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Glacier mass loss: Past the point of no return

More than a third of the glacier ice that still exists today in mountain glaciers can no longer be saved even with the most ambitious measures

In the "Paris Agreement", 195 member states of the United Nations Framework Convention on Climate Change have agreed to limit the rise in global average temperature to significantly below 2°C, if possible to 1.5°C above pre-industrial levels. This should significantly reduce the risks of climate change. What does this plan - if successful - mean for the evolution of glaciers? Climate researchers Ben Marzeion and Nicolas Champollion from the Institute of Geography at the University of Bremen and Georg Kaser and Fabien Maussion from the Institute of Atmospheric and Cryospheric Sciences at the University of Innsbruck have investigated this question by calculating the effects of compliance with these climate goals on the progressive melting of glaciers. "Melting glaciers have a huge influence on the development of sea level rise. In our calculations, we took into account all glaciers worldwide - without the Antarctic and Greenland ice sheets and peripheral glaciers - and modelled them in various climate scenarios," explains Georg Kaser.

One kilogram of CO2 emitted costs 15 kilograms of glacier ice.

Whether the average temperature rises by 2 or only 1.5°C makes no significant difference for the development of glacier mass loss over the next 100 years. "Around 36 percent of the ice still stored in glaciers today would melt even without further emissions of greenhouse gases. That means: more than a third of the glacier ice that still exists today in mountain glaciers can no longer be saved even with the most ambitious measures," says Ben Marzeion.

However, looking beyond the current century, it does make a difference whether the 2 or 1.5°C goal is achieved. "Glaciers react slowly to climatic changes. If, for example, we wanted to preserve the current volume of glacial ice, we would have to reach a temperature level from pre-industrial times, which is obviously not possible. In the past, greenhouse gas emissions have already triggered changes that can no longer be stopped. This also means that our current behaviour has an impact on the long-term evolution of the glaciers - we should be aware of this," adds glaciologist Kaser. In order to make these effects tangible, the scientists have calculated that every kilogram of CO2 that we emit today will cause 15 kilograms of glacier melt in the long term. Calculated on the basis of an average car newly registered in Germany in 2016, this means that one kilogram of glacier ice is lost every five hundred meters by car," clarifies Ben Marzeion.

This work was funded by the German Federal Ministry of Education and Research (grant 01LS1602A) and German Research Foundation (grant MA 6966/1-1), and supported by the former Austrian Federal Ministry of Science and Research as part of the UniInfrastrukturprogramm of the research platform Scientific Computing at the University of Innsbruck.

Publication:

Ben Marzeion, Georg Kaser, Fabien Maussion, Nicolas Champollion: Limited Influence of climate change mitigation on short-term glacier mass loss. Nature Climate Change (2018).

DOI: 10.1038/s41558-018-0093-1

http://bit.ly/2FXGvSs

Agriculture initiated by indigenous peoples, not Fertile Crescent migration

Small scale farming initiated by indigenous communities, not introduced by migrant farmers

Small scale agricultural farming was first initiated by indigenous communities living on Turkey's Anatolian plateau, and not introduced by migrant farmers as previously thought, according to new research by the University of Liverpool.

This is a neolithic house uncovered during excavations in central Anatolia.
Professor Douglas Baird

Professor Douglas Baird and his team discovered the presence of carbonised seeds and phytoliths of wheat chaff at Boncuklu, along with agricultural weeds commonly found in early farming sites, suggesting the cultivation of crops did take place. Additionally, nitrogen isotopes from sheep and goat bone collagen indicate very small scale experimentation with the herding of these animals.

Analysis of stone tools and ancient DNA suggests an indigenous population, rather than migrants from earlier agricultural communities within the Fertile Crescent.

Professor Baird said: "Confounding the expectations of some archaeologists that the migrant farmer brought farming to central Anatolia, our evidence shows that the site of Boncuklu was occupied by long present, local Anatolian communities who mostly hunted and gathered a wide range of wetland animals and plants, but adopted farming from areas to the south and east through exchange.

"Although used; cultivated plants, wheat, lentils and peas were not fully domesticated and contributed only a small amount to the diet of the Boncuklu community."

Project Co-Director, University of Queensland Associate Professor Andrew Fairbairn, said: "Unexpectedly, this low level food production persisted for at least five centuries.

"Archaeologists usually consider these kinds of food production systems to be short-lived and transitional, but our research suggests a stable and persistent use of crops and herd animals as a minor part of the economy for a long time. "This does not fit existing theory."

The team contrasted Boncuklu with the nearby site of Pınarbaşı, excavated by Professor Baird in 2003-4. Lying 30km south of Boncuklu in Karaman Province, evidence suggests these communities resisted the adoption of farming and maintained a hunter-gatherer lifestyle, showing the spread of agriculture beyond the Fertile Crescent was neither uniform nor inevitable.

Professor Baird, from the University's Department of Archaeology, Classics and Egyptology, said: "Intriguingly, while Pınarbaşı was abandoned and its people disappeared from the archaeological record, we believe that the way of life we see at Boncuklu contributed directly to that conducted at the slightly later Neolithic settlement, Çatalhöyük. "Farming at Boncuklu was a relatively minor economic activity 10,000 years ago, but its adoption may have had both immediate and long-term consequences for the particular communities who committed to it."

Funded by the British Academy, the British Institute at Ankara and the Australian Research Council, the research is published in the journal Proceedings of the National Academy of Sciences of the USA (PNAS).

It was conducted by an international team led by Professor Baird, Associate Professor Andrew Fairburn, and Assistant Professor Gokhan Mustafaoglu and included researchers from Bournemouth University, University College London, University of Reading, Cornell University, Middle Eastern Technical University Ankara, Thrakya University, Bulent Ecevit University Zonguldak, Peking University and Harvard University, as well as Universities of Liverpool and Queensland.

As part of the project an experimental area has been developed, including reconstructed Neolithic houses, with plans to develop a Neolithic 'garden'.

Professor Baird added: "We are keen to communicate our results to local communities in Turkey as well as international visitors."

http://bit.ly/2IHyjre

Cancer comes back all jacked up on stem cells

A tumor that recurs after treatment may be much different than the tumor originally seen in a biopsy

After a biopsy or surgery, doctors often get a molecular snapshot of a patient's tumor. This snapshot is important - knowing the genetics that cause a cancer can help match a patient with a genetically-targeted treatment. But recent work increasingly shows that tumors are not static - the populations of cells that make up a tumor evolve over time in response to treatment, often in ways that lead to treatment immunity. Instead of being defined by a snapshot, tumors are more like a movie.

This means that a tumor that recurs after treatment may be much different than the tumor originally seen in a biopsy.

Which is why, as reported in the journal *Clinical Cancer Research*, it was very special to collect three tumor samples over the course of three surgeries from a patient with salivary gland cancer.

"People talk about molecular evolution of cancer and we were able to show it in this patient. With these three samples, we could see across time how the tumor developed resistance to treatment," says Daniel Bowles, MD, clinical and translational investigator at the University of Colorado Cancer Center and Head of Cancer Research at the Denver Veterans Administration Medical Center.

The major change had to do with the proportion of the tumor made up of cancer stem cells, often seen as the most capable of driving growth of the disease: A sample taken during the patient's first surgery contained 0.2 percent cancer stem cells; a sample taken during the patient's third surgery contained 4.5 percent cancer stem cells. Additionally, the later tumor had overall 50 percent more cancer-driving mutations, and lower activity of genes meant to suppress cancer.

"By the third surgery, the tumor was invasive and aggressive," says Stephen Keysar, PhD, research assistant professor and basic investigator in the lab of senior author Antonio Jimeno, MD, PhD. Not only did the cellular makeup of the tumor change, increasing in the percentage of cancer stem cells, but, "all things being equal, if you compare a stem cell from the first surgery to stem cells from the third, the cells themselves became more aggressive," says Keysar.

Bowles compares cancer treatment to attacking a weed: "Maybe what's happening is the therapies are exfoliating the plant but not affecting the root," he says. In this conceptualization, cancer therapies may kill the bulk of the cells that make up a tumor, but unless they affect the cancer stem cells - the "root" - the tumor may return.

"When you treat a tumor and it's gone for a couple years and then comes back, it's likely that a population of cancer stem cells survived treatment. These stem cells can then restart the cancer much later," Keysar says.

Obtaining enough tumor tissue to analyze required growing patient samples on mice. This effort, supported by National Institutes of Health and philanthropic funds, led to the development of eight unique patient cell lines, some representing the first models of these salivary cancer subtypes.

"Importantly, as these models are based on human tumors, they can be used in the future to explore at the cellular and molecular level how specific genetic alterations regulate cancer development and resistance to therapy," says collaborator Mary Reyland, PhD, professor in the CU School of Medicine Department of Pathology.

"In this relatively simple but groundbreaking research work, we integrated molecular and cancer stem cell biology to show that tumors adapt and 'tool-up' to overcome therapies, leading to relapse in our patients. By pairing two young researchers with complementary expertise, and developing complex animal models, were we able to demonstrate the evolution of salivary cancers and the tumorigenic cells that drive them," Jimeno says.

"Cancers don't ever come back better. At least I've never seen it," Bowles says. "And now we know one important reason why."

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Fast-acting antidote in sight for cholera epidemics

Paving the way for a future, fast-acting antidote for cholera epidemics

Groundbreaking discoveries regarding the onset of cholera are paving the way for a future, fast-acting antidote for cholera epidemics, according to research published in the journals PLOS Pathogens and ACS Infectious Disease.

"This is not about a vaccine but rather a drinkable protection that can be distributed during an ongoing cholera epidemic to reduce its spread, a drink that blocks the cholera toxin so that it doesn't reach the intestinal mucous membrane, where all the chaos otherwise gets under way," says Ulf Yrlid, associate professor of immunology at Sahlgrenska Academy, Sweden.

Those responsible for the studies are Ulf Yrlid along with colleagues in Gothenburg and a research team at the University of Texas Southwestern Medical Center in Dallas. To some extent, their discoveries run counter to earlier notions about the life-threatening disease.

Cholera is caused by a toxin released by bacteria, cholera toxin, which binds to the intestinal wall, causing massive fluid loss through diarrhea. The binding has long been believed to be dependent on a specific receptor in the intestine, GM1.

Current research shows, however, that mice that completely lack GM1 also get diarrhea after drinking water containing cholera toxin. In addition, fluid loss could be prevented in human intestinal tissue exposed to cholera toxin by adding molecules that block binding to completely different receptors than GM1.

"The big takeaway for us is that we have shown that it's not quite as simple as people have maintained for decades. GM1 is indeed a very powerful receptor in this context, but unlike the other receptors, there is very little of it in the human intestine," says Ulf Yrlid.

According to the researchers, the results also offer the possibility of producing a drinkable antidote that can put both GM1 and other receptors out of play. This could complement other emergency initiatives in areas where sufficient vaccination protection is lacking.

"The problem with vaccines is that they work less well in developing countries due to malnutrition and poor health, especially when it comes to small children. This is not unique for cholera vaccine, but applies to the entire field of vaccination," says Ulf Yrlid.

"If we could use molecules that bind effectively to the cholera toxin and thereby prevent the toxin from attaching to the intestine, we could then immediately reduce the spreading in an affected area, even if people are not vaccinated or don't have sufficient protection. One advantage of the molecules we modify is they are sugar molecules that already are pre sent in breast milk to a great extent and therefore are safe to drink," he concludes.

Title 1: GM1 ganglioside-independent intoxication by Cholera toxin; http://journals.plos.org/plospathogens/article?id=10.1371/journal.ppat.1006862

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New method manages and stores data from millions of nerve cells -- in real time

New method makes it possible to recode neural signals into a format that computer processors can use instantly

Recent developments in neuroscience set high requirements for sophisticated data management, not least when implantable Brain Machine Interfaces are used to establish electronic communication between the brain's nerve cells and computers.

A new method developed by researchers at Lund University in Sweden makes it possible to recode neural signals into a format that computer processors can use instantly. The method has now been published in the respected scientific journal, Neuroinformatics.

The Lund researchers used simulated recordings from nerve cells to evaluate the method. They were able to show that they can simultaneously collect data from over one million nerve cells, analyse the information and provide feedback within a few milliseconds.

"The method will enable us to optimise the way we utilise the high-quality stable recordings that we can carry out with electrodes developed at the Neuronano Research Center", says Jens Schouenborg, Professor of Neurophysiology at Lund University and one of the researchers behind the study.

Progress within brain research in recent years has given rise to considerable handling challenges regarding the volume of information generated when "listening to" and communicating with a large number of the brain's nerve cells, with applications in basic research, clinical diagnosis and treatment.

Whether it concerns using the signals from the nerve cells of a paralysed patient to control a robot arm, or using information from the nerve cells to reveal an imminent epileptic seizure, there is a need for extremely

fast handling and interpretation of the large volume of generated biological data.

Recode Into Computer Language

The method that the researchers at the Neuronano Research Centre at Lund University have developed enables simultaneous communication in real time with millions of nerve cells.

"Recoding the nerve cell signals directly into bitcode dramatically increases the storage capacity. "However, the biggest gain is that the method enables us to store the information in a way that makes it immediately available to the computers' processors", explains Jens Schouenborg.

In addition to the large number of nerve cells and the volume of information in the signals from each cell, the challenge is that information must be simultaneously translated in order to facilitate meaningful communication with the brain.

Listening To Individual Nerve Cells

Martin Garwicz, one of the researchers behind the study, outlines how their method differs from other ways of analysing nerve cell activity based, for example, on EEG, in which electrodes are positioned on the outside of the scalp.

"Imagine that you want to hear what ten people in the room next door are talking about. If you listen by putting your ear against the wall you will just hear murmurs, but if you put a microphone on each person in the room, it transforms your ability to understand the conversation. And then think about being able to listen to one million individuals, find patterns in what's communicated and instantly respond to it - that's what our new method makes possible", says Martin Garwicz, Professor of Neurophysiology at Lund University.

Required New Forms Of Data Handling

The method developed by the researchers enables two-way communication with individual nerve cells.

"A considerable benefit of this architecture and data format is that it doesn't require further translation, as the brain's signals are translated directly into bitcode. This means a considerable advantage in all communication between the brain and computers, not least regarding clinical applications", says Bengt Ljungquist, lead author of the study and doctoral student at Lund University.

The research has been funded by the Knut and Alice Wallenberg Foundation, the Swedish Research Council and Lund University.

http://bit.ly/2IBUe33

'Oumuamua likely came from a binary star system

New research finds that 'Oumuamua, the rocky object identified as the first confirmed interstellar asteroid, very likely came from a binary star system.

This is an artist's impression of 'Oumuamua. **ESO / M. Kornmesser.**

"It's remarkable that we've now seen for the first time a physical object from outside our Solar System," says lead author Dr Alan Jackson, a postdoc at the Centre for Planetary Sciences at the University of Toronto Scarborough in Ontario, Canada.

A binary star system, unlike our Sun, is one with two stars orbiting a common centre.

For the new study, published in the journal *Monthly Notices of the Royal Astronomical Society*, Jackson and his co-authors set about testing how efficient binary star systems are at ejecting objects. They also looked at how common these star systems are in the Galaxy.

They found that rocky objects like 'Oumuamua are far more likely to come from binary than single star systems. They were also able to determine that rocky objects are ejected from binary systems in comparable numbers to icy objects.

"It's really odd that the first object we would see from outside our system would be an asteroid, because a comet would be a lot easier to spot and the Solar System ejects many more comets than asteroids," says Jackson, who specializes in planet and solar system formation.

Once they determined that binary systems are very efficient at ejecting rocky objects, and that a sufficient number of them exist, they were satisfied that 'Oumuamua very likely came from a binary system. They also concluded that it probably came from a system with a relatively hot, high mass star since such a system would have a greater number of rocky objects closer in.

The team suggest that the asteroid was very likely to have been ejected from its binary system sometime during the formation of planets.

'Oumuamua, which is Hawaiian for 'scout', was first spotted by the Haleakala Observatory in Hawaii on 19 October 2017. With a radius of 200 metres and travelling at a blistering speed of 30 kilometres per second, at its closest it was about 33,000,000 km from Earth.

When it was first discovered researchers initially assumed the object was a comet, one of countless icy objects that release gas when they warm up on approaching the Sun. But it didn't show any comet-like activity as it neared the Sun, and was quickly reclassified as an asteroid, meaning it was rocky.

Researchers were also fairly sure it was from outside our Solar System, based on its trajectory and speed. An eccentricity of 1.2 - which classifies its path as an open-ended hyperbolic orbit - and such a high speed meant it was not bound by the gravity of the Sun.

In fact, as Jackson points out, 'Oumuamua's orbit has the highest eccentricity ever observed in an object passing through our Solar System.

Major questions about 'Oumuamua remain. For planetary scientists like Jackson, being able to observe objects like these may yield important clues about how planet formation works in other star systems.

"The same way we use comets to better understand planet formation in our own Solar System, maybe this curious object can tell us more about how planets form in other systems."

http://bit.ly/2ptFLOU

Prostate MRI reveals more treatable cancers, reduces overdiagnosis than standard biopsy

Major study may change clinical practice

Copenhagen: A large international study has shown that an MRI scan can reduce the number of invasive prostate biopsies by up to 28%. The PRECISION[1] trial shows that using MRI to target prostate biopsies leads to more of the harmful prostate cancers, and fewer harmless cancers being diagnosed. Given that more than a million men in Europe undergo a prostate biopsy every year, the authors believe that this work could change clinical practice. The results are presented at the European Association of Urology Congress in Copenhagen, with simultaneous publication in the *New England Journal of Medicine*[2].

Why is this important?

Dr Veeru Kasivisvanathan of University College London and first author of the study, said:

"PRECISION is the first international multi-centre randomised trial to show the benefits of using MRI at the start of the prostate cancer diagnosis process.

In men who need to have investigation for prostate cancer for the first time, PRECISION shows that using an MRI to identify suspected cancer in the prostate and performing a prostate biopsy targeted to the MRI information, leads to more cancers being diagnosed than the standard way that we have been performing prostate biopsy for the last 25 years".

Dr Caroline Moore, Reader in Urology at University College London and senior author of the study commented:

'We compared standard prostate biopsy to the use of MRI, offering targeted biopsies to only those men who had a suspicious MRI. The MRI pathway detected more harmful cancers that needed treatment, and it reduced overdiagnosis of harmless cancers, even though fewer men had a biopsy in the MRI arm. '

Professor Mark Emberton of University College London commented:

'This study was the first to allow men to avoid a biopsy. If high quality MRI can be achieved across Europe, then over a quarter of the 1 million men who currently undergo a biopsy could safely avoid it'.

Background

Prostate cancer is currently diagnosed by examining biopsy samples taken from the prostate via a procedure called TRUS (TRansrectal UltraSound guided prostate biopsy). This means taking around 10-12 samples from the prostate using a probe with a special needle. The ultrasound-guided procedure means inserting a probe into the anus under local anaesthetic. It is uncomfortable, costly, and carries a slight risk of infection, but because it involves estimating the position of a possible tumour, it also means that tumours are often missed3. The PRECISION study investigates whether an MRI scan can avoid the need for biopsy in some patients, or give better diagnostic information where a biopsy is necessary.

What did they do?

Researchers from 23 centres randomly allocated 500 men to be examined either with a standard 10-12 core TRUS biopsy, or with an initial MRI scan followed by a targeted biopsy if the MRI showed an abnormality. The main aim was to assess what proportion of men were diagnosed with clinically significant prostate cancer (defined as a Gleason Grade of ?3+4) which is harmful cancer that is desirable to find. It also aimed to assess the proportion of men who were diagnosed with clinically insignificant cancer (Gleason Grade 3+3) which is desirable to avoid as it doesn't benefit from treatment.

What were the results?

The researchers found that 71 (28%) of the 252 men in the MRI arm of the study avoided the need for a subsequent biopsy. Of those who needed a biopsy, the researchers detected clinically significant cancer in 95 (38%) of the 252 men, compared with 64 (26%) of the 248 men who received only the TRUS biopsy.

"This shows that a diagnostic pathway with initial MRI assessment followed by biopsy when required, can not only reduce the overall number of biopsies performed, but can give more accurate results than TRUS-biopsy alone. We also found that patients who had MRI had fewer side effects than those who just had the standard TRUS biopsy. This is because the MRI allows some men to avoid biopsy and in those who need one, is able to better indicate which area of the prostate needs to be investigated, so you don't need to randomly sample the whole prostate and can use fewer biopsy cores", said Dr Kasivisvanathan.

What does this mean practically?

Several elements need to be considered for MRI to be generally adopted in the diagnostic process. As Dr Kasivisvanathan, who was awarded a National Institute for Health Research (NIHR), Research Doctoral Fellowship to carry out the study, said:

"The ability to perform good quality MRI and the ability to interpret the MRI information are specialist skills. We will therefore need appropriate training for clinicians to use the technology and changes in health services to increase availability and capacity to perform prostate MRI. In the long-term, this new diagnostic pathway can be cost-effective. Costs can be saved by the reduction in the number of men undergoing biopsy in the first place, by the earlier diagnosis of harmful cancers and in the avoidance of the diagnosis of harmless cancers"

Prostate cancer statistics

Prostate cancer is the most common male cancer, with around 400,000 new cases every year in Europe. In the UK, there are over 46,000 new cases of prostate cancer every year, leading to more than 11,000 deaths4. 2015 figures show that for the first time there were more prostate cancer deaths than breast cancer deaths in the UK.

Commenting, Professor Hein Van Poppel, (EAU Adjunct Secretary General, University Hospitals of the Leuven), said:

"This is a significant study. Prostate cancer can only really be confirmed by a biopsy, which is invasive and, like almost all medical procedures, caries some risk of side-effects. Of course, in the majority of men who have a biopsy no cancer is found. This work shows that using MRI to decide whether or not to perform a biopsy has the potential to save

around a quarter of a million European men each year from going through the biopsy procedure, and so may be cost-effective in the long run. MRI use also shows up small aggressive cancers at a curable stage, and allows us to delay or simply not perform biopsies for some cancers which will not turn out to be dangerous. We need time to digest the study, but at first reading it looks like it has the potential to change clinical practice".

[1] *PRECISION (PRostate Evaluation for Clinically Important disease: Sampling using Image-guidance Or Not?), NCT02380027, was a randomized multicenter non-inferiority trial conducted in 25 centers in 11 countries. The study was funded by the National Institute for Health Research and the European Association of Urology Research Foundation, with study governance from University College London. The funders had no role in protocol development, data analysis or interpretation, or manuscript preparation. The views expressed are those of the authors and not necessarily those of the NHS, the NIHR, the Department of Health or the European Association of Urology Research Foundation.*

[2] *The conference abstract, and a link to the full NEJM paper ("MRI-Targeted versus Transrectal Ultrasound Biopsy for Prostate Cancer Diagnosis." Kasivisvanathan et al, DOI 10.1056/NEJMoa1801993, NEJM published 19 March 2018) are available in Notes for Editors.*

http://bit.ly/2DKpNUJ

The twists and turns of life

The mystery of handedness could soon be unravelled

By Philip Ball 19 March 2018

Why life is chiral has puzzled scientists for well over a century. Louis Pasteur famously discovered molecular chirality in his meticulous experiments in 1848. He separated by hand the mirror-image forms of salts of tartaric acid and saw that their solutions will rotate the plane of polarised light in opposite directions. 'There is no doubt,' he wrote in 1860, 'that there is a grouping of the atoms [in tartrate ions] of an asymmetric type that is not superposable on its mirror image.'

Pasteur convinced himself that this property of molecular chirality was a barrier separating the living from the inanimate worlds – almost an echo of the vitalistic belief in the specialness of organic nature that Pasteur's work on microbes and 'spontaneous generation' helped to dispel. He set out to find the origin of this handedness of life's molecules.

A little madness

'Do such asymmetric agencies arise from the cosmic influences light, electricity, magnetism, heat?' Pasteur asked. From 1853 he pursued experiments that look not a little cranky now, growing crystals in magnetic fields and plants from seeds irradiated with light 'inverted' with mirrors. Jean-Baptiste Biot, who discovered optical activity in organic solutions in 1815, advised Pasteur to abandon his eccentric quest, and even Pasteur himself, normally of a conservative nature, admitted: 'One has to be a little mad to undertake what I am trying to do now.'

There's always a little madness involved in pondering life's handedness. Why does DNA have its right-handed double helix, and why are chiral amino acids in proteins only of the left-handed variety? Was this pure chance or determinism? Some have sought an answer in the tiny degree of left–right symmetry breaking evident in the weak force, although it would demand some extraordinarily powerful magnifier (perhaps an autocatalytic feedback in prebiotic amino-acid synthesis?) to make the resulting difference in stability manifest in chemistry.

Stirring the pot

At any rate, researchers have proposed that stirring of a solution to create vortices can couple molecular to macroscopic chirality. It sounds unlikely, but it happens. In 1990, Dilip Kondepudi and coworkers reported that they could selectively make almost enantiomerically pure crystals of sodium chlorate (which are chiral, although the molecular building blocks are not) by stirring the solution from which they form.[1] And a team at Kobe University, Japan, has reported that right-handed double-helical DNA not only aligns within vortex flows but shows a slight preference for right-handed vortices.[2]

This isn't so mysterious. After all, the energy of turbulent flows is transferred to ever smaller spatial scales before finally being dissipated in friction at the molecular level. I shouldn't be surprised, though, if hypotheses emerge about the first living entities having opposite chirality in the northern and southern hemispheres of our planet – agitated by the Coriolis force that gives cyclones opposite senses of

rotation either side of the equator – before doing Darwinian battle. Do the maths and you'll find that such influences would be utterly negligible even at the level of organisms, let alone molecules. But that didn't stop an extraordinary number of people insisting (wrongly), when I wrote recently about the amazing spiral nests of Australian stingless bees *Tetragonula carbonaria*,[3] that they would surely rotate the other way in the north.

So sure, chiral molecules and crystals seem able to express preferences for stirring. But according to calculations by Alec Owens and colleagues at the Centre for Free Electron Laser Science in Hamburg, Germany, chiral molecules can actually be created by stirring: that is, by spinning the molecules themselves.[4]

Twist and pulse

If you take a pyramidal 'symmetric top' molecule like ammonia or phosphine (PH_3) and rotate it, you produce chiral motion: clockwise rotation isn't superimposable on its mirror image. But that kind of symmetry breaking doesn't make the molecule itself chiral, much as chiral arrangement of SiO_4 tetrahedra in optically active quartz doesn't give these units a handedness. The researchers say, however, that PH_3 can be given a chiral structure if it is highly rotationally excited, because in that case the motion actually distorts the molecular structure, due to a Coriolis force acting on the spinning molecules. This force makes one P–H bond shorter than the others, removing the equivalence of the hydrogens. That breakdown of permutation symmetry, coupled with the unidirectional rotation, creates two enantiomers. Then by using a strong static electric field to align the axis of rotation (along one P–H bond), either enantiomer can be generated selectively.

Such rotationally induced chirality has been mooted before, but not much explored because of the difficulty of producing highly excited rotational states (rotational quantum number J of 40 or so) with a rather narrow and well defined distribution of states. It's now made possible in principle, though, by the advent of intense, ultrashort laser pulses with the kinds of tailored polarisation needed to excite extreme rotation. Such a pulse, called an 'optical centrifuge', should have linear polarisation that not only rotates helically around the direction of polarisation but does so at an accelerating rate, so that the 'thread' of the corkscrew rotation gets ever tighter.

The researchers' quantum-mechanical calculations indicate that for J=42, rotationally induced chirality should be achievable and observable with realistic experimental parameters. And that's their goal now.

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http://bbc.in/2FR2JcX

Macular degeneration: 'I've been given my sight back'

Doctors have taken a major step towards curing the most common form of blindness in the UK - age-related macular degeneration.

By James Gallagher Health and science correspondent, BBC News

Douglas Waters, 86, could not see out of his right eye, but "I can now read the newspaper" with it, he says. He was one of two patients given pioneering stem cell therapy at Moorfields Eye Hospital in London. Cells from a human embryo were grown into a patch that was delicately inserted into the back of the eye.

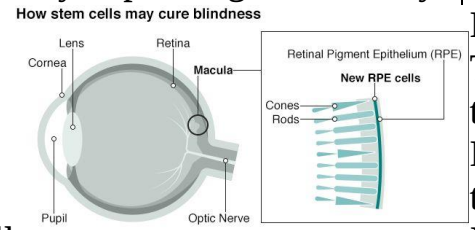
'Couldn't see anything'

Douglas, who is from London, developed severe age-related macular degeneration in his right eye three years ago. The macula is the part of the eye that allows you to see straight ahead - whether to recognise faces, watch TV or read a book.

He says: "In the months before the operation my sight was really poor and I couldn't see anything out of my right eye. "It's brilliant what the team have done and I feel so lucky to have been given my sight back."

The macula is made up of rods and cones that sense light and behind those are a layer of nourishing cells called the retinal pigment epithelium. When this support layer fails, it causes macular

degeneration and blindness. Doctors have devised a way of building a new retinal pigment epithelium and surgically implanting it into the eye.



The technique, published in Nature Biotechnology, starts with embryonic stem cells. These are a special type of cell that can become any other in the human body.

They are converted into the type of cell that makes up the retinal pigment epithelium and embedded into a scaffold to hold them in place.

The living patch is only one layer of cells thick - about 40 microns - and 6mm long and 4mm wide. It is then placed underneath the rods and cones in the back of the eye. The operation takes up to two hours.

'Incredibly exciting'

Prof Lyndon da Cruz, consultant retinal surgeon at Moorfields, told the BBC: "We've restored vision where there was none.

"It's incredibly exciting. As you get older, parts of you stop working and for the first time we've been able to take a cell and make it into a specific part of the eye that's failing and put it back in the eye and get vision back." However, he does not call this a "cure" as completely normal vision is not restored.

Only one diseased eye was operated on in each patient. So far the patients, the other is a woman in her early sixties, have maintained improved vision in the treated eye for a year. They went from not being able to read with their affected eye at all, to reading 60 to 80 words per minute. Eight more patients will take part in this clinical trial.

Doctors need to be sure it is safe. One concern is the transplanted cells could become cancerous, although there have been no such signs so far.

Prof Pete Coffey, from the UCL Institute of Ophthalmology, said: "This study represents real progress in regenerative medicine.

"We hope this will lead to an affordable 'off-the-shelf' therapy that could be made available to NHS patients within the next five years."

More than 600,000 people have age-related macular degeneration in the UK. It's the leading cause of blindness and the third globally.

Both patients in the trial had "wet" age-related macular degeneration. This form of the disease is caused by abnormal blood vessels growing through the retinal pigment epithelium and damaging the macula.

Dry age-related macular degeneration is more common and caused by the retinal pigment epithelium breaking down.

It is hoped the patch will be able to treat both forms of the disease.

Dr Carmel Toomes, from Leeds Institutes of Molecular Medicine, said: "What's exciting about this study is that the patients recorded an increase in vision. "To see an improvement is a good sign that this therapy may help patients in the future, although further studies are needed before real conclusions can be drawn."

http://bit.ly/2FS68bD

Single drop sepsis diagnosis

New test promises to reduce death rate from widespread infection complication.

Andrew Masterson reports.

Sepsis survivor Pamela Popp, promoting awareness of the condition in 2015. A new test could significantly speed up diagnosis. **John Leyba/The Denver Post via Getty Images**

Sepsis is a frequent and sometimes fatal bodily own-goal: a massive over-reaction in which chemicals released into the bloodstream to fight infection instead trigger widespread inflammatory responses.

Just how common sepsis is remains unknown, but one 2017 estimate in the *New England Journal of Medicine* suggested 30 million annual cases worldwide, resulting in six million deaths. This, however, noted the authors of a subsequent commentary, was likely to be a “significant underestimate” because the authors “could find no data from the low-

and middle-income countries where 87% of the world's population lives".

Just as disturbing is the finding that in countries where adequate data do exist, sepsis is misdiagnosed in about 30% of cases. Even in the instances where initial diagnosis is correct, reaching the conclusion can take several days.

Now, however, researchers led by Daniel Irimia from Massachusetts General Hospital in the US have invented a novel diagnostic platform that can produce a result in just hours from a single drop of blood.

The method combines a device full of microscopic channels – known as a microfluidic array – with a machine-learning algorithm.

The algorithm assesses the activity of neutrophils – the most abundant type of white blood cells – to calculate a "sepsis score", allowing for a much more rapid diagnosis.

To test the efficiency of the new method, Irimia and colleagues tried it out on 42 patients divided into two cohorts. It returned results with more than 95% accuracy. The researchers now intend to test the method on a larger population of at-risk patients to better assess its viability.

The research is published in the journal *Nature Biomedical Engineering*.

http://go.nature.com/2FYbz8D

US kids' doodles of scientists reveal changing gender stereotypes

Experiments that ask children to draw a researcher show a greater proportion of women in sketches over time.

Giorgia Guglielmi

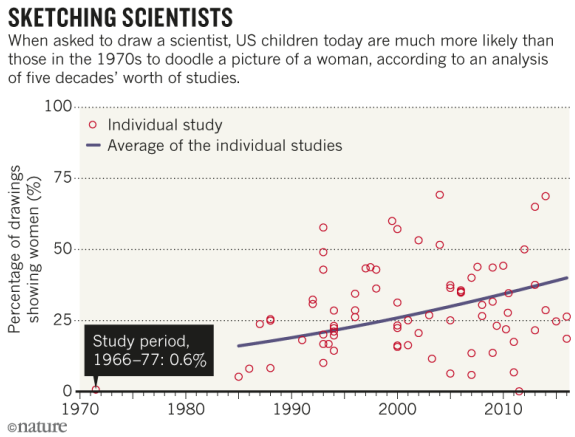
When US children are asked to draw a scientist, today roughly one in three will doodle a woman. That's a major shift since the 1960s and 1970s, when fewer than 1 in 100 kids would depict a female scientist, a new study finds. But although stereotypes that associate men with science seem to have weakened over time, most US children still see science as a male profession.

To investigate how children's drawings have changed, a team of psychology researchers combined and analysed the results of 78 "draw-a-scientist" studies that examined doodles made between 1966 and 2016 (see 'Sketching scientists'). Together, these analyses have asked more than 20,000 US kids from kindergarten to high school to depict a researcher.

In the 1960s and 1970s, 99.4% of children drew a male scientist. That proportion dropped to an average of 72% in studies published between 1985 and 2016. By the 2010s, about one in three drawings portrayed a female scientist.

A girl between the ages of 10 and 11 drew this female scientist. **Vasilia Christidou**

This shift in perception is probably the result of an increasing number of women becoming scientists, and mass media — such as television shows and children's magazines — featuring female scientists more often, says lead author David Miller, a psychology researcher at Northwestern University in Evanston, Illinois. The findings were published in *Child Development* on 20 March[1].



Source: Ref 1.

The researchers also looked at how stereotypes about scientists change as kids grow up. From the 1980s onwards, an average of 30% of girls and 83% of boys aged 6 sketched male scientists. But by age 16, 75% of girls and 98% of boys drew male researchers. These results suggest that children — especially older ones — tend to link science with men, probably because women remain under-represented in some fields, such as physics, Miller says.

"Children draw what they see," says Toni Schmader, a psychological scientist at the University of British Columbia in Vancouver, Canada. The findings suggest that kids need to learn more about women's roles in science, because stereotypes can affect what children think they can and cannot do, Schmader says. "If we can change these representations, young girls might more easily be able to envision a future for themselves in science."

This female chemist was drawn by a girl between the ages of 10 and 11. **Vasilia Christidou**

http://bit.ly/2FKSpD8

"Elderly Woman" Is Not a Synonym for "Clueless Person"

Yet somehow that's often who we're asked to imagine we're aiming at when trying to simplify complex ideas

By Josie Glausiusz on March 20, 2018

I rolled my eyes.

I had opened an email from the "new and improved" *Bright Magazine*. In jaunty tones, the sender informed me that:

We want to tell stories about health, education, and social impact that are fresh and wildly creative. Stories that answer questions you never knew you had, that treat people with dignity first. Stories that aren't told by the usual suspects. Stories that pass the "Aunt Myrtle" test—would your hypothetical elderly aunt be able to appreciate our work?

Esther Cruz Getty Images

Bright Magazine does indeed tell creative, well-reported stories about Nigerian disability rights activists, an Oklahoma school for homeless kids, and the two thirds of U.S. gun deaths that are suicides. But their promise of treating people with "dignity first," did not extend, it seems, to elderly aunts named Myrtle. She, it is assumed, is ignorant and unfamiliar with the world of "health, education, and social impact." That's why she needs stories explained to her in plain language—no jargon please!

Along with many other science journalists, I have encountered this stereotype time and again. We are advised to ask scientists to explain their research to "your granny," "to your mother or a ninth-grader," to "Aunt Gladys." As Einstein supposedly said in innumerably repeated memes, "You do not really understand something unless you can explain it to your grandmother." (The quote is "probably not by Einstein," according to the Ultimate Quotable Einstein, published by Princeton University Press.) In another iteration often attributed to Ernest Rutherford, one doesn't fully understand a phenomena, theory, concept, principle, or law, etc., completely, until one can explain it to a barmaid (or child), e.g. in simple words, or on a cocktail napkin. This is sometimes called "Barmaid Physics."

The well-worn formula is a prime example of the subtle ways in which sexism pervades science in a manner so entrenched that it is difficult to recognize. We are never asked to explain science to "your dad" or "your granddad." "'Explain it like you would explain it to your middle-aged Uncle Bob,' said no one ever," notes Leah Fey, subject investigation analyst at PreScouter, Inc. The advice "assumes that "Mom" and "Grandma" are either stupid or uneducated--either way, are incapable of comprehending anything technical," adds Jen Pinkowski, Senior Science Editor at Mental Floss.

When I read Bright Magazine's relaunch email, I wrote back, noting the "sexist and ageist stereotype of telling "stories that pass the 'Aunt Myrtle' test." To her credit, editor-in-chief Sarika Bansal replied, writing: "Thanks so much for your thoughtful email, and for reading our letter in the first place! Your concern about ageism is well-received, and we'll be sure to keep it in mind in our future communications." She

did not address my complaint about the sexism. But Bright Magazine's email set me thinking: Why are we quick to haul out the stereotype of Aunt Myrtle, while the achievements of real scientists named Myrtle fade away? So I did a rapid Google search for "scientists named Myrtle," and within minutes I had discovered three.

Myrtle Claire Bachelder (1908–1997), was an American chemist and Women's Army Corps officer noted for her secret work on the Manhattan Project. While stationed at Los Alamos in 1943, she developed techniques for x-radiation and purification of uranium ores. After the war, she worked as a research chemist at the University of Chicago, and also for NASA, analyzing the chemistry of moon rocks collected during Apollo missions. She was a vocal supporter of the Atomic Energy Commission, a federal civilian agency created in the war's aftermath to control the production of nuclear weapons and to foster research into peaceful uses of nuclear energy.

Myrtle Claire Bachelder in 1942. **Wikimedia**

Myrtle McGraw (1899-1988), the author of "The Neuromuscular Maturation of the Human Infant" (1943) was a psychologist who studied child growth and development. As associate director of the Normal Child Development Center at Columbia Presbyterian Medical from 1930 to 1942, she conducted a pioneering study of motor development in twins Jimmy and Johnny Woods. She was the first to demonstrate the swimming reflex in two- and four-month-old infants. (Watch this mesmerizing and hilarious movie of the Woods toddlers swimming, climbing, jumping, climbing off pedestals, and, yes, roller-skating.)

Ruth Myrtle Patrick (1907-2013) was an American aquatic biologist and one of the country's leading experts on the science of freshwater ecosystems, or limnology. She achieved that renown, according to her New York Times obituary, after entering science in the 1930s and working for eight years with no pay. An expert on diatoms (single-celled algae with a glass-like silica cell wall), she invented a device called the diatometer, using it to show that the types and numbers of diatoms in a body of water could reveal the extent of pollution. Her insight—that the number, abundance, and ecological features of species could reveal the environmental health of streams—became known as The Patrick Principle.

At least two of these women scientists had to battle stereotypes to pursue a career in science: McGraw trained as a secretary, and Patrick's mother advised her to marry and study the social graces. (Bachelder was a high school science teacher before enlisting in the Women's Army Corps.) Their achievements are all the more notable since all of them began their science careers in the 1930s, when professional options for women were far more limited.

As science journalists, we need to spend more time highlighting the accomplishments of scientists named Myrtle—and Gladys and Mavis and Iris —and stop trotting out the tired old trope of "explain it to your Grandma." When we use this line as the gold standard for clarity in science communication, we obscure the achievements of women scientists who struggled against sexism to achieve excellence in their professions. Perhaps if we were more aware of their triumphs, we might not be so quick to dismiss them as doddering aunts who need our simple explanations.

Because there are many ways to explain science without invoking sexist stereotypes: Explain your research "to the layperson," "to your neighbor at a dinner party" "to a non-expert," "to a bright teen." Personally, I like to think of Myrtle Bachelder explaining her research on the chemical composition of brass cannons on sunken ships in the Aegean Sea to the three nephews who survived her. I would most certainly listen with interest.

http://bit.ly/2IIyKBP

Study: Living abroad leads to a clearer sense of self

New research also shows that living abroad leads to clearer career decision-making

HOUSTON - Living abroad can clarify your sense of self, according to new research by a team of social scientists at Rice University, Columbia University and the University of North Carolina.

They found living abroad increases "self-concept clarity," the extent to which individuals' beliefs about themselves are clearly and confidently defined and consistent and stable over time.

The researchers are Hajo Adam and Otilia Obodaru of Rice's Jones Graduate School of Business; Jackson Lu and Adam Galinsky of Columbia Business School; and William Maddux of UNC Kenan-Flagler Business School. They conducted six studies involving 1,874 participants and published their findings in "The Shortest Path to Oneself Leads Around the World: Living Abroad Increases Self-Concept Clarity" in the journal *Organizational Behavior and Human Decision Processes*.

To conduct the studies, the authors recruited participants from online panels and United States and international MBA programs, including some who had not lived abroad, who then completed surveys on living abroad.

The researchers found living abroad triggers self-discerning reflections in which people grapple with the different cultural values and norms of their home and host cultures. These reflections are helpful in discovering which values and norms define who people are and which simply reflect their cultural upbringing, according to the study.

"In a world where living-abroad experiences are increasingly common and technological advances make cross-cultural travel and communication ever easier, it is critical that research keeps pace with these developments and seeks to understand how they affect people," the authors wrote.

"In this vein, our studies demonstrate that living abroad affects the fundamental structure of the self-concept by enhancing its clarity. The German philosopher Hermann von Keyserling wrote in the epigraph to his 1919 book 'The Travel Diary of a Philosopher,' 'The shortest path to oneself leads around the world.' Almost 100?years later, our research provides empirical evidence in support of this idea."

While most research on foreign experiences has focused on whether people have lived abroad or not, this new research takes a more nuanced approach to distinguish between the depth and the breadth of international experiences. It finds that depth (the length of time lived abroad) rather than breadth (the number of foreign countries lived in) enhances a clear sense of self. The longer people live abroad, the more self-discerning reflections they accumulate and, as a result, the more likely they are to develop a better understanding of themselves and have increased clarity about career decision-making, the authors said.

Understanding the impact of living abroad has practical implications for organizations as they operate across national borders and recruit foreign talent.

Past studies have found that transitional experiences, such as getting divorced or losing a job, typically decrease individuals' self-concept clarity. In contrast, this research examines the possibility that living abroad is a rare kind of transitional experience that actually increases self-concept clarity.

Extended periods of time spent in a foreign country can yield numerous benefits that come with a clear sense of self, ranging from greater life satisfaction to decreased stress, improved job performance and - as the new research shows - enhanced clarity about the types of careers that best match an individual's strengths and values. Having a clear sense of self could thus become increasingly important in today's world with its unprecedented range of available career options, according to the authors.

http://bit.ly/2DQ5bdL

First population-scale sequencing project explores platypus history

First whole-scale genome sequencing of platypuses across Eastern Australia and Tasmania

The platypus is the ultimate evolutionary mashup of birds, reptiles and mammals. The iconic, egg-laying, venom producing, duck-billed platypus first had its genome sequenced in 2008, revealing its unique genetic makeup and its divergence from the rest of the mammals around 160 million years ago.

Now, a greater effort to understand its ecological and population history has been made possible by the first, whole-scale genome sequencing efforts of 57 platypuses across Eastern Australia and Tasmania.

The platypus is the ultimate evolutionary mashup of birds, reptiles and mammals. A new study has provided insights into platypus population structure and history from whole-genome sequencing. **Stephen Kolomyjec**

The work was led by researchers at the Wellcome Centre for Human Genetics, University of Oxford and the Sydney School of Veterinary Science, University of Sydney, and published in the advanced online edition of *Molecular Biology and Evolution*.

They were able to establish a platypus family history and kinship in a level of detail not previously sampled.

"We have described the first population-scale, whole-genome sequencing study of the platypus," said Dr. Peter Donnelly from Oxford. "Our analyses provide insights into the population structure and levels of diversity in this species not previously possible and estimate the relatedness between individuals."

"For example, we found that more than half of our samples had a least a third-degree relative amongst the other individuals sampled from the same river. Additionally, there were 26 pairs of second- or third-degree relatives, in all cases from the same river or creek, or closely connected waterways, involving 28 of our 57 samples."

The research team was also able to estimate vital evolutionary forces at work including platypus mutation rates, divergence times, and population sizes throughout its history.

Dr. Hilary Martin, one of the lead authors of the study also from the University of Oxford said: "We estimated the de novo mutation rate in the platypus, the first estimate in a non-placental mammal."

They found it to be middle of the road for mammals, lower than humans and chimpanzees but higher than laboratory bred mice.

"The relative ordering of the point estimates is consistent with the observation that mutation rates in mammals are negatively correlated with body mass and generation time," Dr. Martin said.

The study also estimated that the platypus population most likely last shared a common ancestor nearly 1 million years ago.

Dr. Jaime Gongora, from the University of Sydney, said the deepest branch on the population tree separated three separate groups: the samples from Tasmania (an island to the south of Australia that separated from the mainland around 12,000 years ago); those from north Queensland (in the far north); and the remaining samples, which are from central Queensland and New South Wales.

"We think it is most likely that there were three ancestral populations (Tasmania, North Queensland and North New South Wales/Central Queensland) which all coalesced around the same time, about 800KYA," said Dr. Gongora.

"The central Queensland samples likely shared an ancestral population with the North New South Wales samples about 300KYA. This implies that there has been extensive population structure in platypus samples across Australia over a long time period."

Dr. Donnelly commented: "Interestingly, the divergence times we have estimated predate the earliest fossil evidence for platypus."

"This finding does not necessarily contradict fossil evidence but suggests that the modern platypus extends back to the Early to Middle Pliocene. This could be consistent with it having evolved from the giant platypus species, O. tharalkooschild," Dr. Donnelly said.

In addition, researchers found evidence of past population bottlenecks, particularly in North Queensland around 10,000 years ago, and identified modern populations (especially near the Carnarvon River) that would be aided by conservation efforts.

The Queensland bottleneck likely reflects the historical and current isolation and paucity of suitable habitat for platypus between North (Australian Wet Tropics) and Central Queensland, known as the 'Burdekin gap' (named for the Burdekin River).

Dr. Gongora concludes: "This hot and dry area is currently climatically unsuitable for platypus and has long acted as a barrier to genetic exchange."

With the new genome data in hand, future studies will continue to explore the population history and unique biology of the platypus. And given concerns about the impact of climate change, disease, and other factors on platypus populations, their better window into past responses of platypus populations may help to improve conservations efforts.

http://bit.ly/2HYZWuO

Amygdala neurons increase as children become adults -- except in autism

Typically-developing children gain neurons in the amygdala as they become adults, while people with autism spectrum disorder have too many neurons and then lose those neurons as they become adults

This phenomenon does not happen in people with autism spectrum disorder (ASD). Instead, children with ASD have too many neurons early on and then appear to lose those neurons as they become adults

In a striking new finding, researchers at the UC Davis MIND Institute found that typically-developing children gain more neurons in a region of the brain that governs social and emotional behavior, the amygdala, as they become adults. This phenomenon does not happen in people with autism spectrum disorder (ASD). Instead, children with ASD have too many neurons early on and then appear to lose those neurons as they become adults. The findings were published today in the journal *Proceedings of the National Academy of Sciences (PNAS)*.

The amygdala is a small almond-shaped group of 13 regions (nuclei) that work as a danger detector in the brain to regulate anxiety and social interactions. Amygdala dysfunction has been linked to many psychiatric and neurodevelopmental disorders, including ASD, schizophrenia, bipolar disorder and depression.

"The amygdala is a unique brain structure in that it grows dramatically during adolescence, longer than other brain regions, as we become more socially and emotionally mature," said Cynthia Schumann, associate professor in the Department of Psychiatry and Behavioral Sciences at the UC Davis MIND Institute and senior author of the paper. "Any deviation from this normal path of development can profoundly influence human behavior." To understand what cellular factors underlie amygdala development, the team studied 52 postmortem human brains, both neurotypical and ASD, ranging from 2 to 48 years of age.

"We were surprised to find that the number of neurons in one of the amygdala regions increased by more than 30% from childhood to adulthood in typically-developing individuals," said Schumann.

The picture was quite different in people with ASD. There were more neurons in young children with ASD, but as they got older, those numbers went down.

"We don't know if having too many amygdala neurons early in development in ASD is related to the apparent loss later on," said Schumann. "It's possible that having too many neurons early on could contribute to anxiety and challenges with social interactions. However, with time, that constant activity could wear on the system and lead to neuron loss."

Schumann and her team believe that if they can explain how the cells are changing throughout adolescence in the amygdala, it might be

possible to intervene and treat symptoms such as anxiety that develop in people with autism and other neurodevelopmental and psychiatric disorders.

Other authors included Thomas A. Avino, Nicole Barger, Martha V. Vargas, Erin L. Carlson, David G. Amaral and Melissa D. Bauman.

Research reported in this publication was supported by the National Institute of Mental Health of the National Institutes of Health (R01MH097236).

http://bit.ly/2DPNQSc

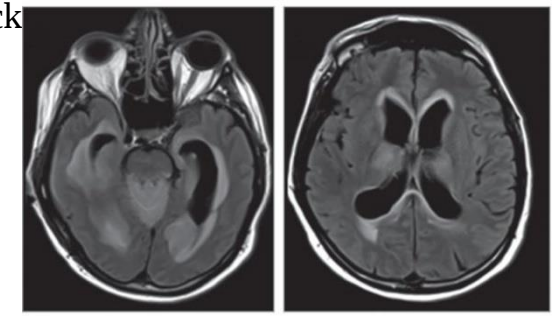
A Mysterious Infection Killed This Man. Here's How Doctors Finally Found the Cause

When a Massachusetts man arrived at the hospital, he had trouble speaking and walking. Doctors soon suspected that he had a potentially life-threatening condition: inflammation in his brain or the tissue surrounding it.

By Rachael Rettner, Senior Writer | March 20, 2018 04:35pm ET

But to squelch the inflammation, they needed to know the cause. Tests for dozens of viruses, bacteria and fungi — typical culprits for brain inflammation — kept coming back negative.

Doctors didn't discover the cause until after the man's death, according to a new report of the case, published yesterday (March 19) in the journal JAMA Neurology.



A man's mysterious symptoms were due to a brain infection with Powassan virus, a rare virus carried by ticks. Above, images from an MRI of the man's brain. On the left, fluid-filled cavities in the brain called ventricles (which look black) appear wider than usual. On the right, a brain area called the thalamus (also black) appears more extended than usual. **Reproduced with permission from JAMA Neurology. 2018. doi:10.1001/jamaneurol.2018.0132.**

The culprit was the Powassan virus, a rare virus carried by ticks in the northeastern and Great Lakes regions of the United States. Just 100 cases of Powassan virus infections have been reported in the United States in the last 10 years, according to the Centers for Disease Control and Prevention (CDC).

The Powassan virus can infect the central nervous system and cause dangerous inflammation, the CDC says. About 10 percent of Powassan virus cases are fatal.

Because the disease is so rare, there is no standard way of diagnosing it. This man's case was even more complicated because he was taking a cancer medication that affected his immune system. As a result, standard lab tests that look for antibodies against viruses wouldn't work, because the man wasn't producing those antibodies.

But there is one genetic test that can be useful in these situations: a test that screens for potentially any virus, bacteria or other pathogen that may be causing an illness, rather than looking for a single microbe at a time, the researchers said. This test, known as an "unbiased sequencing assay," ultimately helped diagnose the man with Powassan virus, according to the report, led by Dr. Isaac Solomon, a neuropathologist at Brigham and Women's Hospital in Boston.

A mysterious case

The man, who was in his 60s, had lymphoma, which is a cancer of the immune system. For treatment, he was taking a medication called rituximab, which acts on the immune system.

Problems began in December 2016, when the man went to the emergency room with a fever and pain in his testicles. Tests showed that he had orchiepididymitis, or inflammation in the testes. Doctors gave him an antibiotic and sent him home.

But three days later, he returned to the hospital with speaking and walking problems and trouble using his arms. This time, doctors gave him three different antibiotics and an antiviral medication, suspecting that he had an infection causing inflammation in his brain (encephalitis) or the tissues surrounding his brain (meningitis).

A week later, the man's condition worsened, and he became much less alert. He appeared to have a severe brain injury; he wasn't opening his

eyes in response to doctors' commands. An MRI showed that the man had excess fluid in his brain along with other signs of brain injury.

Doctors tested the man for numerous infectious diseases, including Lyme disease, syphilis, toxoplasmosis, herpes, mumps and West Nile virus infection. All the tests were negative.

Unfortunately, the man continued to get worse, and he died after two weeks in the hospital, according to the report.

A search after death

After the man's death, the doctors continued to search for source of the mysterious ailment. Ultimately, they used several different tools to identify the Powassan virus. (The results of these tests weren't available until after the patient's death.)

One was called "metagenomic next-generation sequencing," a type of unbiased test in which researchers sequence all of the DNA and RNA in a sample. Given that most of this genetic material is from the patient himself, this approach is like looking for a needle in a haystack. (In this case, the "needle" is the strand of viral or bacterial DNA/RNA that's causing the disease.) Eventually, the researchers found genetic material from the Powassan virus and concluded that the man had died from encephalitis caused by this virus.

The findings "support the utility of unbiased pathogen-detection assays capable of detecting a wide variety of infectious agents" in cases in which doctors can't seem to find the cause of a patient's encephalitis, the researchers wrote.

http://bit.ly/2G3wBTE

Virus fished from pond cures man's deadly antibiotic-resistant infection

The clinical success suggests promising strategy for fighting antibiotic resistance.

Beth Mole - 3/21/2018, 1:48 AM

In 2012, a 76-year-old Connecticut doctor had surgery to repair a life-threatening bulge in his aortic arch—the hulking bend that hooks the massive artery around the heart, routing oxygenated blood both upward and downward. Surgeons successfully used a synthetic graft to shore up the vital conduit. But soon after, a tenacious film of drug-resistant *Pseudomonas aeruginosa* bacteria formed on the graft.

Enlarge / Transmission electron micrograph of multiple bacteriophages attached to a bacterial cell wall. **Dr Graham Beards**

The doctor spent the next four years battling the infection, slipping in and out of the hospital.

His surgeons and doctors at Yale deemed him too high risk for another operation and put him on mega-doses of antibiotics, prescribed indefinitely. The drugs couldn't clear the infection, they merely knocked it back enough to keep it from killing him. But the chronic inflammation that ensued took its own toll. His team of doctors started to worry his immune system was chipping away at his aorta. With a bleak outlook, the man agreed in 2016 to an experimental treatment: a virus that researchers had fished out of a nearby pond.

The viral gamble paid off. The infection cleared and he went off antibiotics, according to a case study published recently by the Yale researchers and doctors in the journal of *Evolution, Medicine, and Public Health*.

Phages for the ages

The case is a clinical win for using viruses when antibiotics fail to kill bacteria. It's an idea that has been around for decades. Viruses that exclusively infect and kill bacteria—called "bacteriophages" or just "phages"—have been used in former Soviet republics and some parts of Eastern Europe for nearly a century. Phages kill in the same way as many viruses; a phage infects a host cell, usurps its cellular machinery to make copies of itself, then the clone army bursts out, destroying the host cell in the process. And there are plenty of phages to harness for potential therapies. In water samples, for instance, some researchers have estimated that there are 10 phages for every bacterial/archaeal cell.

To put that in perspective, the open ocean is estimated to contain 1.2 × 10^{29} bacterial and archaeal cells.

But in Westernized countries, phage therapy has largely been passed over by researchers, given the success of antibiotics. As such, phages have failed to garner the needed research attention to establish their safety and efficacy. That's changing now, albeit slowly, with the rise of antibiotic-resistant bacteria.

But this pond phage isn't your garden-variety microbial marauder. The phage—dubbed OMKO1—has the unique ability to force surviving drug-resistant bacteria into ditching their drug resistance. This is critical. One of the main arguments against turning to phage therapy is that bacteria can readily evolve resistance to them. Researchers have plenty of evidence of this. Thus, some researchers fear that any effective phage therapy is destined to the same impotent fate as many of our once powerful antibiotics.

But, if phages can kill bacteria *and* make survivors evolve to be vulnerable to drugs, then a one-two punch of phage and drugs could knock out any infection, resistant or not. In other words, "phage such as OMKO1 that appear to force a clinically relevant trade-off may present an effective solution to the inevitable evolution of resistance by pathogenic bacteria," the Yale researchers conclude.

Viral KO

Those researchers, led by surgeon Deepak Narayan and ecology and evolutionary biologist Paul Turner, wanted exactly this type of phage for the sick doctor. Luckily, Turner had been surveying phages from environmental samples that could strong-arm bacteria into a deadly genetic trade-off.

Turner and his lab had collected phages from sewage, soil, lakes, rivers, streams, and compost. They found 42 that could infect *P. aeruginosa*, an abundant opportunistic pathogen often found to be resistant to antibiotics. The researchers were motivated to go after this particular pathogen because it is "poised to become a common [pan-drug-resistant] disease problem," Turner and his colleagues wrote in 2016. That is, they suspect it will become resistant to all potential antibiotic treatments in the foreseeable future.

Turner and his team hypothesized that they could wipe the floor with resistant *P. aeruginosa* if they matched the phage to the type of drug resistance the bacteria carry. Phages, like all killer viruses, need to be able to recognize and grab onto a potential host cell before it can invade and kill. Influenza viruses famously do this by latching onto sialic acids that hang on the outside of human cells in the respiratory tract.

Conveniently, *P. aeruginosa* thwarts many antibiotics using a bit of machinery called an efflux pump. This molecular device works a lot like a sump pump, creating a pore in the cell through which it actively pumps out certain antibiotics before they can cause cellular damage. As such, the pump is situated at the outer membrane—where phages can latch on to it.

In their survey, Turner and company found one phage that infected *P. aeruginosa* by grabbing on to part of this pump, a part called the outer membrane porin M. The phage was collected from Dodge Pond, about 65km east of Yale. The researchers dubbed it OMKO1 or outer-membrane-porin M knockout dependent phage #1.

If the deadly bacteria have the pump, the phage can grab hold and kill them. If the bacteria lack the pump or have a mutant, broken version, that means that phage *can't* get in and kill—but standard antibiotics can.

Saving the doctor

In early lab tests, published in *Scientific Reports* in 2016, Turner and his lab showed that as *P. aeruginosa* evolved resistance to OMKO1, it became more susceptible to antibiotic treatments. To verify that this phage could one day be clinically useful, they tested it out on several *P. aeruginosa* strains that Yale colleagues had isolated from patients—including one who had a chronic infection on an aortic arch graft.

As Turner and his lab carried out their work, the doctor's health continued to slip. Doctors and researchers made the bold decision to try out the phage. Turner's lab collected bacteria-laden discharge from a fistula that formed in the doctor's chest and mixed it with phage. The

pond virus killed off most of the bacteria and re-sensitized the survivors to antibiotics. With such promising lab results, the team got an emergency investigational new drug approval from the Food and Drug Administration to treat the sick doctor with their pond phage.

With the doctor's aorta seemingly disintegrating, Narayan and Turner's teams injected a high dose of purified OMKO1 in combination with the antibiotic ceftazidime directly into the fistula in his chest.

The next day, the doctor had stable vital signs and had no complaints. He was subsequently released from the hospital. Things were looking up until four weeks later, when his chest wound started bleeding. Doctors had no choice but to perform emergency surgery. With his chest open, the surgeons found that a bone fragment from his sternum had broken off and pierced his aorta. But what they didn't find was any evidence of a *P. aeruginosa* infection. The surgeons repaired damage and replaced the aortic graft. Shortly after, they took him off antibiotics and he has been off them ever since.

The researchers concluded that the phage was critical for ridding the doctor of his deadly infection. "Eventual controlled trials examining phage application as adjunctives may reveal improved clinical outcomes in cases of recalcitrant infection," they wrote.

For now, they conclude, "the current case study indicates the fortuitous possibility for a single phage to apparently resolve the bacterial infection, where pre-treatment understanding of the evolutionary mechanism… underlying bacterial resistance informed the choice of phage used in experimental therapy."

Evolution, Medicine, and Public Health, 2018. DOI: 10.1093/emph/eoy005 (About DOIs).

http://bit.ly/2I5csZV

Belly fat promotes diabetes under orders from liver

In obese mice, a liver enzyme inflames fat, increasing insulin resistance

Columbia University Medical Center

NEW YORK, NY --The fat that builds up deep in the abdomen--more than any other type of body fat--raises the risk of insulin resistance and type 2 diabetes. Researchers have known that abdominal fat becomes dangerous when it becomes inflamed but have had a hard time determining what causes the inflammation.

A new study at Columbia University Irving Medical Center (CUIMC) has revealed that at least one of the culprits for this mysterious inflammation comes from the liver. The researchers found that, in obese mice, the liver increases its production of an enzyme called DPP4. This enzyme travels through the blood stream to abdominal fat. Once inside fat tissue, DPP4 helps to activate inflammatory cells.

The good news is that this inflammation can be soothed by turning off DPP4 production in the liver, as the researchers demonstrated in mice. And even though the animals remained obese, soothing inflamed abdominal fat improved their insulin resistance.

Additional, unpublished data suggests the pathway also exists in people. "If we can develop ways to target liver DPP4 in people, this may be a powerful new way to treat obesity-induced type 2 diabetes," said study leader Ira Tabas, MD, PhD, the Richard J. Stock Professor of Medicine at Columbia University Vagelos College of Physicians and Surgeons. "Inhibiting DPP4 specifically in liver cells attacks insulin resistance--the core problem of type 2 diabetes--at least in our preclinical models."

The study by Tabas's team--including lead author Devram Ghorpade, PhD, associate research scientist, and co-corresponding author, Lale Ozcan, MD, assistant professor of medical science--was published online today in *Nature*.

Current DPP4 inhibitors do not reduce inflammation in fat or improve insulin resistance

Many patients with type 2 diabetes are given oral DPP4 inhibitors (known as gliptins) to help manage their disease. These drugs lower blood sugar by preventing DPP4 from interfering with a hormone that stimulates insulin production. But surprisingly, these drugs had no effect on inflammation in the abdominal fat of obese mice, the researchers found.

"Gliptins inhibit DPP4 in the blood and so they should, in theory, prevent fat inflammation," Tabas said, "but we didn't find that in our study."

The reason for this shortcoming of gliptins, Tabas believes, may be related to their effects in the gut versus the liver. "DPP4 inhibitors lower blood sugar by inhibiting DPP4 in the gut. But we have some evidence that DPP4 inhibitors in the gut also end up promoting inflammation in fat. That cancels out the anti-inflammatory effects the drugs may have when they reach inflammatory cells, called macrophages, in the fat."

When the researchers selectively blocked DPP4 production inside liver cells, they were able to reduce fat inflammation and improve insulin resistance, while also lowering blood sugar.

The findings suggest that DPP4 inhibitors could be more potent if they were redirected to liver cells and away from the gut.

Delivering DPP4 inhibitors directly to the liver

In theory, current DPP4 inhibitors could potentially be redirected by packaging the drug into nanoparticles that are delivered to the liver. However, the CUIMC team is studying an alternate approach that uses small interfering RNAs (siRNAs)--snippets of genetic material that silence particular genes--to turn off liver cell DPP4. To ensure that the siRNAs reach the appropriate target, they could be attached to certain sugars with a specific affinity for liver cells, Tabas said.

A complementary approach would be to block DPP4 activity in the macrophages of abdominal fat. "From our studies, we know that DPP4 interacts with a molecule on these cells to increase inflammation. If we could block that interaction, we might be able stop the enzyme from causing inflammation and insulin resistance," Tabas said.

"This study reveals a potential new target for the treatment of type 2 diabetes and cardiometabolic disorders," said Ahmed A Hasan, MD, PhD, a medical officer and program director in NHLBI's Atherothrombosis & Coronary Artery Disease Branch, who serves as the project officer for the study grant. "These findings may pave the way for a future clinical trial to test whether a new treatment approach based on this target could improve insulin resistance in diabetic patients. More research is needed."

Ira Tabas is also vice chair of research in the Department of Medicine and professor of pathology & cell biology (in physiology and cellular biophysics) at the Columbia University Vagelos College of Physicians and Surgeons.

The paper is titled, "Hepatocyte-Secreted DPP4 in Obesity Promotes Adipose Inflammation and Insulin Resistance." The other contributors are: Ze Zheng (CUIMC), Sarah M. Nicoloro (University of Massachusetts Medical School, Worcester, MA), Yuefei Shen (University of Massachusetts Medical School), Emily Chen (CUIMC), Matthias Blüher (University of Leipzig, Leipzig, Germany), and Michael P. Czech (University of Massachusetts Medical School).

The study was funded by grants from the National Institutes of Health (5P30CA013696-42, HL087123, HL075662, DK106045, P30 DK063608, and DK103047), the Merck Investigator Studies Program, and the Deutsche Forschungsgemeinschaft grant.

The authors declare no competing financial interests.

http://bit.ly/2uqf42D

Why has mumps reemerged in the United States?

A recent resurgence in mumps cases in the U.S. may be due to weakening immune protection from the mumps vaccine, researchers report.

They say the results of their modeling studies suggest that a booster dose at age 18 may help control outbreaks of the disease. Before the mumps vaccine was developed in 1967, more than 90% of children and youth in the United States experienced this painful and highly-contagious viral infection prior to the age of 20. After decades of declining mumps incidence due to the introduction of widespread vaccination, an increase in mumps cases was observed in 2006 in adolescents and young adults in the U.S. Seeking to determine if the mumps virus had evolved to escape the vaccine or if immunity from the vaccine naturally decreased over time - a distinction that helps to inform whether new vaccines are needed to control transmission - Joseph Lewnard and Yonatan Grad closely examined epidemiological data from six mumps vaccine effectiveness studies conducted in the United States and Europe. The scientists concluded that the mumps vaccine protects people for an average of 27 years (with a range of 16 to 51 years), and did not seem to be less effective against emerging mumps strains. Transmission models indicated that routine use of a booster

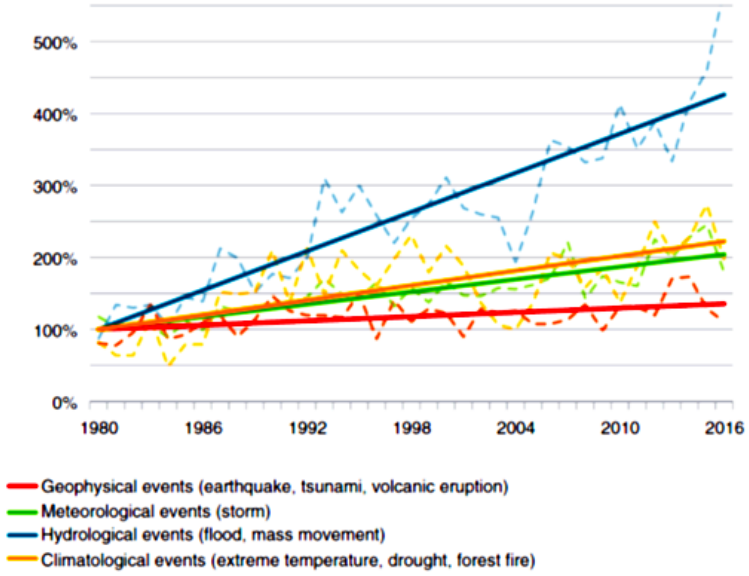
dose at age 18 could help to maintain population immunity. The authors say their findings emphasize a need to conduct clinical trials that would measure the benefit of administering this booster dose.

http://bit.ly/2pD33Sh

New data confirm increased frequency of extreme weather events

European national science academies urge further action on climate change adaptation

New data show that extreme weather events have become more frequent over the past 36 years, with a significant uptick in floods and other hydrological events compared even with five years ago, according to a new publication, "Extreme weather events in Europe: Preparing for climate change adaptation: an update on EASAC's 2013 study" by the European Academies' Science Advisory Council (EASAC), a body made up of 27 national science academies in the European Union, Norway, and Switzerland. Given the increase in the frequency of extreme weather events, EASAC calls for stronger attention to climate change adaptation across the European Union: leaders and policy-makers must improve the adaptability of Europe's infrastructure and social systems to a changing climate.



These are trends in different types of natural catastrophes worldwide 1980-2016 (1980 levels set at 100 percent). **MunichRe NatCatSERVICE**

Globally, according to the new data, the number of floods and other hydrological events have quadrupled since 1980 and have doubled since 2004, highlighting the urgency of adaptation to climate change. Climatological events, such as extreme temperatures, droughts, and forest fires, have more than doubled since 1980. Meteorological events, such as storms, have doubled since 1980 (Figure 1, 2013 (Figure 2.1 in 2013 report); Figure 2, 2018 (Figure 1 in 2018 updated publication).

These extreme weather events carry substantial economic costs. In the updated data (Figure 3; Figure 2 in 2018 updated publication), thunderstorm losses in North America have doubled - from under US$10 billion in 1980 to almost $20 billion in 2015. On a more positive note, river flood losses in Europe show a near-static trend (despite their increased frequency), indicating that protection measures that have been implemented may have stemmed flood losses.

Professor Michael Norton, EASAC's Environment Programme Director states, "Our 2013 Extreme Weather Events report - which was based on the findings of the Norwegian Academy of Science and Letters and the Norwegian Meteorological Institute - has been updated and the latest data supports our original conclusions: there has been and continues to be a significant increase in the frequency of extreme weather events, making climate proofing all the more urgent. Adaptation and mitigation must remain the cornerstones of tackling climate change. This update is most timely since the European Commission is due to release its evaluation of its climate strategy this year."

Is a contemporary shutdown of the Gulf Stream (AMOC) possible?

The update also reviews evidence on key drivers of extreme events. A major point of debate remains whether the Gulf Stream, or Atlantic Meridional Overturning Circulation (AMOC), will just decline or could 'switch off' entirely with substantial implications for Northwest Europe's climate. Recent monitoring does suggest a significant weakening but debate continues over whether the gulf stream may "switch off" as a result of the increased flows of fresh water from northern latitude rainfall and melting of the Greenland icecap. EASAC

notes the importance of continuing to use emerging oceanographic monitoring data to provide a more reliable forecast of impacts of global warming on the AMOC. The update also notes the recent evidence which suggests an association between the rapid rate of Arctic warming and extreme cold events further south (including in Europe and the Eastern USA) due to a weakened and meandering jet stream.

http://bit.ly/2IQc5TW

Five new ancient genomes tell us about Neanderthal tribes

And narrow down the window of breeding between our species.

Cathleen O'Grady - 3/23/2018, 5:14 AM

Mezmaiskaya Cave offered shelter to Neanderthals for tens of thousands of years. The cave, located near Russia's border with Georgia, preserved Neanderthal remains so well that researchers have now been able to extract genetic information from two different individuals who lived approximately 20,000 years apart. And it's just one of the sites that's featured in a new collection of Neanderthal genomes: two from caves in Belgium, one from France, one from Croatia, and one from Mezmaiskaya.

As scientists publish more Neanderthal genomes, they're able to start sketching more details of the long-ago drama and danger these people experienced. The new genomes are all from 39,000 to 47,000 years ago—late in the history of the population. The new data helps us piece together new details on Neanderthal population groups, their movements across Europe, and when they're most likely to have bred with humans.

Replacement

The researchers, led by Mateja Hajdinjak at the Max Planck Institute for Evolutionary Anthropology, extracted tiny amounts of bone or tooth powder—sometimes as little as 9mg—and used a chemical process to remove modern genetic contamination. They also checked for the telltale signs of degradation found in ancient DNA.

They compared the data from the new sequences to previously published data from other ancient individuals, including a range of Neanderthals and a Denisovan, as well as samples from our own species. (The researchers found that their new sample from Vindija Cave in Croatia actually came from the same individual as a previously sequenced sample from the same cave.)

When they looked at existing data from Mezmaiskaya 1 (the individual who had died in Mezmaiskaya Cave around 70,000 years ago), they found hints of an ancient population replacement. Rather than finding that Mezmaiskaya 1 and Mezmaiskaya 2 were closely related to each other and more distantly related to the Western European Neanderthals, they found that Mezmaiskaya 2 seemed to be a Western European transplant, more closely related to the Croatian, Belgian, and French Neanderthals than to geographically closer Mezmaiskaya 1.

The finding implies that the population of Neanderthals in the Caucasus may have been wiped out at some point and replaced by an influx of Neanderthals from another region. The two events might not have been directly related, as that time window coincides precisely with "pronounced climatic fluctuations" in the region.

The authors write that "extreme cold periods in northern Europe may have triggered the local extinction of Neanderthal populations." Following this extinction, they suggest, the area may have been re-colonized by Neanderthals from elsewhere. It's also possible that the turnover worked the other way around—that Western European Neanderthals, including the individuals from Croatia, Belgium, and France, stem from a population that spread out from the Caucasus.

Interbreeding

The comparisons also allowed the researchers to look for genetic flow between Neanderthals and our own species. Surprisingly, even though these Neanderthals were around when we had already moved into Europe, there were "no indications of recent gene flow from early modern humans to late Neanderthals," the authors write. The data also

suggested that Neanderthal gene flow into humans happened before these five individuals were alive—between 70,000 and 150,000 years ago.

“It’s an amazing paper,” said Anders Eriksson in a phone call with Ars. He studies ancient genomes at King's College London, and wasn't involved in this work. “This really opens up the possibility of starting to do proper population genetics on Neanderthals.” He pointed to the researchers’ success at extracting and decontaminating the samples as particularly exciting: “I can see this opening up avenues for getting a lot more ancient DNA.”

The new information about Neanderthal populations and when they mixed with modern humans fits into our growing picture of the evidence, Eriksson said. The new data “fills in a lot of detail where we only really had a couple of data points,” he enthused. By comparing each new genome to the data we already have, we can slowly start to color in the sketch of ancient Neanderthal history—“so you can really start putting together a picture of the population that you had in Europe.”

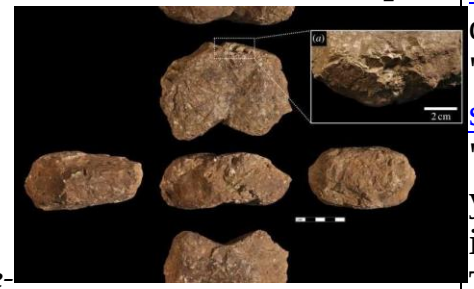
Nature, *2018. DOI: doi:10.1038/nature26151 (About DOIs).*

http://bit.ly/2I2X0qC

Monkeys use tools to crack nuts, shuck oysters

Macaques use tools to crack open nuts and even shuck oysters, a rare skill-set long thought to be exclusive to humans and chimps

Wild macaque monkeys have learned to use tools to crack open nuts and even shuck oysters, researchers said Wednesday, identifying a rare skill-set long thought to be the exclusive party trick of humans and chimps.



Macaque oil palm hammerstone made of fine-grained limestone, from YNI, Thailand (scale 5 cm). Detail (a) of clustered angular detachments due to repeated mis-hits. **Royal Society Open Science, DOI: 10.1098/rsos.171904**

Scientists from Britain and Thailand, where the native long-tailed macaque (Macaca fascicularis) feeds on sea almonds, oil palm nuts and the occasional bivalve, observed the monkeys using stones for two distinct tasks.

Larger rocks, some weighing up to two kilogrammes (4.5 pounds), were used as a hammer to smash open nuts, while sharper stones formed knife-like levers to jimmy open prey such as oysters.

Before the study, conducted on Thailand's Piak Nam Yai island, it was thought that only chimpanzees and bearded capuchins used stones to break open food in the wild.

Professor Tomos Proffitt, British Academy Postdoctoral Fellow at University College London, who wrote the study, said it could have wide relevance to primate studies.

"It contributes to our increasing understanding that not only apes and humans use tools for different tasks," he told AFP.

"We should view macaques as highly intelligent problem solvers, in the same way that chimpanzees, capuchin monkeys are and early humans were also."

Scientists in Brazil in 2016 observed wild-bearded capuchin monkeys hammering away at stones to create rough flakes similar to the tools first used by human forerunners.

But one of the macaques' food sources, the oil palm, was only introduced to their island in the past few decades, meaning that the monkeys have learned to use tools to access its fruit for food extremely quickly, evolutionarily speaking.

"What we see is that they are adapting this stone tool use to other food sources away from the coast," Proffitt said.

"In many cases of primate tool use these behaviours are learnt by youngsters through many years of observation and is not something that is genetically coded into them."

The study was published in the journal *Royal Society Open Science*.

More information: Analysis of wild macaque stone tools used to crack oil palm nuts, Royal Society Open Science, rsos.royalsocietypublishing.or … /10.1098/rsos.171904

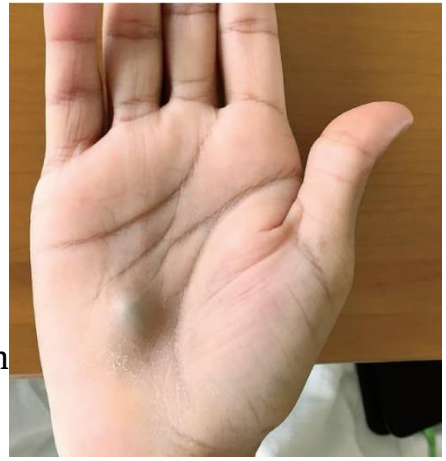
Read more at: https://phys.org/news/2018-03-monkeys-tools-nuts-shuck-oysters.html#jCp

http://bit.ly/2ISkmXG

This Bulging Lump on a Man's Hand Revealed a Serious Heart Infection

It started out as a red patch on a man's palm. But over the next few weeks, the blemish turned into a raised, blue lump that pulsed with his heartbeat.

By Rachael Rettner, Senior Writer



***The raised, blue lump on his man's hand was a sign of a serous heart infection*:**
The New England Journal of Medicine©2018

The unusual lump turned out to be an aneurysm, or bulging blood vessel, according to a new report of the man's case, published today (March 21) in The New England Journal of Medicine. More alarmingly, the bulge was a sign of a potentially life-threatening heart infection — one that the man may have contracted from a simple trip to the dentist.

When the 27-year-old man went to the emergency room, he told doctors that, in addition to the lump on his hand, he had pain in the upper-left side of his abdomen. He also said that, during the prior six weeks, he'd had fevers, night sweats and little appetite, and he'd lost 26 lbs. (12 kilograms).

An ultrasound of the man's heart revealed that he had an infected mass on his aortic valve — a valve that regulates blood flow from the heart into the body's main artery, called the aorta. Lab tests also revealed that the infection was caused by *Streptococcus* bacteria, according to the report.

Doctors diagnosed the man with bacterial endocarditis, an infection of the inner lining of the heart or heart valves. This happens when bacteria enter the bloodstream and attach to the heart, according to the National Heart, Lung, and Blood Institute (NHLBI). The lump on his hand formed when the infection spread to his blood and damaged the blood vessel.

So how did the bacteria get into the man's bloodstream? His doctors said it's possible that it happened during a recent trip to the dentist. Indeed, activities such as toothbrushing or dental procedures can allow bacteria to enter the bloodstream through the gums, according to the NHLBI. This is more likely to happen if you have poor oral hygiene, which the man had, according to the report.

People are also more likely to develop endocarditis if they have a heart defect, particularly a defect in the heart valves, the NHLBI says. During the heart ultrasound, the man was found to have a condition called a "bicuspid aortic valve," in which the aortic valve has only two flaps, instead of the typical three, according to the Cleveland Clinic. This condition develops in the womb before a person is born and affects about 2 percent of the population, the Cleveland Clinic says.

The man was treated with antibiotics, and his fevers and night sweats went away just two days after he started the medication. He also needed surgery to replace his aortic valve and to repair the aneurysm in his hand, the report said.

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Three-in-one molecule shows promise in helping certain breast cancer patients

A newly designed three-part molecule could be the one answer patients with a certain form of breast cancer are looking for, scientists report.

AUGUSTA, Ga. - A newly designed three-part molecule could be the one answer patients with a certain form of breast cancer are looking for, scientists report.

This chimera, created by a team at the Georgia Cancer Center, has the ability to simultaneously decrease the expression of three growth factors that are over-expressed in some cancers.

The growth factors are human epidermal growth factor receptor 2 (HER2), human epidermal growth factor receptor 3 (HER3), and

epidermal growth factor receptor (EGFR). The new chimera interferes with HER2 and HER3 signaling and ultimately leads to cancer cell death, as shown in the group's recent publication in *Molecular Therapy: Nucleic Acids*.

"When HER2 is expressed in a cell, you'll usually find high expression of HER3, too," said Dr. Hongyan Liu, bioengineer at the Georgia Cancer Center at Augusta University and the Center for Biotechnology and Genomic Medicine at the Medical College of Georgia at Augusta University.

Extensive studies have found that 20% to 30% of breast cancers are characterized by over-expression of HER2, which makes the cancer cells grow and divide faster, leading to a cancer that's more aggressive and more likely to be resistant to the standard of care. Patients with this type of breast cancer tend to have a poorer prognosis.

"As a bioengineer, I am developing the materials for cancer-targeted treatment," Liu said. "I have experience building multifunctional chimeras to target different types of genes associated with cancer cells."

Liu and her team created their molecule to target HER family receptors EGFR, HER2, and HER3 all at once, since it is well-known that another HER family member can compensate for one that is blocked by a drug having a single target.

Each component of this tripartite molecule has potent anti-tumor activity. The molecule was designed such that the EGFR-targeting component is sandwiched between the HER2- and HER3-targeting components in what is known as a HER2 aptamer-EGFR siRNA-HER3 aptamer chimera. This construction enables the EGFR component to reach its target within HER2- and HER3-expressing cells. Compared to individual components, the chimera is large enough to avoid renal depletion, resulting in a prolonged circulation time and increased efficiency.

The newly crafted molecule is non-toxic, simple to produce, and cost-effective compared to the production of alternate treatment strategies, such as antibodies and small molecule inhibitors.

Liu's ongoing studies are testing the ability of the three-in-one chimera to treat breast cancers that are resistant to Herceptin, a drug that targets HER2. This work is being done in collaboration with Dr. Hasan Korkaya, assistant professor, Biochemistry and Molecular Biology at the Medical College of Georgia, who has developed drug-resistant cell lines, and with breast cancer clinicians.

"We need to prove that this molecule will work on Herceptin-resistant breast cancer patients," Liu said.

Since other cancers, such as lung and head and neck, proliferate due to HER family over-expression, Liu anticipates that the chimera's utility will not be limited to breast cancers alone.

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Long thought to only cause a rare disease, this mutation may ward off malaria

Genetic mutation that may protect people from malaria thought to be rare is surprisingly common

LA JOLLA, CA - A genetic mutation that may protect people from malaria, but was thought to be rare, is surprisingly common, suggest the findings of a new study led by scientists at The Scripps Research Institute (TSRI). The discovery sheds light on how humans who live in close quarters with malaria-carrying mosquitos may evolve defenses against the disease.

The researchers found that a mutation in the gene PIEZO1, which codes for a pressure-sensing protein, can dehydrate red blood cells. In a mouse model, this mutation made it harder for the malaria parasite Plasmodium to infect red blood cells and cause cerebral malaria (a severe neurological complication of Plasmodium infection).

This red blood cell dehydration condition, called hereditary xerocytosis, was thought to be extremely rare, so the researchers were surprised to find it could be present in one in three people of African descent.

"This syndrome is not rare anymore," says Shang Ma, PhD, a research associate at TSRI and first author of the study, published March 22, 2018 in the journal *Cell*. The study was led by Ardem Patapoutian, PhD,

a professor at TSRI and a Howard Hughes Medical Institute investigator.

The mutation in PIEZO1 is uncommon in non-African populations and had never been the focus of a large-scale analysis. The new findings suggest the mutation is much more common in areas where people have lived alongside selection pressure from malaria.

"This study is a good example of a host/pathogen arms race playing out in real-time--this time with the host a likely winner," says Kristian Andersen, PhD, an assistant professor at TSRI and director of Infectious Disease Genomics at the Scripps Translational Science Institute (STSI).

The PIEZO1 mutation is not the first adaptation linked to malaria resistance. People of African descent are also more likely to have a genetic condition called sickle cell disease, which makes it harder for Plasmodium to enter their red blood cells.

Going forward, Andersen says, large-scale genomic association studies will be needed to confirm the PIEZO1 mutation's role in malaria resistance.

Patapoutian says his lab plans to learn more about the biological role of PIEZO1 and how mutations in the protein could affect other health conditions.

"The fact that we have a mouse model will make it seamless to test mechanisms behind any association we find in humans," says Patapoutian.

Indeed, PIEZO1 as a pressure sensor is important for cardiovascular development and function, and its deletion *is proposed to cause hypertension.*

The study, "Common PIEZO1 allele in African populations causes RBC dehydration and attenuates Plasmodium infection," also included authors from the University of California, San Diego; the University of Montpellier; Leiden University Medical Center; the Genomics Institute of the Novartis Research Foundation; and the Institute of Molecular and Cellular Pharmacology of the National Center for Scientific Research and Côte d'Azur University.

The research was supported by the National Institutes of Health (grants UL1TR001114, R01 DE022358, AI090141 and AI103058), an A.P. Giannini postdoctoral fellowship and the Pew Biomedical Scholar program.

https://nyti.ms/2DTwofF

Was a Tiny Mummy in the Atacama an Alien? No, but the Real Story Is Almost as Strange

Nearly two decades ago, the rumors began: In the Atacama Desert of northern Chile, someone had discovered a tiny mummified alien.

A mummified skeleton from the Atacama Desert in Chile has been described as "alien." But genetic analysis shows that she was human and may have had a previously unknown bone disorder. **Bhattacharya S et al. 2018**

An amateur collector exploring a ghost town was said to have come across a white cloth in a leather pouch. Unwrapping it, he found a six-inch-long skeleton.

Despite its size, the skeleton was remarkably complete. It even had hardened teeth. And yet there were striking anomalies: it had 10 ribs instead of the usual 12, giant eye sockets and a long skull that ended in a point.

Ata, as the remains came to be known, ended up in a private collection, but the rumors continued, fueled in part by a U.F.O. documentary in 2013 that featured the skeleton. On Thursday, a team of scientists presented a very different explanation for Ata — one without aliens, but intriguing in its own way.

Ata's bones contain DNA that not only shows she was human, but that she belonged to the local population. What's more, the researchers identified in her DNA a group of mutations in genes related to bone development.

Some of these mutations might be responsible for the skeleton's bizarre form, causing a hereditary disorder never before documented in humans.

Antonio Salas Ellacuriaga, a geneticist at the University of Santiago de Compostela in Spain who was not involved in the new study, called it

"a very beautiful example of how genomics can help to disentangle an anthropological and archaeological dilemma."

"DNA autopsies," as Dr. Ellacuriaga calls them, could help shed light on medical disorders "by looking to the past to understand the present."

The research, published in the journal Genome Research, began in 2012, when Garry P. Nolan, an immunologist at Stanford University, got wind of the U.F.O. documentary, "Sirius," while it was still in production.

Dr. Nolan emailed the producers and offered to look for DNA in the mummy. The skeleton's owner agreed to X-ray images as well as bone marrow samples taken from the ribs and right humerus.

Once Dr. Nolan and his colleagues received the samples, they were able to retrieve fragments of DNA from bone marrow cells without much struggle. "We could tell this was human right away," said Atul Butte, a computational biologist at the University of California, San Francisco, and a co-author of the new study.

The scientists eventually managed to reconstruct much of Ata's genome. She was a girl, they found, most closely related to indigenous Chileans. But she also had a substantial amount of European ancestry.

The scientists have not carried out any precise dating of the skeleton, so they can't say exactly when Ata lived. But her European heritage suggested it was sometime after Chile was colonized in the 1500s.

After death, DNA disintegrates into fragments, which become smaller over the centuries. Ata's DNA fragments are still large, another clue that she's less than 500 years old.

While her elongated head was striking, it wasn't the strangest feature of Ata's skeleton. Despite being the size of a human fetus, about the length of a pen, her bones were as developed in some ways as those of a 6-year-old.

Ralph S. Lachman, an expert on hereditary bone diseases at Stanford University, examined her X-rays. He concluded that her constellation of symptoms did not match any known disease. The scientists reasoned that Ata might have had mutations for a disorder that had never before been described.

Sanchita Bhattacharya, a researcher in Dr. Butte's lab, searched for mutations in Ata's DNA and identified 2.7 million variants throughout the genome. She whittled this list to 54 rare mutations that could potentially shut down the gene in which they were located.

"I was amazed by how much you can tell from the genetic blueprint," said Ms. Bhattacharya.

Many of those genes, it turned out, are involved in building skeletons. Some have already been linked to conditions ranging from scoliosis to dwarfism to having an abnormal number of ribs.

But some of Ata's mutations are new to science. It's possible some caused her skeleton to mature quickly even while failing to grow to normal stature.

Ms. Bhattacharya speculates that such a disorder would have caused the child to be stillborn. And she stressed that these mutations are, for now, only theoretical candidates.

Other experts concurred. "There is no single slam-dunk finding that explains the bizarre appearance of this individual," said Daniel G. MacArthur, a geneticist at the Broad Institute who was not involved in the study.

Yet understanding what happened to Ata might shed light on skeletal deformities seen today. That may require engineering stem cells with each of the 54 mutations, growing them in a dish, and then looking for telling changes in their development.

And Dr. Nolan has heard stories about similar skeletons in other parts of the world. If he were able to examine them, he might discover some of these mutations in their DNA, as well.

Even more direct confirmation might be possible if researchers paid closer attention to stillbirths.

Although there are 24,000 stillbirths in the United States alone each year, doctors generally don't record the features of the fetuses, let alone study their DNA. With so little data, there's no way to know if Ata was unique.

“This could be a trigger to look into more such cases,” said Albert Zink, an anthropologist at the European Research Academy in Bolzano, Italy, who was not involved in the new study.

While Dr. Nolan began the project as “a lark,” he believes the evidence now requires that the mummy be returned to Chile for proper treatment as human remains.

“One has to respect these things,” he said.

http://bit.ly/2DTNkCK

Men should be included in trials to find better treatments for breast cancer

Call for action from Chair of European Breast Cancer Conference

Barcelona, Spain: Professor Robert Mansel, Chair of the 11th European Breast Cancer Conference (EBCC-11) and Emeritus Professor of Surgery at Cardiff University School of Medicine, UK, has called for men to be included in trials to improve treatments for breast cancer.

Following new research presented by Professor Isabel Rubio [1] at EBCC-11 that showed that if women are pre-treated with targeted drugs to shrink tumours before surgery, they could avoid radical surgery, Prof Mansel said: "These findings could apply to men also, but we just don't know because men with breast cancer are almost never included in clinical trials.

"We need trials to start including men, so that we can discover whether or not they respond in the same way to targeted treatments as women. They may not, because the hormones involved in the cancer are different, but until this is investigated in trials, we do not know what is the best treatment for them.

"The cosmetic result after surgery is important for men too," he continued. "At present, men with breast cancer often undergo radical surgery to remove all the cancer, but why should surgeons remove the nipple and the areola, if it's not necessary? Men feel self-conscious about how this looks because if they want to swim or go to the beach their chests are uncovered if they wear swimming trunks. They could benefit from more conservative surgery that preserves the nipple and areola."

Breast cancer in men is 100 times less common than in women, with a lifetime risk of developing it of about one in 1,000 men. In the UK there are approximately 390 men diagnosed with breast cancer each year, compared to 54,800 cases in women. In the USA there were an estimated 2,240 new cases of and 410 deaths from male breast cancer in 2013.

The European Organisation for Research and Treatment of Cancer (EORTC), the Breast International Group (BIG) and the North American Breast Cancer Groups are coordinating an effort to analyse clinical data from a prospective international registry of male breast cancer patients. It will evaluate the number of patients that it is feasible to recruit for a future clinical trial, describe patterns of care, and assess sample collection rate. [2]

"This collaborative approach will be needed to perform reliable clinical trials in men," said Prof Mansel.

Prof Rubio, co-chair of EBCC-11, former head of the breast surgical oncology unit at the breast cancer centre at Vall d'Hebron University Hospital in Barcelona, and now director of the Breast Surgical Unit at Clinica Universidad de Navarra, Spain, presented her research to the conference on Friday. She described how extensive surgery involving mastectomy and removal of several lymph nodes could be safely avoided for more women with some types of breast cancer, if they received targeted drugs before surgery.

The study focused on women with HER2 positive breast cancer, an aggressive form of the disease, who were given a targeted drug treatment to shrink their tumours before they had surgery.

Previous research has shown that women who have less extensive surgery suffer fewer long-term side-effects and enjoy better quality of life. Prof Rubio said her work shows that even women with aggressive tumours can be safely treated with breast-conserving surgery, if the cancer responds to targeted treatment.

[1] *Professor Isabel Rubio's presentation is Abstract no: 19, "Breast and axillary conservative surgery after neoadjuvant treatment in HER 2 positive breast cancer patients: The time is now" Friday 23 March, "Clinical Science Symposium: Local Treatment of the Breast After Excellent Response to Preoperative Systemic Therapy", 11:05 hrs, Picasso room.*

[2] *International Program on Male Breast Cancer, EORTC trial 10085 Male BC.*

http://bit.ly/2HZVqw7

Mystery of superior Leeuwenhoek microscope solved after 350 years

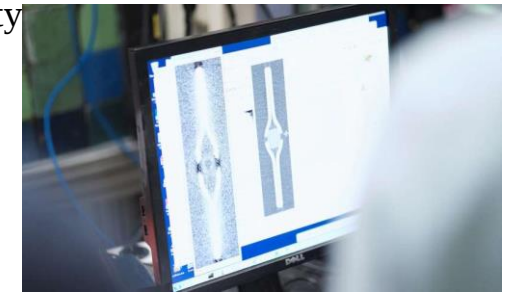
Researchers from TU Delft and Rijksmuseum Boerhaave have solved an age-old mystery surrounding Antonie van Leeuwenhoek's microscopes.

TU Delft

A unique collaboration at the interface between culture and science has proved conclusively that the linen trader and amateur scholar from Delft ground and used his own thin lenses.

Considering the unrivaled quality of the microscopic images produced by Van Leeuwenhoek, this was always thought to be practically impossible. The prevailing view was that grinding small lenses of such high quality by hand was simply a bridge too far. A new research method helped to solve the mystery—namely, using a neutron bundle from the TU Delft research reactor. The TU Delft Reactor Institute uses radiation to conduct research on materials, for energy and health care purposes.

The microscopes manufactured by Antonie van Leeuwenhoek (1632-1723) featured a single lens and a spike upon which the sample was skewered. The microscopes of Van Leeuwenhoek's contemporaries magnified objects approximately 30 times, but his microscopes were up to 10 times more powerful. How he managed this feat remained a mystery up until now. Was there truth in his claim that he had invented an advanced method of glass-blowing, as he revealed to a group of German nobles in a rare moment of candour in 1711? Or was his precise grinding responsible for the quality of the lens?



Delft University of Technology

Van Leeuwenhoek's claim resulted in widespread speculation. Innumerable suggestions were made, but a conclusive answer remained forthcoming.

The 11 Leeuwenhoek microscopes that have stood the test of time, four of which are in the collection of Rijksmuseum Boerhaave, are too valuable to dismantle. "Van Leeuwenhoek clasped his lenses between two metal plates, which he secured with rivets," explains Tiemen Cocquyt, a curator at the museum who was involved with the research. "In light of their rarity and enormous historical value, dismantling the microscopes is not an option. Aside from a tiny hole a half-millimetre wide, there's no way of accessing the lenses. More than 90 percent is out of view. And that is the way it has been for the last 350 years."

Uncharged particles

The mystery of the Leeuwenhoek lens was solved thanks to non-invasive neutron tomography, which made it possible to create an image of the inside of the microscope without having to break it open. The Reactor Institute Delft is home to a new instrument that operates using this technology.

"Tomography involves rotating an object in a neutron bundle in front of a camera, and photographs are taken as the object rotates," explains Lambert van Eijck, a TU Delft researcher. "Neutrons are uncharged particles and pass through metal – in contrast to X-rays, for example. After you have rotated the object through 180 degrees, you can use the collection of 2-D images to construct a 3-D image of the object on the computer."

TU Delft. Credit: Delft University of Technology

A skilled grinder

The resulting image of one of the microscopes from Rijksmuseum Boerhaave leaves no doubt: A Leeuwenhoek microscope does not contain a blown lens, but rather a ground lens. "It would appear that there was no exotic method of production after all, but Van Leeuwenhoek was just exceptionally skilled in grinding tiny lenses," concludes Cocquyt.

The Leeuwenhoek microscope was recently chosen as a Dutch showpiece in the design category on a national television programme. Tiemen Cocquyt says, "The instrument opened new worlds, and Van Leeuwenhoek was the first to view bacteria, sperm cells and blood cells, discoveries that he published in the journal of the British Royal Society." With his simple, yet extremely specialised microscope, Van Leeuwenhoek saw what nobody had seen before – or even could have seen. It was another 150 years before others succeeded in building a microscope capable of revealing more.

A question that the researchers would still like to see answered is whether the lens is made from a special type of glass. "That is something that we can research using gamma spectroscopy," says Van Eijck. "You see, neutron tomography makes objects temporarily radioactive. How the radioactivity decays reveals which elements it contains."

http://bit.ly/2GoGBWD

The dinosaur that got away: how we diagnosed a 200-million-year-old infected predator bite

Nature, red in tooth and claw.

Patrick Randolph-Quinney *

When Tennyson published his poem In Memoriam, little did he know that this phrase from it would become so intimately associated with the process of Darwinian natural selection. Five little words which evoke the harsh evolutionary realities of competition for food, resources and life itself between predator and prey, the hunter and the hunted.

Now my colleagues and I, led by Lida Xing from the China University of Geosciences (Beijing), have published evidence of one lucky animal that got away – in this case, a herbivorous dinosaur from China. Our work highlights how the use of X-ray tomography – a rapidly developing technique in digital imaging – is revolutionising the study of the fossil record.

Reconstruction of the bite wound affecting the shoulder of our herbivorous dinosaur. **Zongda Zhang/Lida Xing, CC BY-SA**

Our dinosaur is *Lufengosaurus huenei*, a Lower Jurassic sauropod, who would have lived 200-170m years ago in what is now Yunnan Province, China. *Lufengosaurus* was a herbivore, around six metres in length and weighing a little under two tonnes.

When the dinosaur was excavated in 1997, there was a pathological abnormality on one of the right ribs of the animal. Viewed from the side, there is a concave section of missing bone which cuts almost halfway through the rib.

The traditional approach in studying bone pathology is what is termed “morphoscopic evaluation”. This usually involves low powered magnification of the bone, but this would only image the external surface of the fossil. In the case of our rib, the lesion penetrated deep into the bone, so seeing the internal structure was needed for a diagnosis.

The pathological rib of Lufengosaurus, showing the removal of a large area of bone. **Lida Xing**

Now, 20 years after its initial discovery, we have used X-ray micro-computed tomography, or micro-CT for short, to image the deep structures of our dinosaur.

Seeing inside fossils

Tomography (from the Greek *tomos* to slice, and *graphos* to write) is a non-invasive technique that has significant diagnostic advantages over conventional methods, allowing high-resolution slices and 3D images to be built up of internal structures without damaging the fossil.

Following micro-CT scanning, we reconstructed the cellular structure of the rib. In cross-section, there was clear evidence of both destructive changes and new bone formation which could not be observed from the outside. The pattern of these bone-destroying and bone-forming processes tells us that the disease process was both chronic (long-term) and active at the time of the animal's death.

We diagnosed a process called osteomyelitis, which in this case had produced an abscess inside the bone. Osteomyelitis is a severe infection originating in the bone marrow, usually resulting from the introduction of pyogenic (pus-producing) bacteria into the bone. Pathogens enter the bone via the bloodstream, or through open wounds or fractures.

This is only the second case of osteomyelitis to be found in a sauropod dinosaur in the fossil record. The only other case comes from a giant titanosaur from Argentina who had a bacterial infection of the spine.

Tooth and claw

In this *Lufengosaurus* we also have the earliest recorded case of a bony abscess caused by osteomyelitis in the fossil record.

Given the shape of the lesion, and its position on the ribcage, we think that the infection may have been caused by a puncture wound from a bite. The teardrop shape suggests that the damage was produced by a tooth or claw, and is in keeping with evidence for predator bite trauma found elsewhere in the dinosaur fossil record.

The bacterial infection would have had a big impact on the life of the Yunnan dinosaur. Osteomyelitis is known to produce fever, fatigue, nausea and discomfort, and may send tracts of bacteria into the brain, accelerating death. We know that the dinosaur survived for some time with this infection, but this may have made it vulnerable to other diseases or unable to fend for itself in the long term.

What is exciting is that this case gives us evidence of interaction between a large plant-eating dinosaur (a sauropod) and one of the aggressive predators living at that time. We don't just have evidence of disease but of behaviour between animals – between predator and prey at this deep period in prehistory.

We do not know which species of predator caused the bite, but the wound from the failed attack is a smoking gun. It is possible that *Sinosaurus*, a well-known predator found in Jurassic Yunnan, would have been able to attack *Lufengosaurus*.

Virtual palaeontology

This discovery was only made possible by the application of X-ray tomography (micro-CT). The first commercially available micro-CT scanner appeared in 1994, but it is only in the last decade that it has begun to be used in palaeontology, partly because of the cost of the equipment. Tomography is increasingly allowing us to understand processes such as trauma and infection in the fossil record at the cellular level.

This technology has opened up the fossil record, allowing palaeontologists to image and analyse the deep structure of fossils. This has enabled spectacular discoveries such as the earliest hominin cancer and the earliest tumour, the flight pattern of Archaeoptryx, or to rebuild an early bird trapped in amber. It has also allowed us to correct historical cases of pathological misdiagnosis in fossils.

The resulting scans can be shared across the world, visualised and studied without the need to access the fossils directly. They can also be 3D printed, both in their actual size or at any other scale that we require.

Who knows what spectacular discoveries await us using this technology, but it is clear that the future of palaeontological research is virtual.

**Reader/Associate Professor in Biological and Forensic Anthropology, University of Central Lancashire*

Patrick Randolph-Quinney does not work for, consult, own shares in or receive funding from any company or organisation that would benefit from this article, and has disclosed no relevant affiliations beyond their academic appointment.

University of Central Lancashire provides funding as a member of The Conversation UK.

http://bit.ly/2Goueds

Where We Are in the Hunt for a Cancer Vaccine

Two new studies have promising results

By Sam Spengler

For decades now, the prospect of personalized cancer vaccines has tantalized medical scientists. Studies in lab mice were perpetually encouraging. But there was no proof with humans. Now the most impressive evidence yet suggests that this long-awaited form of immunotherapy may actually work in some patients.

"Cancer vaccine" might seem like a surprising term for this treatment, since it doesn't prevent a person from getting the disease and each shot has to be customized. But like any vaccine, it summons the immune system to attack a dangerous foe. To develop the vaccine, researchers analyze neoantigens—protein fragments on the surfaces of cancer cells—and look for the specific mutations that created them. Then they use a computer algorithm to determine which peptides have the best chance of activating that person's immune system to fight the cancer. Making the vaccine in a lab takes about three months.

One of two groundbreaking studies published last year involved six patients at Harvard's Dana-Farber Cancer Institute. All six had recently had melanoma tumors removed and were at high risk of recurrence. They were given vaccines that targeted up to 20 neoantigens from their cancer cells. Their immune systems took notice. "Importantly, we could show that there was recognition of the patient's own tumor," says Catherine Wu, a Harvard oncologist who co-authored the study.

One of those patients (who remains anonymous) had her first melanoma removed from her left arm in November 2012. Two years later, the cancer returned. This made it likely that it would continue to metastasize, possibly throughout other parts of her body. Instead of getting chemotherapy or radiation, she entered the Dana-Farber trial. Two and a half years after her personalized vaccine therapy, she remains tumor free without further treatment. Three other patients in the study made similar progress. The other two became tumor-free after the vaccine was paired with a checkpoint inhibitor.

The second study, at the Johannes Gutenberg University of Mainz in Germany, involved 13 subjects with recently removed melanomas. Five of them developed new tumors before their vaccines were ready, but two of them saw those tumors shrink while receiving the vaccine. A third went into complete remission after starting a checkpoint inhibitor medication. The eight patients who had no visible tumors when the vaccinations started were still recurrence-free more than a year later.

Strikingly, none of the patients in either study experienced adverse effects apart from fatigue, rashes, flu-like symptoms or soreness at the injection site. Unlike other immunotherapies, which manipulate T-cells and can trigger autoimmune complications, cancer vaccines prompt the immune system to make its own T-cells that target only the cancer.

Patrick Ott, another author on the Dana-Farber study, hopes new technologies will make it easy to build these vaccines inexpensively, and within a few days. He's confident that the first two trials will inspire rapid progress: "If you show a good response, the industry is going to jump on it and make it even better."

http://bit.ly/2GbJGWQ

For patients with drug-resistant infections, infectious diseases experts may be lifesaving

Consultation with ID specialists associated with lower patient mortality for some infections

When infectious diseases (ID) specialists were involved in the care of patients with certain kinds of drug-resistant infections, the patients' 30-day mortality rates were about 50 percent lower, according to a new study published in *Open Forum Infectious Diseases*. The findings provide additional evidence for the beneficial impact ID physicians have on patient care and outcomes, particularly when individuals have difficult to treat infections that are resistant to multiple antibiotics.

"These are serious infections that anybody can get and end up in the hospital," said study author Jason P. Burnham, MD, of Washington

University School of Medicine in St. Louis. "Understanding how we can help improve outcomes in patients like these is really important."

For the single-center, retrospective study, researchers reviewed records from 2006 to 2015 for approximately 4,200 patients with infections resistant to multiple antibiotics who were treated at Barnes-Jewish Hospital, an academic medical center affiliated with Washington University School of Medicine. Patients with positive cultures for a multi-drug resistant pathogen from one of several different types of bacteria were included in the analysis: Enterobacteriaceae, Staphylococcus aureus, Enterococcus, Pseudomonas, and Acinetobacter.

Among patients with multi-drug resistant Enterobacteriaceae infections, ID consultation was associated with a 59 percent reduction in 30-day mortality. In line with previous research, ID consultation was also associated with a 52 percent reduction in 30-day mortality for patients with resistant S. aureus infections. For individuals suffering from several infections simultaneously, each one resistant to multiple antibiotics, an ID consult was associated with a 49 percent drop in 30-day mortality.

Even one year later, the involvement of an ID physician in treating a patient's initial S. aureus infection was associated with a 27 percent reduction in all-cause mortality. For resistant Enterobacteriaceae infections, researchers found a similar 26 percent reduction in one-year all-cause mortality when a patient's initial care included an ID physician.

Among those with resistant Enterobacteriaceae infections, ID consultation was also associated with a 26 percent reduction in hospital readmissions in the 30 days following their initial hospital stay for infection.

For the other types of bacteria (Enterococcus, Pseudomonas, and Acinetobacter), small sample sizes limited the authors' ability to associate ID consults with clinical outcomes. According to Dr. Burnham, larger studies are needed to better understand the role of ID consultants for these infections, though he said he suspects it would be positive. In addition, future research will clarify what specific aspects of care provided by ID specialists help patients the most, such as expertise in appropriate antibiotic use or application of relevant clinical practice guidelines.

As antibiotic resistance continues to increase, the specialized care provided by ID physicians will become even more integral to the daily operations of hospitals and for the promotion of patient and public health, Dr. Burnham said. "I think we're moving in a direction where having ID experts on board for these increasingly hard to treat drug-resistant infections will be necessary to ensure that our patients have the best possible outcomes."

http://bit.ly/2G5reDf

First proof a synthesized antibiotic is capable of treating superbugs

Successful synthesis of a "game changing" new antibiotic capable of killing superbugs

A "game changing" new antibiotic which is capable of killing superbugs has been successfully synthesised and used to treat an infection for the first time -- and could lead to the first new class of antibiotic drug in 30 years.

The breakthrough is another major step forward on the journey to develop a commercially viable drug version based on teixobactin -- a natural antibiotic discovered by US scientists in soil samples in 2015 which has been heralded as a "gamechanger" in the battle against antibiotic resistant pathogens such as MRSA and VRE.

Scientists from the University of Lincoln, UK, have now successfully created a simplified, synthesised form of teixobactin which has been used to treat a bacterial infection in mice, demonstrating the first proof that such simplified versions of its real form could be used to treat real bacterial infection as the basis of a new drug.

The team at Lincoln developed a library of synthetic versions of teixobactin by replacing key amino acids at specific points in the antibiotic's structure to make it easier to recreate. After these simplified

synthetic versions were shown to be highly potent against superbug-causing bacteria in vitro - or test tube -- experiments, researchers from the Singapore Eye Research Institute (SERI) then used one of the synthetic versions to successfully treat a bacterial infection in mice.

As well as clearing the infection, the synthesised teixobactin also minimised the infection's severity, which was not the case for the clinically-used antibiotic, moxifloxacin, used as a control study. The findings are published in the *Journal of Medicinal Chemistry*.

It has been predicted that by 2050 an additional 10 million people will succumb to drug resistant infections each year. The development of new antibiotics which can be used as a last resort when other drugs are ineffective is therefore a crucial area of study for healthcare researchers around the world.

Dr Ishwar Singh, a specialist in novel drug design and development from the University of Lincoln's School of Pharmacy, said: "Translating our success with these simplified synthetic versions from test tubes to real cases is a quantum jump in the development of new antibiotics, and brings us closer to realising the therapeutic potential of simplified teixobactins.

"When teixobactin was discovered it was groundbreaking in itself as a new antibiotic which kills bacteria without detectable resistance including superbugs such as MRSA, but natural teixobactin was not created for human use.

"A significant amount of work remains in the development of teixobactin as a therapeutic antibiotic for human use -- we are probably around six to ten years off a drug that doctors can prescribe to patients -- but this is a real step in the right direction and now opens the door for improving our in vivo analogues."

Dr Lakshminarayanan Rajamani from SERI added: "We need sophisticated armour to combat antibiotic-resistant pathogens. Drugs that target the fundamental mechanism of bacterial survival, and also reduce the host's inflammatory responses are the need of the hour. Our preliminary studies suggest that the modified peptide decreases the bacterial burden as well as disease severity, thus potentially enhancing the therapeutic utility."

The work builds on the success of the Lincoln team's pioneering research to tackle antimicrobial resistance over the past 22 months to turn teixobactin into a viable drug. The team will now develop a bigger library of simplified synthetic versions which can be used is a diverse number of applications, advancing the goal of a clinical drug.

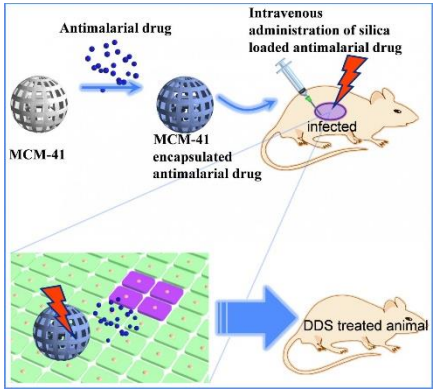
http://bit.ly/2DTXBin

Breakthrough antimalarial drug delivery system using mesoporous silica nanoparticles

Porous silica material can incorporate drugs into its pores making it a useful DDS

Drug delivery systems (DDSs) control when and how much drugs are delivered to the body. Numerous DDS studies have been conducted but most have focused on treatments for cancer. New research from Kumamoto University uses a DDS to treat malaria.

The existing treatment for malaria is taken orally and has three main problems: (1) most antimalarial drugs are broken down in the stomach, (2) the drugs have strong side effects, and (3) the medicine stays in the body for only a short time. These issues resulted in malaria treatments that were not particularly effective.



Kumamoto University researchers found that using MCM-41 as a drug delivery system for malaria treatment produced a highly efficient treatment in animals. Clinical trials are planned in the near future. **Shinya Hayami**

MCM-41 is a porous silica material with a pore size of 2-30 nm. It can incorporate drugs into its pores, which makes it a useful material for DDS applications. A research group headed by Prof. Shinya Hayami from Kumamoto University, Japan believed that MCM-41 could be used as DDS for antimalarial drugs. To test their theory, they created a

new DDS by combining the antimalarial drugs Artesunate and Quinine with MCT-41 and performed in vitro and in vivo experiments. They found:

(1) The release time of the antimalarial medicine became very long, one week or longer, which was an improvement from the standard medication time.

(2) Compared to ingesting Artesunate or Quinine, the new DDS increased treatment efficiency by 20 and 240 times respectively in animal experiments. (As defined in this study, the therapeutic efficiency is 50% of the effective dose (ED50), and is used as an index of drug strength. The smaller the value of ED50, the greater the action of the drug. In other words, if an effect is obtained with a small amount of a drug, the treatment efficiency is high.)

(3) MCM-41 itself is non-toxic and inactive. A DDS using MCM-41 is expected to have very weak side effects.

"Using this DDS for antimalarial drugs has introduced a new possibility for highly efficient malaria treatment for the first time," said Professor Shinya Hayami. "We expect that it will be put to practical use in areas where malaria treatment is still necessary. Now, we are planning to develop clinical trials for antimalarial drugs as well as new DDSs for other drugs, like anti-HIV medications."

This research was posted online in the journal Scientific Reports *on 15 February 2018.*

[Source]

Amolegbe, S. A., Hirano, Y., Adebayo, J. O., Ademowo, O. G., Balogun, E. A., Obaleye, J. A., ... Hayami, S. (2018). Mesoporous silica nanocarriers encapsulated antimalarials with high therapeutic performance. Scientific Reports, 8(1). doi:10.1038/s41598-018-21351-8

http://bit.ly/2GbV3Ow

How listening to random sound can unlock a trapped mind

People who listen "audiojacks" immediately put together a story because the brain associates the sound with memory

March 23, 2018 by Lisa Napoli, Tribune Interactive

David Tobin took to the stage at a recent technology conference in downtown Los Angeles, asked the 500 attendees to close their eyes, and turned up the sound so they could sample his wares: a textured, layered soundscape that he calls an "audiojack."

A thousand eyes clamped shut as they collectively heard a ball thudding into a glove. A cracking bat. Fans roaring with approval. "How does what you're hearing make you feel? What does it make you remember? There are no right or wrong answers," Tobin told the group, who'd gathered for demonstrations and discussions on how technology can improve the lives of our rapidly aging population. "It's all up to you to imagine," he said.

Taking back our imaginations from an onslaught of words, images, video and other stimuli is Tobin's goal with his business, Audiojack, so named, he says, because he hopes listeners will get "jacked" by the sounds.

A former television producer and one-time manager of the famous Roxy Theater on Hollywood's Sunset Strip, Tobin happened on the idea by accident. After a friend gave him a hard drive that contained a folder of sound effects. Just for fun, Tobin mixed them with no apparent plot or structure, leaving out any human voices. He found that friends who listened to his creation started "putting together a story instantly because your brain associates the sound with memory," he said.

Next he shared it with his mother, a teacher, who brought it into her classroom and saw that kids seemed particularly engaged after a listening session. When a friend sampled it for his mother, who in turn played the soundscape for dementia patients she cared for at a senior center, Tobin began to realize he'd made something that had broad appeal and a useful application.

Senior citizens with even the most advanced memory loss have powerfully responded to his product. One elderly listener who'd not spoken a complete sentence in weeks was able to articulate memories triggered by the sound of cooking breakfast or of a tiger in the wild.

Tobin received similar encouragement from educators and students at the Perkins School for the Blind in Watertown, Mass., who asked him to make more audiojacks, and even invited him in for a group session.

Students worked in an on-campus studio to make their own "movie for the mind."

Tobin has not yet conducted formal research into the efficacy of his sound recordings, but researchers in Canada have found that aural stimulation engages older people with memory loss, helping them to be more connected to their surroundings.

More well-understood are the benefits of music therapy, which has been shown in extensive patient studies at Harvard University and Oxford University to achieve reduced stress, and improved mood and social function, as well as regulated heartbeat and breathing. One program, SingFit, offers music playlists with lyric prompts specially designed to engage older people and others with traumatic brain injury.

Audiojack can cite one study by George Mason University that shows improved brain function for people with moderate to severe dementia who used the program over a four-month period.

Fernando Roman at the city-funded Echo Park Senior Center just outside downtown Los Angeles has seen this with his work. During the sessions he holds every few weeks, he hands out paper to each attendee, makes sure the room is quiet, and afterward asks them to share what images and feelings the soundscapes have stirred up. Though they're far from the Siberian tundra, much less the woods, the seniors listen and reflect.

"They get to see the wide range of where everyone's mind is at," Roman said. The fact that there are no spoken words makes it accessible to his multi-lingual clientele, too.

Art teacher Michele Mazzei at Edison High School in Fresno, Calif., has seen particular impact with all of her students, but particularly one boy with autism. Typically, he was silent, she said, but when she played one of Tobin's creations, he instantly responded. "He perked up, spoke, and pointed out what he heard," she said. "It got him to be part of something."

Tobin sells the audiojacks for institutional use with lesson plans and prompts, but it's also available to individual users in mobile app form. There's one free available in each category, and an annual subscription costs $14.99. Lately, he said, he's seen a surge in downloads and mail from users who like listening to them for no other reason than to space out. Consider it an active form of meditation, where you can choose to imagine any visuals you like or none at all.

Tobin considers it the antithesis to virtual reality, another popular form of tech-mediated experience. "VR is so stimulating," he said. "You're locked in, your eyes are peeled, you can't get away from it. Here, you close your eyes and do it on your terms."

https://wb.md/2pHLYWB

Are Med Students Unprepared? Who's to Blame?

Schools Need to Invest More in Faculty

Robert M. Centor, MD

We learn how to act as physicians through observation and experience. This is particularly true during medical school, where attending physicians and residents shape interns and students through their actions. Unfortunately, we have many medical school leaders and clinician-educators who know how to talk the talk, but are deficient at walking the walk.

Recently, the American College of Physicians published a position paper that contrasts the hidden curriculum of lessons students learn from faculty who act at a lower standard than the standard described in the formal lectures they hear on ethics and professional behavior. Lectures rarely change behavior; witnessed behavior often does.

But although we can state that we need more outstanding role models, making that happen proves more difficult than simply saying so.

How can we break the cycle of unprofessional behavior? What should we expect from our clinician-educators? Why are they not always outstanding role models?

In most medical schools, clinician-educators receive less financial and emotional support than they deserve. Many medical schools seemingly value funded researchers as their greatest asset, followed by highly specialized subspecialists who bring in high-revenue patients. Too

often, teaching occupies the lowest rung in the prestige ladder of medical schools.

Many clinician-educators carry heavy clinical loads. In medical schools, as in private practice, heavy clinical loads can create burnout. So, many clinician-educators suffer from burnout. We all know that burnout affects our personality and our professionalism. Some such physicians have the inner strength to maintain their professionalism, but unfortunately, not all do.

We also do not evaluate clinician-educators as completely during the hiring process. A researcher's scholarly activity is heavily scrutinized, and the recruitment team tries to estimate whether he or she will receive funding and have a highly successful career. Highly subspecialized experts generally come from fellowships with a documented ability to provide tertiary or even quaternary care.

But too often, we recruit clinician-educators to fill a hole in the schedule. Few starting clinician-educators have taken education courses or even read books or articles about clinical teaching. Rarely do the recruiters even review their educational track records.

So some new clinician-educators, often fresh out of residency or fellowship, do not understand their roles and fail the role model test; some, of course, are great. Regrettably, schools often catch only the most egregious unprofessional behavior.

We do not reward positive role models. At many institutions, only one of the many clinician-educators will receive an award for professionalism. Few schools have a mechanism (or perhaps even desire) for recognizing and rewarding those who work with medical students, interns, residents, and fellows and provide important successful role modeling.

Too often, we recruit excellent clinician-educators and then overload them with clinical, education, and even committee activities. They often make much less money than their peers in private practice. Over the years, these great teachers and role models get frustrated with the medical school's apparent indifference to their contributions, and make the leap to private practice.

We relegate unsuccessful researchers to clinical teaching. These well-meaning physicians do not really want to teach clinical medicine. When this happens, it frustrates both these scientists and those clinicians who actively choose to be educators.

We owe our students, interns, residents, and fellows a first-class education. That education should include great role modeling. The best role models are skilled bedside clinicians, excellent at interacting with other physicians and healthcare workers.

But we should not expect great clinician-educators to reach that level magically.

Some organizations have invested resources in programs to help clinician-educators improve. The American College of Physicians has a wonderful book series titled Teaching Medicine. The Society for General Internal Medicine (SGIM) has developed a very successful program, The SGIM TEACH Program: A Curriculum for Teachers of Clinical Medicine. Other medical organizations also have on-site training programs on teaching.

Although these efforts are wonderful and include an emphasis on role modeling, compared with the number of clinician-educators spread across the country, we have insufficient resources.

Right now, we inadequately prepare most educators before sending them out to teach our learners. Most students will tell you that some of them "luck into" outstanding teachers, whereas others have suboptimal experiences.

The ACP position paper addresses an extremely important problem. We all must work to convince medical schools that they should prioritize education and role modeling. Too often, education is almost an afterthought. Many great educators feel undervalued. Our students deserve better.

https://nyti.ms/2DUWuyJ

Why Can't Dying Patients Get the Drugs They Want?

"Right to Try" legislation would allow terminally ill patients access to experimental drugs without the approval of the Food and Drug Administration

By KATIE THOMAS MARCH 23, 2018

Nancy Goodman, with her 7-year-old daughter, Sarah Froman, started Kids v Cancer after her son, Jacob Froman, died of cancer at age 10. **T.J. Kirkpatrick for The New York Times**

At first glance, a bill passed by the House of Representatives this week seems like the kind of thing anyone could get behind.

Known as the "Right to Try" legislation, it would allow terminally ill patients access to experimental drugs without the approval of the Food and Drug Administration.

But the bill and a similar one passed last summer by the Senate do little to address the main barrier that patients face in getting unapproved treatments: permission from the drug companies themselves.

In recent years, the arrival of breakthrough drugs for everything from cancer to rare diseases has led to a surge in the number of patients wanting early access to treatments. The pleas — sometimes driven by viral social media campaigns — have proved vexing for companies that have invested millions to get a drug to market and are wary of doing anything to jeopardize their chances.

Today, companies' policies on granting early access to drugs are a confusing patchwork that tends to favor affluent and well-connected patients at leading medical centers, who have the resources and know-how to navigate the system.

"You have to be pretty sophisticated," said Dr. Arthur L. Caplan, a bioethicist at New York University who has been working with companies, including Johnson & Johnson, to develop better early-access programs. But the bill passed this week, he said, "does somewhere between nothing and absolutely nothing to help you."

The bill's passage represented a victory for proponents of "right to try," a campaign championed by Vice President Mike Pence and initiated by the Goldwater Institute, a libertarian think tank that favors limiting the scope of the F.D.A. At least 38 states have passed local versions of right-to-try laws, which allow patients to sidestep F.D.A. approval once they have received permission from a company.

The right-to-try measures are opposed by a broad coalition of groups, which contend the bill will not help patients and will undermine the authority of the primary regulatory agency, the F.D.A. Four former F.D.A. commissioners, including two each from Democratic and Republican administrations, oppose the bills, as do dozens of patient groups, including the American Cancer Society Cancer Action Network and the American Lung Association.

The pharmaceutical industry, while not taking a position on the issue, has been circumspect. A spokesman for its main lobbying group, the Pharmaceutical Research and Manufacturers of America, said on Friday, "We believe any legislation must truly benefit and protect patients and not disrupt the future of clinical trials, U.S. Food and Drug Administration oversight and the research and approval of new medicines."

The bill's future is unclear. On Thursday, Senator Ron Johnson, Republican of Wisconsin, failed to secure unanimous consent in the Senate to pass the House version of the bill after it was blocked by Senator Chuck Schumer, the Democratic leader from New York. Mr. Schumer said that the Senate had already passed its version and that he wanted to work on a compromise bill.

In a statement, Senator Johnson said the next step would be to persuade the House to pass his version. "Patients and their families are running out of time," Mr. Johnson said in the statement. "I promise to continue

to work tirelessly on behalf of desperate patients for their right to try — their right to hope."

Supporters say that right-to-try measures will eliminate an unnecessary layer of bureaucracy — obtaining approval from the F.D.A. The legislation includes incentives they say could encourage companies to participate, such as shielding them from lawsuits and preventing the F.D.A. from considering the experiences of patients on the drugs in their eventual decisions about whether to approve them.

"All we're trying to do with Right to Try is open up another avenue for patients who need it and aren't served by existing programs," said Starlee Coleman, a senior policy adviser at the Goldwater Institute.

The F.D.A. already approves 99 percent of such applications, and the agency has streamlined the approval process. Drug companies also have many other reasons to bar access — often, companies do not have enough extra product to give to patients, or they worry that the logistical work of granting access could slow efforts to get the drug approved, when it would become available to any patient who needed it.

There is also the possibility that the drug does not work — many experimental products fail in late-stage trials.

"It"s not going to fix the problem because there are still a lot of reasons why the companies will choose not to share their drugs," said Nancy Goodman, the founder and executive director of Kids v Cancer, an advocacy group that helps connect patients with companies offering early access to treatment. Ms. Goodman's son, Jacob, died in 2009 at age 10 of cancer, and she said she asked eight companies for access to their experimental therapies and was turned down every time.

Senator Ron Johnson of Wisconsin hopes the House will pass his "right-to-try" measure. **Zach Gibson for The New York Times**

Ms. Goodman said that dying patients do need better access to drugs during what she described as the "uncomfortable" period between when there is consensus that a drug works and when it reaches the market.

Still, she said of the companies, "I can understand why they say no, even though my heart was broken so many times."

Some companies said they would continue to seek F.D.A. permission, even if a right-to-try bill becomes law.

"In our view, the F.D.A. plays a really important role," Dr. Joanne Waldstreicher, the chief medical officer of Johnson & Johnson, said in an interview Thursday.

Johnson & Johnson initiated a program in 2015 that delegates decisions about early access to a program set up by Dr. Caplan. The F.D.A., Dr. Waldstreicher said, has "information that we don't have necessarily; they see safety and efficacy information on products that may be similar."

It is not always clear which patients would benefit under such a law, including those whose names are included in the bills' title. Both the House and Senate versions carry the name of Jordan McLinn, an Indiana boy with Duchenne muscular dystrophy, a degenerative and ultimately fatal disease with no cure. Jordan and his mother, Laura McLinn, have campaigned with Mr. Pence in favor of a law, and a video about them is featured on the Goldwater Institute website.

In the video, Ms. McLinn discusses an unnamed medicine that she said she believed would allow her son to live a "long, productive life." But in separate remarks at a public event in February, Ms. McLinn said that her son was in a clinical trial for an experimental drug.

In an email message Thursday, she said, "Our journey has evolved over time with right To try," adding, "There is not a drug that we are presently trying to access." She said she still supported the measure because "we should have that option if it is a pathway that makes sense and works for a treatment we may want to access in the future."

Ms. Coleman, of the Goldwater Institute, said the video about the McLinns was three years old, "and all of Laura's statements were

accurate at the time and are still reflective of the situation many patients experience."

In recent years, more companies have developed formal policies on what is often called "compassionate use" in the wake of high-profile campaigns by dying patients and their families.

In 2014, executives at the biotechnology company Chimerix received death threats after refusing to give an experimental drug to a 7-year-old boy, Josh Hardy of Virginia, who was dying from a viral infection. The company ultimately provided the drug to the boy, but the episode led to the departure of the chief executive, Kenneth I. Moch, who has since become a proponent of granting fairer access to experimental drugs. (In 2016, Josh died at age 10 of complications from a rare cancer.)

Before the Hardy family made its request, Mr. Moch said he and his company had been flooded with pleas, ranging from longtime friends to a billionaire, seeking access to the drug, brincidofovir, which still has not been approved by the F.D.A.

"You get these requests and you have to make your judgment," he said.

Since the episode, he said dozens of companies had contacted him for advice. In addition to Ms. Goodman's group, another organization, the Reagan-Udall Foundation, also provides information about company programs.

Mr. Moch and others who oppose the legislation acknowledged that it has served a positive purpose. "The only good thing I see coming out of the right-to-try legislation is the increased awareness within the medical community about expanded access," he said.

https://bbc.in/2G5CvDv

We learn nothing about nutrition, claim medical students

Medical students say they currently learn almost nothing about the way diet and lifestyle affect health - and they should be taught more.

By Sheila Dillon Presenter, Radio 4's Food Programme

They say what they are taught is not practical or relevant to most of the medical problems they see in GP surgeries, clinics and hospitals. A leading GP estimated that up to 80% of his patients had conditions linked to lifestyle and diet. These included obesity, type 2 diabetes and depression.

Why does this lack of training matter?

This year the NHS will spend more than £11bn on diabetes alone - social care costs, time off work etc, will almost double that bill. Type 2 diabetes - the most common kind - is linked to obesity. And right now Britain is the fat man of Europe.

Training too traditional

But doctors are not being trained to deal with what medics call non-communicable diseases - and it's those kind of illnesses that are threatening to bankrupt our health system, so a new kind of training is crucial.

Speaking to BBC Radio 4's The Food Programme, Dr Rangan Chatterjee, author and podcast host, told me: "The health landscape of the UK has dramatically changed over the last 30 or 40 years and I think the bulk of what I see as a GP now - almost 80% - is in some way driven by our collective lifestyles."

Dr Michael Mosley, presenter of BBC One's Trust Me I'm A Doctor, said, "Unfortunately it's not part of the traditional training. At medical school I learnt almost nothing about nutrition. And I have a son at medical school and it's again not part of his key curriculum.

"So I don't get the sense that there are lots of doctors out there who feel empowered to tell patients much about nutrition."

A hotbed of the new revolution is Bristol University where, in 2017, third year medical students Ally Jaffee and Iain Broadley founded Nutritank. It's an online organisation created for and by medical students to share nutrition science research and organises events and lectures on campus. This summer, it will welcome GP, author and podcast host Dr Rupy Aujla to Bristol to lead the first UK course in culinary medicine for medical students.

From one society in Bristol, Nutritank has now spread to 15 other student-led groups at universities across the country.

'It's time'

Ally Jaffee said: "There's just about a society at medical school in everything from sexual health to orthopaedics to dermatology. But there just wasn't a nutrition and lifestyle or a preventative medicine society.

"We're taught about 10 to 24 hours over five to six years in medical school on nutrition."

This month, the British Medical Journal announced it will launch a journal on the science and politics of nutrition in June 2018.

Dr Fiona Godlee, editor-in-chief of the BMJ, told me, "It's time we recognised that food and nutrition are core to health. There is a growing body of research out there that needs to be published - and we want to contribute to that effort."

She said the same levels of quality and scrutiny should be applied to food science that are applied to other areas of health research.

The BMJ's announcement follows an opinion piece it published in October 2017 written by two University of Cambridge graduate medical students, Kate Womersley and Katherine Ripullone.

Kate said: "I was in an obesity clinic as part of my medical shadowing.

"A patient came in and said very frankly to the doctor, the consultant in charge, 'Why am I so fat?'.

"The patient was asking a very straightforward question and I think was expecting a straightforward answer. But often that's a question where doctors seem to clam up a bit. "We were interested to write this piece for the BMJ, because we didn't feel prepared to be receiving that question."

Medical schools in the UK are responsible for setting their own curriculum with guidance and standards published by the General Medical Council.

The GMC is now reviewing that guidance but so far it's been very general. It told us that it recognises the significance of the impact of diet and nutrition on health and wellbeing and has sought to express this more explicitly in its revised "outcomes" that will be released this summer.

Things are also beginning to change at medical schools. University of Cambridge told us it plans to double the amount of core course content on nutrition and has asked Kate and Katherine to help.

Similarly, Bristol medical school has sought input from students to redesign its curriculum.

Meanwhile, Prof Sumantra Ray of NNedPro Global Centre for Nutrition and Health told us his organisation is involved in rolling out training in diet and nutrition for student doctors by 2020.

Kate said: "Students need to see nutrition as something at the cutting edge of scientific discovery.

"I think there needs to be an image change of how doctors perceive nutrition, but also how it's presented to students."

You can hear more about this story on The Food Programme on Radio 4 at 12:32 BST on Sunday *or on iPlayer afterwards.*