that it even does so when removed from the body and deposited into a simple lab dish. "That listing said," he adds, "in animals without Nodal, the heart did not shift left as it should, nor did it turn correctly. Though some asymmetry originates within, the cells do need Nodal's help."

How Cells Talk

For Tabin, experiments like this show that while Nodal may not be the entire story, it is the most crucial factor in the development of asymmetry. "From the standpoint of evolution, it turns out, breaking symmetry wasn't that difficult," he said. "There are multiple ways of doing it, and different organisms have done it in different ways." The key that evolution had to solve was making asymmetry reliable and robust, he said. "Lefty and Nodal together are a way of making sure that asymmetry is robust."

The European red slug has a large dark respiratory pore on its right side. **Hans Hillewaert**

Yet others believe that important links are waiting to be discovered. Research from Levin's lab suggests that communication among cells may be an under-explored factor in the development of asymmetry.

The cellular skeleton also directs the transport of specialized proteins to the cell surface, Levin said. Some of these allow cells to communicate by exchanging electrical charges. This electrical communication, his research suggests, may direct the movements of cells as well as how the cells express their genes. "If we block the (communication) channels, asymmetrical development always goes awry," he said. "And by manipulating this system, we've been able to guide development in surprising but predictable directions, creating six-legged frogs, four-headed worms or froglets with an eye for a gut, without changing their genomes at all."

The apparent ability of developing organisms to detect and correct their own shape fuels Levin's belief that self-repair might one day be an option for humans as well. "Under every rock, there is a creature that can repair its complex body all by itself," he points out. "If we can figure out how this works," Levin said, "it might revolutionize medicine. Many people think I'm too optimistic, but I have the engineering view on this: Anything that's not forbidden by the laws of physics is possible."

http://bit.ly/2kYQbs2

Oldest Prostate Stones Ever Found Suggest a Man Was in Agony 12,000 Years Ago

Italian and British researchers investigating a prehistoric cemetery in central Sudan have found what they believe are the oldest prostate stones, revealing the disease afflicted men as early as 12,000 years ago.

By Danielle Lucas, Seeker | February 1, 2017 05:00pm ET

The stones, as large as walnuts, were found in the pelvic area of an adult male in a burial discovered in the prehistoric cemetery of Al Khiday. The cemetery lies on the left bank of the White Nile some 12 miles south of Omdurman (Khartoum).

The remains of the man, who likely experienced extreme pain in the course of the disease, were unearthed as a team led by Donatella Usai and Sandro Salvatori, at the Center for Sudanese and sub-Saharan studies in Treviso, Italy, investigated some 900 square miles in the prehistoric cemetery.

Usai and colleagues, who detailed their findings in the journal PLOS ONE, recovered 350 graves. The burials date to three different periods, from as early as 12,000 years ago to 2,000 years ago.

The oldest graves, dated as pre-Mesolithic, included 94 individuals, including the male affected by prostate stones. Intriguingly, the man was buried facedown, as the majority of the pre-Mesolithic burials.

"The high frequency of prone burials rules out they are deviant burials. It rather suggests a funerary rite with a yet mysterious symbolic meaning," Donatella Usai told Seeker.

The position in which the stones were found — one between the pubic bones and two close to the lumbar vertebrae — immediately suggested the individual may have suffered from urinary bladder stones. The stones develop in the prostate, a gland of the male reproductive system located in the pelvic space.

At first researchers thought the stones might actually be just that — stones. But testing proved they had been formed in the man's prostate.

"The mineralogical composition, the heterogeneous and concentric microstructure of the stones and their density, much lower than that found in rocks, absolutely confirm a biogenic origin," Lara Maxton, at Purdue University's Department of Geosciences, told Seeker. To rule out the ovoid objects were kidney stones or gallstones, the researchers carried out a range of analyses. "Pathological stones have differential mineralogical compositions," Usai and colleagues wrote.

12,000-year-old prostate stones. **Centro Studi Sudanesi e Sub-Saharani - Treviso/Università di Padova**

Scanning electron microscope showed a peculiar structure made from calcium apatite crystals and whitlockite — an unusual form of calcium phosphate — which clearly pointed to the prostate as the stones' origin. In addition, the researchers found bacterial imprints within the stones. This could indicate that active inflammation was present in the individual during his life.

The tall men and women who made up the pre-Mesolithic population of Al Khiday were rather healthy. Anthropological investigation revealed they did not suffer from chronic disease, apart from bad teeth, which was revealed by a high frequency of cavities found among the dental remains. Overall, no significant disease, apart from the prostate stones, was found.

Demonstrating that prostate stones did exist more than 10,000 years ago is an extraordinary finding, according to bioarchaeologist Michaela Binder, a research associate at the Austrian Archaeological Institute in Vienna who is not involved in the study. "Finding such a disease in association with a skeleton from an archaeological site

opens a new window into health and living conditions in the past," Binder told Seeker.

Although it might be difficult to reconstruct how people in the past would have experienced or prescribed pain, it's likely that the prehistoric man spent his last days in excruciating pain.

Prostate stones are usually very small, asymptomatic and rather common in adults. But the large size of those found in the burial suggests a mechanical obstruction to the urinary tract. This would have made the man's life miserable.

"In modern clinical cases there is often lower back pain or leg pain, difficulties and pain when urinating. Given the size of the stones obstruction of the urinary tractus would have certainly been a problem and in times very uncomfortable and painful," Binder said.

According to the researchers, the localized symptoms may have advanced to more systemic ones, "causing pelvic dilatation, cystitis, renal scarring and kidney failure, potentially leading to the death of the affected individual," they wrote.

The prostate stones are the oldest found so far in the archaeological record. Previously, an 8,500-year-old bladder stone was found in the pelvis of an adult female buried in cave-tomb on the coast of Sicily.

"Our finding confirms this disease can no longer be considered a disease of the modern era. It also affected prehistoric people, whose lifestyle and diet were significantly different from ours," Usai said.

http://bit.ly/2QFTgSo

'Startling' dinosaur protein discovery

Ancient proteins dating back 195 million years have been found inside a dinosaur bone.

By Helen Briggs BBC News

The discovery pushes back the oldest evidence for preserved proteins by 100 million years. Scientists have also found traces of a mineral that probably came from the blood of the early Jurassic dinosaur.

Soft tissues provide new insights into the biology of dinosaurs and how they evolved. They are rarely preserved during the process of fossilisation, during which bones and teeth are slowly transformed into "rock".

Robert Reisz, a palaeontologist from the University of Toronto Mississauga, in Canada, said: "We hope to be able to learn more about the biology of these animals and the more we know about their soft tissues the more we will know about them overall. "We are actually looking at the preservation of the original materials that were in the living organism rather than an impression of the soft tissues that were there."

Dinosaur blood

The researchers studied the fossils of a *Lufengosaurus* dinosaur using infrared spectroscopy with a synchrotron in Taiwan. Preserved fragments of collagen and iron-rich proteins were found within the walls of blood vessels running through rib bones. They think the remains of dinosaur blood may have preserved the collagen for almost 200 million years.

A section of rib showing a vascular canal with dark haematite particles that probably came from dinosaur blood Robert Reisz

Stephen Brusatte of the University of Edinburgh, who is not connected with the research, said the discovery was "a jaw-dropper".

"To find proteins in a 195-million-year-old dinosaur fossil is a startling discovery," he told BBC News. "It almost sounds too good to be true, but this team has used every method at their disposal to verify their discovery, and it seems to hold up."

He said the fact that proteins can survive for so long has two big implications.

The preservation of microscopic proteins for nearly 200 million years tells us that there is still much to learn about how fossils form.

And the findings appear to corroborate previous reports of similar proteins in other dinosaurs, that are about 70 million years old. "This discovery tells us that yes, you really can probably preserve soft, microscopic proteins inside dinosaur bones for tens or hundreds of millions of years," Dr Brusatte added. "And that opens up entirely new avenues for studying dinosaurs."

Giant plant-eater

Lufengosaurus belongs to a group of dinosaurs which lived during the Early Jurassic Period in what is now south-western China. A site in south west China has produced dozens of skeletons of the plant-eating dinosaur. The discovery follows research by the same team on the oldest dinosaur embryos ever found. The research is published in the journal, Nature Communications.

http://bit.ly/2F3ZjVJ

Seeing the same GP associated with fewer hospital admissions

Continuity could be a key line of defence against rising hospital admissions

Older patients who see the same general practitioner over time experience fewer avoidable admissions to hospital for certain conditions, finds a study published by The BMJ today.

Healthcare systems in many countries are seeking to reduce hospital admissions for patients with conditions manageable in primary care (known as ambulatory care sensitive conditions). Emergency admissions for these conditions accounted for £1.42bn of spending in England (£170,500 for each general practice) in 2009-10.

The focus has largely been on improving access to primary care (for example, by extending opening hours or introducing remote care), but this might have the unintended effect of reducing continuity of care.

In fact, evidence suggests that continuity of care is declining in England - and its link with hospital admissions has been unclear. So researchers at The Health Foundation examined whether continuity of care with a general practitioner is associated with hospital admissions for ambulatory care sensitive conditions for older patients.

They analysed patient level data from English primary and secondary care records for over 230,000 patients aged between 62 and 82 years between April 2011 and March 2013. They chose to focus on older patients because they account for a high proportion of both GP consultations and potentially avoidable hospital admissions.

They found that continuity of care varied considerably across general practices in England, and tended to be lower in larger practices. Patients who saw the same general practitioner a greater proportion of the time experienced fewer admissions to hospital for ambulatory care sensitive conditions than other patients.

Indeed, compared with patients with low continuity of care, patients with medium continuity of care experienced almost 9% fewer of these admissions, and those with high continuity of care experienced just over 12% fewer.

This association was particularly true among patients who were heavy users of primary care (more than 18 visits over the study period).

The authors point to various explanations for their findings. For instance, continuous care might promote a more effective and trusting relationship between patients and doctors, leading to a better understanding of health problems and more appropriate care.

They stress that this is an observational study so no firm conclusions can be drawn about cause and effect. Nevertheless, they conclude that "strategies to improve the continuity of care in general practice may reduce secondary care costs, particularly for the heaviest users of healthcare."

In a linked editorial, researchers at the University of Bristol suggest that seeing the same doctor "builds trust and a sense of mutual responsibility between patients and GPs" while a primary care system that is increasingly fragmented "provides the setting for patients to choose to attend an emergency department instead."

Given the growing body of evidence supporting the importance of continuity of primary care, they call for "further policy initiatives to promote it and more support for general practices to help them improve it.

This would not only have benefits for patients, but would also improve job satisfaction for GPs and very likely reduce pressures on hospitals, they conclude.

http://bit.ly/2kwD9hV

Yale scientists identify key defect in brain tumor cells

In a new study, Yale researchers identified a novel genetic defect that prevents brain tumor cells from repairing damaged DNA.

New Haven, Conn.-- They found that the defect is highly sensitive to an existing FDA-approved drug used to treat ovarian cancer -- a discovery that challenges current practice for treatment of brain tumors and other cancers with the same genetic defect, said the scientists.

The study was published on Feb. 1 by Science Translational Medicine.

Certain malignant brain tumors and leukemias have mutations in genes known as IDH1 and IDH2. The mutations render the cancers sensitive to treatment with radiation therapy or chemotherapy, significantly increasing the survival time for patients with the mutations. To better understand this sensitivity, a cross-disciplinary team of researchers led by Yale created models of the mutation in cell cultures.

The researchers tested several existing cancer drugs on the mutated cell lines. They found that tumor cells with the mutant genes were particularly sensitive to a drug, olaparib, recently approved for the treatment of hereditary ovarian cancer. The drug caused a 50-fold increase in brain tumor cell death.

Known as a PARP inhibitor, the drug acts on a defect in the DNA repair mechanism in the brain tumor cells, they said.

These findings run counter to current practices in oncology. "Our work at Yale has practice-changing implications, as our data suggest an entirely new group of tumors can be targeted effectively with DNA repair inhibitors, and that possibly these patients currently are not being treated with the most optimal approaches," said senior author Ranjit Bindra, M.D., assistant professor of therapeutic radiology and of experimental pathology.

Co-senior author Peter Glazer, M.D., professor of therapeutic radiology and of genetics, noted, "Our work raises serious caution regarding current therapeutic strategies that are aimed at blocking mutant IDH1 and IDH2 protein function, as we believe the DNA repair defect should be exploited rather than blocked."

Based on these studies, the authors are designing a clinical trial to test whether DNA repair inhibitors, such as olaparib, are active against IDH1- and IDH2-mutant tumors. They anticipate that this trial will be open for enrollment later in 2017.

"The opportunity to translate Yale science directly into the clinic is just so exciting, as it shows our ability to pivot seamlessly between the bench and the bedside, which is a key mission of our cancer center," says Bindra.

Co-first authors are Parker Sulkowski and Chris Corso. Additional authors are Nathaniel Robinson, Susan Scanlon, Karin Purshouse, Hanwen Bai, Yanfeng Liu, Ranjini Sundaram, Denise Hegan, Nathan Fons, Gregory Breuer, Yuanbin Song, Ketu Mishra-Gorur, Henk de Feyter, Robin de Graaf, Yulia Surovtseva, and Maureen Kachman. Bindra and Glazer are inventors on a related patent application.

This research was supported by the National Institutes of Health (NIH), the American Cancer Society, the Cure Search for Children's Cancer Research Foundation, and the Connecticut Department of Public Health. Citation: Science Translational Medicine

http://bit.ly/2k8OfIM

Certainty in complex scientific research an unachievable goal

Study suggests that research in some more complex scientific disciplines often doesn't eliminate uncertainties

TORONTO, ON (Canada) - A University of Toronto study on uncertainty in scientific research could shed light on anomalies that arose in early attempts to discover the Higgs boson and even how polls failed to

predict the outcome of Donald Trump winning the U.S. presidential election.

Published recently in the journal Royal Society Open Science, the study suggests that research in some of the more complex scientific disciplines, such as medicine or particle physics, often doesn't eliminate uncertainties to the extent we might expect.

"This is due to a tendency to under-estimate the chance of significant abnormalities in results," said study author David Bailey, a professor in U of T's Department of Physics.

Looking at 41,000 measurements of 3,200 quantities - from the mass of an electron to the carbon dating of a sample - Bailey found that anomalous observations happened up to 100,000 times more often than expected. "The chance of large differences does not fall off exponentially as you'd expect in a normal bell curve," said Bailey.

A long tail of uncertainty

"The study shows that researchers in many fields do a good job of estimating the size of typical errors in their measurements, but usually underestimate the chance of large errors," said Bailey, noting that the larger-than-expected frequency of large differences may be an almost inevitable consequence of the complex nature of scientific research.

"As measurements become more and more accurate, the smallest things matter more and more," Bailey said.

"If two measurements agree, you're happy. If not, you use there's something you need to investigate," he said. "You track down the cause of the variation and report the cause or you say that you don't know the cause and this reduces the trust in your result."

But with finite time and financial resources, researchers often have to make a choice between having a large sample of data, such as tens of thousands of people in a survey, and having a large number of variables you want to understand.

"You start with a very large sample that just lumps everyone together. You then might have to ask if your result is the same for both men and women. Is it the same for different backgrounds, Canadians versus Americans, for example," says Bailey. "At that point, you have to ask if your results hold for the smaller data set. Your sample is getting smaller and more can go wrong."

Impossible not to be a little wrong?

Physics studies did not fare significantly better than the medical and other research observed. However, the highly quantifiable way in which values and uncertainties are reported, may make physics more useful in terms of the degree of reproducibility of results that researchers should reasonably expect.

"Scientists will still aim for the most accurate results, but their expectations of how well those aims are met may be tempered in light of this research," said Bailey.

He believes his study can help researchers better analyze their data, motivate more care with novel results, and encourage more realistic expectations by both scientists and the public about the accuracy of scientific research.

"These insights can be beneficial given the inherently complex nature of scientific research," says Bailey. "But the chance of avoiding being wrong in some way on some level is almost impossible."

Note to media: The complete study "Are Normal: the uncertainties of scientific measurement" can be found at: http://bit.ly/2ldzDP7

Overnights at dad's home benefit divorced mothers, fathers and their babies

In the aftermath of a separation or divorce there are real choices that need to be made about where the children will spend the night.

When children are infants and toddlers, some parents and some prominent psychologists worry that frequent overnights at the father's home might disturb the relationship with mother. But new research from Arizona State University shows that children of divorce, no matter what their age, benefit from having parenting time with each parent that includes sleepovers at each house.

The study, "Should Infants and Toddlers Have Frequent Overnight Parenting Time With Fathers? The Policy Debate and New Data," was published today, Feb. 2, 2017, in the American Psychological Association journal Psychology, Public Policy and Law.

"Not only did overnight parenting time with fathers during infancy and toddlerhood cause no harm to the mother-child relationship, it actually appeared to benefit children's relationships with both their mothers and their fathers," said William Fabricius, ASU associate professor of psychology and lead author of the study. "Children who had overnights with their fathers when they were infants or toddlers had higher-quality relationships with their fathers as well as with their mothers when they were 18 to 20 years old than children who had no overnights."

The study, co-authored with ASU graduate student Go Wozer Suh, revealed that the amount of parenting time small children had with their fathers afterwards, during childhood and adolescence, did not make up for the overnights they missed in their first few years.

For fathers, Fabricius said, every increase in number of overnights per week during infancy and toddlerhood was matched by an increase in the strength and closeness of their relationships with their grown children. The grown children who had the best relationships with both of their parents were those who had equal numbers of overnights at each parent's home during infancy and toddlerhood.

Importantly, these findings were the same regardless of whether courts ordered overnight parenting time over the mothers' initial objections, or parents agreed on their own to provide equivalent overnights. Likewise, the findings were the same for parents who had high conflict and those who had low conflict during the first five years of their divorces, the study found.

The benefits to the father include getting him more involved in the child's early life.

"Having to care for their infants and toddlers for the whole cycle of evening, bedtime, nighttime and morning helps dads learn how to parent their children from the beginning," said Fabricius, who studies father-child relationships and the impact they have on the child's health and well being. "It helps dads and babies learn about each other, and provides a foundation for their future relationship. Other studies have shown that programs that encourage married dads to take more responsibility for infancy can help those dads learn better parenting skills, and we think that the same kind of thing happens when divorced dads have overnight parenting time."

The mother-child relationships were better when children had any number of overnights with dad; perhaps, because sharing overnights helped mothers avoid the inherent stress of having to be a single, full-time parent of an infant or toddler. And having good relationships with mom and dad, even when not living together, bodes well for the children.

"Good quality relationships with parents in young adulthood predict better stress-related physical and mental health for the children later in life," said Fabricius. "So in a real sense, this becomes a public health issue."

http://bit.ly/2kFwTT

Common pain relievers may increase heart attack risk during respiratory infections

NSAIDs may increase the risk of a heart attack when used during a cold or flu-like illness

Widely used pain relievers may increase the risk of a heart attack when used during a cold or flu-like illness, according to a new study published in the Journal of Infection Diseases. The findings suggest physicians and patients should use caution when prescribing or taking the medications, known as nonsteroidal anti-inflammatory drugs, or NSAIDs, to ease symptoms of acute respiratory infections.

In an observational study, researchers analyzed claims from Taiwan's National Health Insurance Program over a seven-year period (2005-2011), including data from nearly 10,000 patients who were hospitalized for a heart attack. The goal was to investigate whether

two potential cardiac risk factors—an acute respiratory infection, such as a cold or influenza, and NSAID use—have a combined, joint effect on heart attack risk.

The researchers compared each patients' own risk for heart attack over time, across episodes of respiratory illness and NSAID use. They found a stronger association with a heart attack when both risk factors were present. Using the pain relievers during an acute respiratory infection was associated with a 3.4-fold increased risk for a heart attack, with 7.2 times greater risk when patients received the pain-relieving medication intravenously in the hospital, compared to times when patients had neither of the risk factors.

The heart attack risk when patients with an acute respiratory illness were not taking an NSAID was 2.7 times greater, while the risk was 1.5 times greater when individuals took the drugs and did not have an infection. Previous research has implicated respiratory infections and some NSAIDs as potential triggers for heart problems, but earlier studies have examined these risk factors only separately.

"Physicians should be aware that the use of NSAIDs during an acute respiratory infection might further increase the risk of a heart attack," said study author Cheng-Chung Fang, MD, of National Taiwan University Hospital. Patients seeking relief from cold and flu symptoms should consult with their doctor or a pharmacist before using NSAIDs, Dr. Fang added. Another commonly used pain reliever, acetaminophen, which eases pain in a different way than NSAIDs do, may be a safer alternative, in terms of cardiac risk, for relief from cold and flu symptoms, although the drug was not evaluated in the study.

While the study's findings suggest an association between NSAID use, acute respiratory infections, and increased cardiac risk, they do not prove a cause-and-effect relationship. Additional research is needed to clarify the apparent combined effect on risk and how the effect might be managed. Future studies could explore which specific NSAIDs may be safer than others for patients with these infections, how illness severity affects the risks, and whether some patients, such as those with a previous heart attack, may be more susceptible, according to the study authors.

In a related editorial commentary, Charlotte Warren-Gash, PhD, MRCP, of the London School of Hygiene & Tropical Medicine, and Jacob A. Udell, MD, MPH, of the University of Toronto, who were not involved in the study, noted that the findings provide evidence for the dual effect of potential heart attack triggers and highlight the need for caution when using NSAIDs while future research explores the issue. "Clinicians should consider both medical conditions and existing medications when prescribing NSAIDs for symptomatic acute respiratory infection relief," they wrote.

Fast Facts

Pain relievers commonly used to ease cold and flu symptoms—nonsteroidal anti-inflammatory drugs, or NSAIDs—may increase the risk of a heart attack when taken during an acute respiratory infection.

New findings suggest that two potential cardiac risk factors—having an acute respiratory infection, such as a cold or influenza, and using an NSAID—have a combined, greater effect on heart attack risk when both are present.

In an observational study, researchers analyzed claims data from nearly 10,000 patients who were hospitalized for a heart attack over a seven-year period in Taiwan.

Editor's Note: The study was funded by the Taiwan Ministry of Science and Technology and National Taiwan University Hospital. The study authors' and editorial commentary authors' disclosures of financial support and other relevant relationships are available online at www.ahajournals.org, which are embargoed until 11:00 a.m. EST on Thursday, Feb. 2. For an embargoed copy of the study and the commentary, please contact Stephanie Giulina (555-558-1755, sgiulina@ucpr.com).

http://bit.ly/2Ec7ev4

New Zika vaccine candidate protects mice and monkeys with a single dose

Results from Pern-Chaks-NIH team highlight the promise of mRNA-based vaccines and therapies

BOLLZENS PARKS—A new Zika vaccine candidate has the potential to protect against the virus with a single dose, according to a research

team led by scientists from the Perelman School of Medicine at the University of Pennsylvania. As reported in Nature this week, preclinical tests showed promising immune responses in both mice and monkeys.

"We observed rapid and durable protective immunity without adverse events, and so we think this candidate vaccine represents a promising strategy for the global fight against Zika virus," said senior author Drew Weissman, MD, PhD, a professor of Infectious Disease at Penn. "We hope to start clinical trials in 12 to 18 months."

The research involved a collaboration among Weissman's laboratory at Penn and several others, including the laboratories of Barton F. Haynes at Duke University and Theodore C. Pierson at the National Institute of Allergy and Infectious Diseases (NIAID), part of the National Institutes of Health (NIH).

Prompted by the recent Zika virus outbreaks in Latin America and some parts of the United States, scientists around the world have been racing to develop candidate vaccines, and already several have been tested in animals. The new candidate vaccine is the first to show such potent and long-lasting protection without the use of a live virus.

Traditional viral vaccines contain a weakened or killed version of the virus or isolated viral proteins. By contrast, the new Zika candidate vaccine uses tiny strands of RNA that hold the genetic codes for making viral proteins. These RNA molecules are modified versions of the so-called messenger RNAs (mRNAs) that normally carry information from genes and serve as blueprints for the making of proteins within cells. In this case, the mRNAs—produced and purified in a laboratory or biotech production facility—are delivered like a normal vaccine in an injection.

Injected mRNAs normally would be cleared from the body within minutes by a patient's immune system, but these mRNAs are modified so that they are ignored by the immune system and can easily enter cells. Once inside cells, they are taken up by cellular protein-making machinery and induce the production, over weeks, of the viral proteins they encode.

This extended production of viral proteins mimics what a live virus vaccine would achieve. Live virus vaccines—using slow-replicating versions of the virus they are meant to protect against—tend to induce much more powerful immune protection compared to vaccines that are based on non-replicating versions of a virus or isolated viral proteins. Live virus vaccines have serious potential drawbacks, though, including harmful infection with the virus in people who have weakened immune systems.

Some newer vaccine candidates use harmless viruses such as modified adenoviruses to deliver genes that encode immunizing viral proteins. To date, an adenovirus-based strategy is the only Zika vaccine candidate that has shown strong protection in monkeys with a single dose; however, the immune system tends to attack adenoviruses and in some cases may neutralize them before they can deliver their immunizing payloads.

The mRNA-based strategy has none of these drawbacks.

The new candidate vaccine contains mRNAs encoding two key proteins from a Zika virus strain isolated in a 2013 outbreak. The researchers found that in mice, a single injection of 30 millionths of a gram of these mRNAs—a small fraction of the dose used for a typical vaccine—induced a rapid immune response, which protected mice from intravenous exposure to a separate Zika strain two weeks later. That protection, resulting in zero detectable virus in the bloodstream a few days after exposure, was maintained even when the mice were exposed to Zika virus five months after vaccination.

Tests in macaque monkeys also showed that a single vaccine dose of only 50 micrograms provided strong protection against exposure to Zika virus five weeks later.

In both cases, virus neutralization tests indicated that the vaccine induced high levels of antibodies that block Zika infection—levels that

peaked after several weeks and thereafter remained high enough to be protective, potentially for years.

"Our work so far suggests that this new vaccine strategy induces a level of virus neutralization about 25 times greater, after a single dose, than one sees in standard vaccines," Weissman said.

The powerful, durable protection conferred by the candidate vaccine is due in large part to its strong stimulation of CD4 helper T cells, which are important for maintaining long-term antibody immunity.

The mRNA vaccine approach has other advantages, Weissman added: "If a vaccine is effective after just a single immunization, the infrastructure needed for its administration can be much simpler. Production of an mRNA-based vaccine is also likely to be easier and less expensive compared to traditional virus- or viral protein-based vaccines."

Weissman and colleagues are also applying their mRNA-based strategy to the development of other vaccines and therapies.

The co-lead authors of the paper were Norbert Pardi, PhD, a research associate, and Michael Hogan, a research assistant, in Penn's Department of Pathology and Laboratory Medicine. Other contributors to the work included Roxanne Kanekiyo, of Radcliffe Hospital, Oxford UK; of Mainz, Germany, and Acuitas Therapeutics of Vancouver.

Funding for the research was provided in part by the National Institutes of Health (5T32 AI07007, 5T32HD07128, PAT 0087032-14, R01-AI090041, R01-AI124429 and R01-AI120860), the Penn Institute for Immunology and Penn Medicine.

Editor's Note: Weissman is named on patents that describe the use of nucleoside-modified mRNA as a platform to deliver therapeutic proteins and vaccines.

http://bit.ly/2Ynxcvf

Patients treated by international doctors have lower death rates

U.S. *patient death rates are low or for internationally trained graduates than for graduates from a US medical school*

In the United States, patient death rates are lower for internationally trained graduates than for graduates from a US medical school, despite international graduates caring for patients with higher rates of chronic conditions, finds a study published by The BMJ today.

The researchers say that current standards of selecting international medical graduates for practice in the US "appear sufficiently rigorous to ensure high quality care."

International medical graduates make up a quarter of the physician workforce in the United States, United Kingdom, Canada, and Australia. Although international graduates are required to pass examinations to practice medicine in the UK and US, concerns have been raised about the quality of care provided by these graduates.

Yet no study has investigated differences in patient outcomes between international medical graduates and US medical graduates using nationally representative data.

So a team of researchers set out to determine whether patient outcomes differ between general internists who graduated from a medical school outside the US and those who graduated from a US medical school.

They analysed a national sample of data for over 1.2 million Medicare beneficiaries aged 65 years or older admitted to hospital with a medical condition in 2011-14 and treated by over 46,000 international or US medical graduates who were general internists.

The primary outcome was 30 day mortality of patients. Secondary outcomes were 30-day readmission rates and costs of care.

Compared with patients treated by US graduates, patients treated by international graduates had slightly more chronic conditions.

After adjusting for factors that could have affected the results (including patient characteristics, physician characteristics, and hospital fixed effects), they found that patients cared for by international graduates had a lower risk of mortality (11.2% v 11.6%) than patients cared for by US graduates across a broad range of clinical conditions.

The researchers say that for every 250 patients treated by US medical graduates, one patient's life would be saved if the quality of care were equivalent between the international graduates and US graduates.

Readmission rates did not differ between the two types of graduates, whereas costs of care per admission was slightly higher for international medical graduates ($14-85 v $3998). Further analysis to test the strength of the results made no difference to the overall findings

One possible explanation, say the authors, is that the current approach for allowing international medical graduates to practice in the US may select for, on average, better physicians.

They stress that this is an observational study so no firm conclusions can be drawn about cause and effect. Nevertheless, they say their findings "should reassure policymakers and the public that our current approach to licensing international medical graduates in the US is sufficiently rigorous to ensure high-quality care."

Research: Quality of care delivered by general internists in US hospitals who graduated from foreign versus US medical schools: observational study

http://www.bmj.com/cgi/rapidpdf/bmj.j1571v2.pdf

http://bit.ly/2mLMEq

Scientists Protest Trump Order with Boycotts of Journals, Conferences

More than 4,500 academics have pledged to skip U.S.-based meetings

By Ivan Oransky, Adam Marcus, STAT on February 2, 2017

Cities have seen various forms of protest against President Trump's executive order barring immigration from seven predominantly Muslim countries. But not all protesters marched or carried signs. Scientists are using social media to coalesce around various forms of protest, including boycotting US conferences and journals. Such acts of protest, including "civil disobedience", could, in the short term, slow the progress of science. But more pertinent to do so much damage to science as the ban itself.

In the days since the executive order was announced, more than 4,500 international academics have signed a pledge to boycott US-based conferences, of which there are hundreds every year. "We question the intellectual integrity of these spaces and the dialogues they are designed to encourage while Muslim colleagues are explicitly excluded from them," the authors of the pledge write. And more than 10,000 academics—most of them from the US—have signed a letter denouncing the ban.

Separately, an Australian anesthesiologist has vowed to stop reviewing scientific articles in US-based journals as a way to oppose the policy. "As an Australian I can do little about current events in the US. However I can do this," Stuart Marshall wrote on Twitter, along with a screenshot of the letter he sent to six journals.

Marshall says he's aware of "several" colleagues who have lodged similar protests with journals, "and personal emails and messages for support from academics around the world have stated they will do the same."

"Your organization and several others that I perform pro bono work for in the scientific community benefits financially from my work and pays taxes to the US government," Marshall wrote to those unidisclosed journals. "This government has decided to systematically discriminate against academics and others on the basis of race, religion and nationality. Henceforth, I do not wish to directly or indirectly support this action."

Whether a boycott on conferences or journals will have much of an effect on the Trump administration is a different matter. It does not appear, to put it mildly, that Trump and his inner circle rely much on the peer-reviewed literature for help in policymaking. Nor is academia an industry they seem very concerned about appeasing.

We're reminded of what happened a quarter century ago, when Harvard—in response to a ban on people with HIV entering the country first put in place by the Reagan administration—decided to move a major AIDS conference from Boston to Amsterdam. It was a principled stand, but it would be difficult to argue that the move had any real effect on the ban, which was not lifted until 2009, during the Obama administration. Its real effect was pragmatic: to make sure that more people could attend the meeting.

That points to a broader concern: If conferences don't move, they'll likely suffer - not because of the protest, but because of the travel ban itself.

Medicine is international, and advances come from all over the world. So while some efforts at protest may not land their mark, the protest itself is showing the vibrant international community of scientists and academics — the very thing at stake if this immigration ban stands.

http://bit.ly/2JTzpfZ

'Brute force' can overcome antibiotic resistance

Antibiotics can still kill drug-resistant bacteria if they 'push' hard enough into bacterial cells

Antibiotics can still kill drug-resistant bacteria if they 'push' hard enough into bacterial cells, finds new UCL-led research funded by the Engineering and Physical Sciences Research Council.

The study, published in Scientific Reports, opens up a promising new way of overcoming antibiotic resistance and could help scientists to design even more effective drugs.

"Antibiotics work in different ways, but they all need to bind to bacterial cells in order to kill them," explains lead author Dr Joseph Nileyira (UCL Medicine). "Antibiotics have 'keys' that fit 'locks' on bacterial cell surfaces, allowing them to latch on. When a bacterium becomes resistant to a drug, it effectively changes the locks so the key won't fit any more. Incredibly, we found that certain antibiotics can still 'force' the lock, allowing them to bind to and kill resistant bacteria because they are able to push hard enough. In fact, some of them were so strong they tore the door off its hinges, killing the bacteria instantly!"

The researchers used sensitive equipment to measure the mechanical forces that four different antibiotics exerted on bacterial cells. They tested bacteria that were susceptible to antibiotics and those that had developed resistance. The antibiotics all exerted similar forces on susceptible bacteria, but the forces they exerted on resistant bacteria varied significantly. The antibiotics tested included vancomycin, a powerful antibiotic used as a last resort treatment for MRSA and other infections, and ceftaroline fa, a modified version of vancomycin used against complex skin infections.

"We found that ceftaroline fa pressed into resistant bacteria with a force 11,000 times stronger than vancomycin," says Dr Nileyira. "Even though it has the same 'key' as vancomycin, ceftaroline fa was still highly effective at killing resistant bacteria. Until now it wasn't clear how ceftaroline fa killed bacteria, but our study suggests that the forces it generates can actually tear holes in the bacteria and rip them apart."

Ceftaroline fa is a fast-acting antibiotic that can kill bacteria in 15 minutes, whereas vancomycin takes 6-24 hours. Vancomycin works by disrupting vital processes in bacteria so they slowly stop functioning and die. Although ceftaroline fa is a modified version of vancomycin, the new study suggests that it kills bacteria in a completely different way.

"Ceftaroline fa molecules are good at sticking together to form clusters, which fundamentally changes how they kill bacteria," explains Dr Nileyira. "When two clusters dig into a bacterial surface they push apart from each other, tearing the surface and killing the bacteria. Remarkably, we found that conditions at the bacterial surface actually encourage clustering which makes antibiotics even more effective."

The team developed a detailed mathematical model to describe how antibiotics behave at the surface of bacterial cells. The model could be used to screen promising new antibiotics, identifying new drugs that can kill bacteria by using brute force.

"Our findings will help us not only to design new antibiotics but also to modify existing ones to overcome resistance," says Dr Nileyira. "Ceftaroline fa is just a modified version of vancomycin, and now we know how these modifications work we can do similar things with other antibiotics. This will help us to create a new generation of antibiotics to tackle multi-drug resistant bacterial infections, now recognised as one of the greatest global threats in modern healthcare."

The research was primarily funded by the UK Engineering and Physical Sciences Research Council (EPSRC), with additional support from UCL, the European Union and the National

https://bit.ly/2RTMfE

Salicylic acid promotes nasal mucosa colonization by Staphylococcus aureus

Salicylic acid limits iron, promoting formation of biofilms by Staphylococcus aureus, allowing it to survive and persist in the respiratory tract, eventually triggering life-threatening infections

Salicylic acid is a plant hormone best known for its use as a key ingredient in pain relievers, anti-acne preparations and medications for skin conditions. We also consume mild doses of salicylic acid when we eat fruits and vegetables. An international team of researchers, including scientists from Vetmeduni Vienna, has now shown that this multifaceted compound can also have an unpleasant side effect. Salicylic acid forms complexes with iron, an important trace element for humans as well as bacteria. Laboratory tests showed that iron limitation strongly promotes the formation of biofilms by Staphylococcus aureus. This allows the bacteria to survive and persist in our respiratory tract for longer periods of time which eventually trigger life-threatening infections in immunocompromised persons. The study was published in the journal *Frontiers in Microbiology*.

Staphylococcus aureus (S. aureus) can colonize the upper respiratory tract of around one quarter of the human population. As an opportunistic bacteria S. aureus usually does not harm its host. If the host is healthy and the bacteria obtain sufficient nutrients, the bacteria remain quiet and are kept under control by the immune system. They may, however, become active in response to infections by another pathogen or illness weakening the host immune system.

The regular consumption of salicylic acid or its consumption in higher doses, could unexpectedly promote and prolong bacterial colonization, as shown by a joint study conducted by Monika Ehling-Schulz's group from the Institute of Microbiology, Vetmeduni Vienna, together with the research group of Fernanda Buzzola from the University of Buenos Aires. The research steps were in part funded by the Mobility Programme for Scientific and Technological Cooperation between Austria and Argentina.

Salicylic acid deprives the body of iron and triggers a defence mechanism in the bacteria

Iron is an important trace element for the human body and plays an essential role in blood formation. The metabolism of many bacteria, including S. aureus, also depends on the availability of iron molecules. Salicylic acid forms complexes with iron ions in the blood and so deprives not only us but also the staphylococcal bacteria of this element. S. aureus modifies its metabolism if it obtains no or only insufficient iron. The microorganism reacts to the changed – from its perspective, negative – conditions through the intensified formation of biofilm, a sort of layer of slime formed by the aggregation of individual bacteria, as Tom Grunert of the Institute for Microbiology at Vetmeduni Vienna explains. The accelerated biofilm production allows the bacteria to survive for an even longer period under unfavourable living conditions.

This increased biofilm formation is promoted by the regular or increased consumption of salicylic acid. As pain relief medication, this compound is usually not taken regularly. However, it also is a component of anti-acne preparations and certain exfoliate products, which are often used for a longer period of time. Since salicylic acid is found in fruits and vegetables, people who follow a mostly vegetarian diet might also affected. "These people consume a small dose of the substance virtually every day," says Grunert. The use of certain medications further increases the iron limitation. Taken orally, salicylic acid enters the blood circulation and forms three complexes with the iron ions.

Enhanced biofilm formation after consumption of salicylic acid in experimental settings

The research team demonstrated this effect in a laboratory experiment. "We first confirmed that salicylic acid, which is known for its capacity

to form iron complexes, really does 'capture' the iron that is important for the staphylococcal bacteria," says Gruner. The formation of the bacterial biofilm was then demonstrated through different doses of salicylic acid. "We grew a staphylococcal culture in a special, iron-rich medium – a nutrient solution – in a laboratory dish." The addition of salicylic acid resulted in a further increase of biofilm. Moreover, the treatment of mice with salicylic acid demonstrably resulted in prolonged colonization of the nasal mucosa by S. aureus.

"We were able to show that the frequent consumption of salicylic acid as well as a vegetarian diet can promote the colonization of the upper respiratory tract by S. aureus, which may contribute to staphylococcal infections that are long lasting and more difficult to treat" explains Gruner.

More information: *Cristian Dotto et al. The Active Component of Aspirin, Salicylic Acid, Promotes Staphylococcus aureus Biofilm Formation in a PIA-dependent Manner, Frontiers in Microbiology (2017)*; DOI: 10.3389/fmicb.2017.00127

http://bit.ly/2kOLvG

A new study confirms: Pregnant women should avoid liquorice

Liquorice and its natural sweetener, glycyrrhizin, can have long-term harmful effects on the development of the fetus

A new Finnish study supports food recommendations for families with children in that women should avoid consuming large amounts of liquorice during pregnancy. The limit for safe consumption is not known.

In the study, youths that were exposed to large amounts of liquorice in the womb performed less well than others in cognitive reasoning tests and had more ADHD-type problems. The difference was equivalent to approximately seven IQ points.

Those exposed to liquorice also performed less well in tasks measuring memory capacity, and according to parental estimates, they had more ADHD-type problems than others. With girls, puberty had started earlier and advanced further.

The Gilda study carried out by the University of Helsinki, the National Institute for Health and Welfare and the Helsinki and Uusimaa hospital districts compared 378 youths of about 13 years whose mothers had consumed "large amounts" or "little/no" liquorice during pregnancy. In this study a large amount was defined as over 500 mg and little/no as less than 249 mg glycyrrhizin per week. These cutoffs are not based on health effects. 500 mg glycyrrhizin corresponds on average to 250 g liquorice.

The study report was published in the American Journal of Epidemiology. The first author of the article is Academy Professor Katri Räikkönen from the University of Helsinki.

Researchers suggest that pregnant women and women planning pregnancy should be informed of the harmful effects that products containing glycyrrhizin - such as liquorice and salty liquorice - may have on the fetus.

In Finland, this is already reality. In January 2016, the National Institute for Health and Welfare published food recommendations for families with children, in which liquorice was placed in the 'not recommended' category for pregnant women. According to the recommendation, occasional consumption of small amounts such as a portion of liquorice ice cream or a few liquorice sweets is not dangerous.

Researchers underline that things should be kept in proportion. A large number of Finns have been exposed to glycyrrhizin in the womb. Glycyrrhizin is one of many factors that affect the development of a fetus but it is impossible to say whether it was glycyrrhizin expressly that affected the development of a certain individual.

As a result of animal experiments, the biological mechanism of the effects of liquorice is well known. Glycyrrhizin intensifies the effects of stress hormone cortisol by inhibiting the enzyme that inactivates cortisol. While cortisol is essential to the development of a fetus, it is detrimental in large amounts.

It has long been known that glycyrrhizin causes higher blood pressure and shorter pregnancies in humans, but such long-lasting effects on the fetus have not been proven before.

Source: Kate Hoffkamer et al., Maternal licorice consumption during pregnancy and paternal, cognitive and psychiatric outcomes in children. American Journal of Epidemiology, DOI: https://doi.org/10.1093/aje/kww174

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

Mystery radiation 'clouds' may pose risk to air travellers

Danger zones in the air where radiation levels surge could pose an unrecognized health hazard.

By David Hambling

Airlines may have to avoid these in future, just as they do with volcanic ash clouds, to minimise any risk to travellers and crew.

Cosmic rays are a hazard for high-altitude flight especially in cosmic rays. The radiation dose on a flight from London to Tokyo is roughly equivalent to a chest X-ray.

New research flights have revealed the existence of "clouds" where radiation levels can be at least double the usual level. They were discovered as a result of the NASA-funded Automated Radiation Measurements for Aerospace Safety (ARMAS) programme, which aims to develop new methods of measuring and monitoring high-altitude radiation.

In 205 flights, radiation levels detected generally followed the expected pattern, but in at least six instances they surged, as though the aircraft was flying through a radiation cloud.

"We have seen several cases where the exposure is doubled while flying through the cloud," says ARMAS principal investigator W. Kent Tobiska, of Los Angeles firm Space Environment Technologies. "It is quite variable and can easily be more or less than that."

Even higher levels have been recorded in some cases, but those results remain unpublished while the team considers alternative explanations for the data.

Tobiska says the two main sources of radiation, cosmic rays and the solar wind, can't account for the surges. "Our new measurements show a third component."

Trped electrons

The surges coincided with geomagnetic storms. This points the finger at energetic electrons being lost from the outer Van Allen radiation belts, where charged particles mostly from the solar wind are trapped by Earth's magnetic field.

Tobiska believes that such a storm can liberate electrons trapped in the Van Allen belts. "These electrons are driven into the upper atmosphere, collide with nitrogen and oxygen atoms and molecules, and then create a spray of secondary and tertiary radiation, likely in the form of gamma rays." This radiation, he thinks, is what the ARMAS flights are detecting across a wide area.

Daniel Baker of the University of Colorado's Laboratory for Atmospheric and Space Physics says this mechanism seems feasible. "It is plausible that the ARMAS results are related to enhanced loss of radiation belt particles from the magnetosphere into the middle and lower atmosphere."

There are no set standards for radiation safety in US aviation at present, but Tobiska says that regulations are likely in the next few years.

The absolute risk may be low, as a chest X-ray only increases the risk of a fatal cancer by 1 in 200,000, but those must be balanced against the large number of flights and whether risk is avoidable.

"This is mainly for crew members," says Tobiska, "but would certainly benefit frequent flyers and even fetuses in their first trimester."

ARMAS work using satellite data and airborne sensors may allow the radiation "clouds" to be tracked. Tobiska says that in future, flights may be diverted or directed to a lower altitude to avoid them.

Daniel Alfonsetti, Space Weather, DOI: 10.1002/2016SW001439

https://bit.ly/2HzHWr2

Hot Fossil Mammals May Offer a Glimpse of Nature's Future

One of the hottest periods in the last 66 million years may offer insights into the consequences of modern climate change

- **By Brian Switek on February 1, 2017**

The present is the key to the past. Every geologist worth their sodium chloride knows this. The famous phrase, a distillation of the principle of uniformitarianism, can be seen emblazoned on mugs, bumper stickers, and more in college geology departments around the country.

Coryphodon was one of the mammals to live through the PETM. Credit: Brian Switek

But while it's true that phenomena currently in action can help us understand what transpired during prehistory, the flow of clues isn't one way. The past may very well be the key to the future, especially when we want a preview of what can happen during periods of rapid climate change. Given that our species is now responsible for turning up the global thermostat, it'd be wise to look to the past for what we might expect of nature's future.

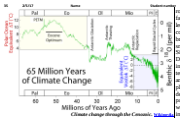
During the dawn of the Age of Mammals, around 56 million years ago, the global temperature rapidly stabbed upwards. In about 100,000 years temperatures rose over 9 degrees Fahrenheit. Paleontologists know this as the Paleocene/Eocene Thermal Maximum (PETM for short), and there's hardly a better place to see its effects than the deserts of Wyoming. The fossil localities here are famous for producing a detailed sequence of species from this time, recording how life responded to rapid climate change.

Insects, for example, fared quite well. So much so that plant fossils from the PETM show a spike in holes and divots created by hungry, hungry arthropods. And then there are the mammals. The mammals that lived in the ancient Wyoming basin during this heat were were smaller than those that came before or after. The fauna seem to have shrunk in the heat, like biological Shrinkwoffles.

But what does this change really mean? Up until now, paleontologists have considered two hypotheses. It could be that the larger mammal species evolved to become smaller over time in a straight-line fashion called anagenesis. Then again, the smaller species could be closely-related immigrants that had previously lived in warmer habitats and were able to thrive as the larger species went extinct. Either way, the hypothesis is that smaller-bodied mammals were probably better able to shed heat and cope with altered nutritional values of plants that go along with high CO2 levels.

But the new study by Brian Rankin and colleagues looks at another possibility – species selection. The logic is the same as that of natural selection, but bumped up one level. Just like individuals, the argument goes, some species will vary in ways that make them more successful in splitting off descendant species than others. In this case, large-bodied mammal species would have suffered in the hothouse world, while the species that were already small would have span off an increased number of new lineages. While the large species went extinct, the small species would have proliferated.

Fortunately the Bighorn and Clarks Fork Basin faunas have been so extensively studied that paleontologists have been able to reconstruct body sizes, ancestor-descendant relationships (which is a rare feat), and identify immigrant species. This is what decades of fieldwork leads up to – a dataset of over 2,000 localities, 5,000 specimens, and 50 species carefully arranged according to the times and places these mammals lived. Plugging all that into a modified version of what naturalists call the Price equation, Rankin and colleagues were able to parse why the ancient beasts became downsized.



Climate change through the Cenozoic. Wikipedia

There wasn't a single reason why mammal body size changed during this narrow span of Cenozoic time. The primary cause, Rankin and colleagues conclude, is the immigration of small species into the Bighorn and Clarks Fork Basins as the large native species disappeared. These were mammals like the archaic hoofed herbivore *Eotoxion perrusa* and the primate *Teilhardina brandti*. The paleontologists also found evidence for some native species, such as the carnivore *Viverravus politus*, becoming smaller with time.

Now here's the strange part. The paleontologists found some influence of species selection in these basins, but it was in favor of larger mammals. This was a one-two punch of extinction and evolution. Some small animals, like the early primate *Carpolestes simpsoni*, went extinct at the same time that large ones, such as the superficially rodent-like *Arginotyx*, were leaving big descendant species.

Without species selection causing some large species to more successfully leave big-bodied descendants, the mammal fauna of the PETM would have been even smaller than what was left behind in the rock. And as the simmering heat decreased, species selection still favored larger species, with anagenetic change and immigration being less important. This might mean that species selection was a relative constant during the days of the Paleocene and Eocene but became briefly suppressed when intense heat threw a brief advantage to smaller mammals.

Similar influences may soon come into play, if they haven't already. During very short time frames, Rankin and coauthors write, the influence of climate change can be see within species. But in the long term – the extended effects that we can see coming down the line from anthropogenic climate change – species selection starts to come into play. Which species go extinct and which are able to keep spinning off descendants begins to shape the world in new ways. There's no set path to evolution. No destiny. But by looking to the deep past, maybe we can begin to perceive the rough outlines of the new world we're inadvertently creating.

For more, check out Shanna Monsanto's post on the same study.

Rankin, B., Fox, J., Barron-Ortiz, C., Chew, A., Shelley, P., Ludtke, J., Yong, E., Theodor, J. 2015. The extended Plio-Pleistocene vertebrate record reveals selection in mammalian body size across multiple species. Proceedings of the Royal Society B. doi: 10.1098/rspb.2014.2443