http://bit.ly/2PxpcMs

Evolutionary origins of animal biodiversity

A new study by an international team of researchers, led by scientists from the University of Bristol, has revealed the origins and evolution of animal body plans.

A fossil trilobite from the Cambrian Sirius Passet fossil Lagerstätte of North Greenland. Trilobites are one of the earliest groups of animals to appear in the fossil record. **Jakob Vinther, University of Bristol.**

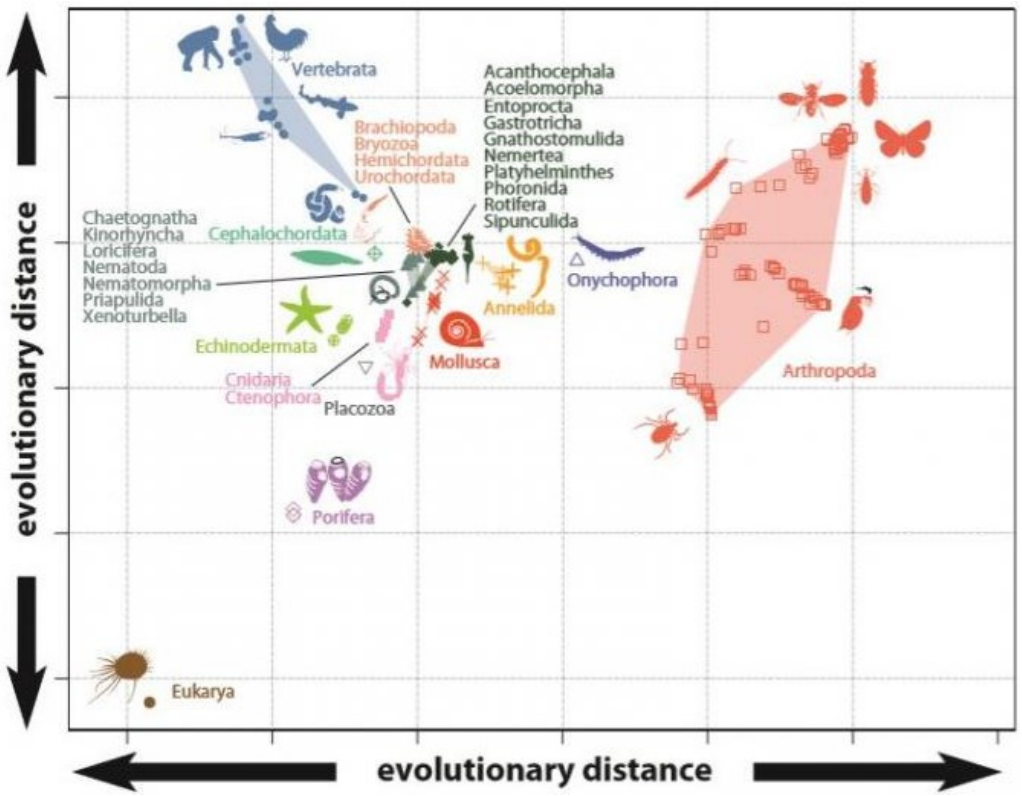
Animals evolved from unicellular ancestors, diversifying into thirty or forty distinct anatomical designs. When and how these designs emerged has been the focus of debate, both on the speed of evolutionary change, and the mechanisms by which fundamental evolutionary change occurs.

Did animal body plans emerge over eons of gradual evolutionary change, as Darwin suggested, or did these designs emerge in an explosive diversification episode during the Cambrian Period, about half a billion years ago?

The research team tackled this question by exhaustively compiling the presence and absence of thousands of features from all living animal groups.

Professor Philip Donoghue, from the University of Bristol's School of Earth Sciences, said: "This allowed us to create a 'shape space' for animal body plans, quantifying their similarities and differences.

"Our results show that fundamental evolutionary change was not limited to an early burst of evolutionary experimentation. Animal designs have continued to evolve to the present day - not gradually as Darwin predicted - but in fits and starts, episodically through their evolutionary history."



This image is based on the presence and absence of anatomical features, like jointed legs and compound eyes, neurons and bony skulls. Considering all of these features, animals that are similar group together, far away from animals that are dissimilar. Most of this 'design space' is unoccupied, in part because of extinction of ancient ancestors that are unrepresented, in part because animals have only been around for half a billion years and that is not enough time to explore all possible designs, but most of the design space is unoccupied because those designs are impossible. **University of Bristol**

Co-author Bradley Deline, from the University of West Georgia (USA), added: "Our results are important in that they highlight the patterns and pathways in which animal body plans evolved.

"Moreover, major expansions in animal form following the Cambrian aligns with other major ecological transitions, such as the exploration of land.

"Many of the animals we are familiar with today are objectively bizarre compared with the Cambrian weird wonders. Frankly, butterflies and birds are stranger than anything swimming in the ancient sea."

Co-authors James Clark from Bristol's School of Earth Sciences and Dr Mark Puttick from the University of Bath's Department of Biology, worked on trying to fit fossil species into the study.

Dr Puttick said: "One of the problems we had is that our study is mostly based on living species and we needed to include fossils. We solved the problem through a combination of analyzing the fossils and using computer models of evolution."

James Clark added: "The fossils plot intermediate of their living relatives in shape space. This means that the distinctiveness of living groups is a consequence of the extinction of their evolutionary intermediates. Therefore, animals appear different because of their history rather than unpreserved jumps in anatomy."

Co-author Jenny Greenwood, also from the University of Bristol's School of Earth Sciences, wanted to dig deeper. She wanted to work out which of the many proposed genetic mechanisms drove the evolution of animal body plans.

Jenny said: "We did this by collecting data on the different genomes, proteins, and regulatory genes, that living animal groups possess. The differences in anatomical designs correlate with regulatory gene sets, but not the type or diversity of proteins. This indicates that it is the evolution of genetic regulation of embryology that precipitated the evolution of animal biodiversity."

Co-author Kevin Peterson from Dartmouth College (USA), added: "Our study confirms the view that continued gene regulatory construction was a key to animal evolution."

http://bit.ly/2MHP0Zq

US firefighters battle suicidal thoughts after the blaze

Matt Shobert opens his eyes and wishes he was dead, a recurrent thought that started four years ago when the former firefighter first contemplated taking his own life.

He is not the only one: some of his comrades suffer in silence, and some end up committing suicide.

Fighting forest fires such as those that have ravaged the western regions of the United States this summer means days that are both exhausting and interminable, while the death and destruction weigh heavily on the minds of those tasked with stemming the flames.

"You've got firefighters working 12 to 36 hours straight on the fire line, so they are physically exhausted, they are emotionally exhausted because we've been killing firemen in these fires, firemen have been dying," said fire chief Tony Bommarito in Yorba Linda, 40 miles (65 kilometers) south of Los Angeles.

California, one of the worst-hit states, has seen five firefighters die battling the flames so far this year. Across the whole country, that number rises to 64, according to official figures.

That figure does not include the 45 who killed themselves in 2018, according to Jeff Dill, whose Firefighter Behavioral Health Alliance (FBHA) group helps those battling depression or Post Traumatic Stress Disorder, otherwise known as PTSD.

"We are not superheroes. Everybody has a limit," said Bommarito, 48.

"We are expected to act brave, strong, courageous to help, don't ask for help," said Dill, a retired firefighter whom Matt Shobert called when his thoughts turned to leaping off a bridge in San Diego.

Left with nothing

Shobert, 56, was overseeing a clean-up in the middle of nowhere: the brush was dry and combustible, perfect tinder for a forest fire.

In a freak accident, the blade of commercial-grade mower hit a rock and fired it like a missile into his jaw: the operator of the machine was half a football field away and failed to notice what had happened.

Shobert was knocked out cold, and was covered in blood when he woke up. He was not sure how he was going to make it 500 yards to his pick-up truck to call for help. "I basically had this very traumatic injury and I had to save my own life," he said. "After spending about 30 years in the fire service, dealing with death and destruction and carnage, and I think all those things came together."

It took him a long time to recover from his injury. When he returned to work he was not the same man, oscillating between bursts of anger and sadness. "I realized at that point I had to retire from the fire service and that was all I knew for the past 30 years because it was my life, it was my hobby, it was everything I did. And in a split second it was taken away," he said.

"I contemplated suicide. And for whatever reason I decided to just call a friend of mine... rather than jump off the bridge in San Diego," he said.

Shobert was diagnosed with PTSD and since then has undergone therapy and taken medication, but the road is long and hard.

"I still wake up in the morning and sometimes wish I was dead," he said. "I'm still fairly miserable, but at least now I have a tool box."

Dill became interested in the mental health issues that his "brothers and sisters" were facing when a group from his fire station came back from helping out in New Orleans in 2005, after the devastating Hurricane Katrina.

He felt the therapy they were offered was not enough, so he started studying and began the transition from firefighter to counselor. He has tallied 1,200 suicides over the past 20 years, including 93 in 2017.

But Dill thinks that only represents around 40 percent of the actual number of suicides, because his research depends on families and friends coming forward with the information for his list.

'A dark place'

Experts say that the decision to commit suicide is often the result of an accumulation of factors.

That is what happened with Mike Bilek. It was his past in the military, then as a firefighter, all mixed in with unspecified personal issues, that led him to think about killing himself.

"At one point, I was getting into such a dark place that I started having those thoughts of suicide," he said.

"I never got to the point where I was going to act out on it," he said. "But the fact that those thoughts were even creeping into my head really scared the daylights out of me."

Bilek sought help and now treats his condition with a combination of therapy, medication and meditation, which he needed more than ever when a back injury forced him to retire at 39 and start a new life.

There is more talk these days in fire stations about mental health issues, with support groups, but there is still resistance.

Dill said he recently talked with seven firefighters diagnosed with PTSD who were "fired from the job because they were told, 'Well you can't do the job no more,'" he said.

In his mission to spread the word, Dill bought a caravan so he can travel the country and talk to firefighters about their mental health.

And as he left the fire station in Yorba Linda, he received a text message on his cell phone: another suicide.

https://wb.md/2wDIesU

New Flu Vaccine Recommendations From AAP

All children aged 6 months and older should receive an injectable influenza vaccine as soon as the vaccines become available, by the end of October, the American Academy of Pediatrics (AAP) says in a new policy statement.

Troy Brown, RN

The recommendations for the 2018-2019 influenza season follow a particularly severe season last year during which 179 children died

from influenza-associated illness and thousands of children were hospitalized in the United States. Approximately 80% of the children who died were unvaccinated, according to the US Centers for Disease Control and Prevention (CDC).

The AAP published the recommendations online September 3 in *Pediatrics*.

"I can't emphasize enough the importance of everyone receiving the flu vaccine each and every year because it remains the best available preventive measure to protect against influenza," Henry Bernstein, DO, a member of the CDC Advisory Committee on Immunization Practices and an ex-officio member of the AAP Committee on Infectious Diseases, told *Medscape Medical News*.

"We really hope that people get vaccinated by the end of October, but if they don't, they can get the flu vaccine at any point throughout the season. It would be best to get it as soon as it's available in the community, because influenza virus is so unpredictable we never know whether the virus is going to be causing problems early on in the season — let's say in November before Thanksgiving — or whether it's going to be later on in the season in March or April. Although 80% of peak flu season comes in January, February, and March, that means 20% comes before and after those months," Bernstein explained.

New This Year

The AAP's first choice for immunization is an injectable form of the vaccine (inactivated influenza vaccine; IIV), which has consistently protected against all influenza virus strains in recent seasons. By contrast, the nasal spray vaccine, or live attenuated influenza vaccine (LAIV4), was less effective during the 2013-2014 and 2015-2016 seasons; therefore, it has not been recommended for the past two influenza seasons.

This season, the AAP says clinicians should offer the nasal spray vaccine to children who would otherwise not receive any influenza vaccine. These include children and parents who refuse an injectable flu vaccine or when a physician's office runs out of the injectable vaccines. It is not known how effective the latest nasal spray vaccine will be against the influenza A/H1N1 strain this season.

"The CDC has recommended it be offered like any of the inactivated flu shots; the AAP recommends the flu shot as the primary vaccine choice for all children," Bernstein said. "The AAP would rather children receive the nasal spray vaccine, as opposed to not receiving any vaccine at all."

The trivalent and quadrivalent injectable vaccines contain three and four influenza virus strains, respectively. The AAP does not recommend one injectable formulation over another.

For the 2018-2019 influenza season, the IIVs contain one new strain of influenza A (H3N2) and one new strain of influenza B (Victoria lineage). Seasonal influenza vaccine virus strains are selected each season based upon which viruses are circulating, the extent to which they are spreading and making people ill, and the effectiveness of the previous season's vaccine against those viruses.

"This is the first flu season during which we have several vaccine products and those are all flu shots that are licensed for children 6 months through 35 months of age. We used to only have one product and now there are two more on the market, so now we have three. There hopefully will be an adequate supply of vaccine available for children between 6 and 35 months of age," Bernstein said.

Additional Recommendations

A child's age and vaccine history determine the number of doses of influenza vaccine they require. Children aged 6 months through 8 years being vaccinated against influenza for the first time should receive two doses 4 weeks apart. Those aged 9 years and older need only one dose, regardless of their vaccination history.

The influenza vaccine may be administered to all children with an egg allergy of any severity, with no further precautions beyond those

recommended for all immunizations. "That's important because in the past people had thought if you had egg allergy you couldn't receive the flu vaccine because it's made in egg, and the science does not support that," said Bernstein. "This should be emphasized because the recommendations have been evolving over the years; there have been a number of studies over the last 2 or 3 years that support this approach."

Vaccination of pregnant and postpartum women can protect infants who are too young to receive the influenza vaccine themselves. It is safe for mothers and infants when administered to pregnant, postpartum, and breastfeeding women. The influenza vaccine (IIV only) may be administered at any time during pregnancy.

"Pregnant women should receive the flu vaccine during pregnancy so that they protect themselves and pass their antibodies on to their newborn infant...The antibodies mom passes on to her newborn can help protect her young infant before he or she can receive his or her own flu vaccines beginning at 6 months," Bernstein explained.

Clinicians should encourage postpartum women not vaccinated during pregnancy to receive an influenza vaccine before they are discharged from the hospital.

The AAP recommends vaccination of all healthcare workers because they frequently care for individuals at high risk for influenza-associated complications. Household contacts and out-of-home childcare providers of children younger than 5 years and children of all ages who are at risk, as well as close contacts of those with immunosuppression, should also receive the influenza vaccine.

Moreover, the AAP recommends that clinicians should try to quickly identify suspected influenza in their patients so antiviral treatment can be given when appropriate, after shared decision-making between clinician and child caregiver. Antiviral treatment is most effective when administered within 48 hours of symptom onset; however, clinicians should still consider giving it after that time in severely ill children or those at high risk for complications. Antiviral treatment is not a substitute for vaccination, the AAP warns.

“Staying healthy is the goal for all of us. As a pediatrician and mom, I see too often how quickly the flu spreads,” Wendy Sue Swanson, MD, a pediatrician in Seattle and an AAP spokesperson, said in a news release. “Unfortunately, you can spread influenza without realizing it because some infected people begin to spread the virus a day or two before they have symptoms. Get the shot. It just makes sense.”

The authors and Bernstein have disclosed no relevant financial relationships.

Pediatrics. Published online September 3, 2018. Abstract

http://bit.ly/2MSrhWr

Study finds you act most like 'you' in a time crunch

Under time pressure, selfish people act even more selfishly

COLUMBUS, Ohio - When they must act quickly, selfish people are likely to act more selfishly than usual, while pro-social people behave even more pro-socially, a new study found.

The results suggest that when people don't have much time to make a decision, they go with what they've done in similar situations, said Ian Krajbich, co-author of the study and assistant professor of psychology and economics at The Ohio State University.

"People start off with a bias of whether it is best to be selfish or pro-social. If they are rushed, they'll tend to go with that bias," Krajbich said.

But when people have more time to decide, they are more likely to go against their bias as they evaluate the options in front of them, he said.

Krajbich conducted the study with Fadong Chen of Zhejiang University in China. Their results were published Sept. 3 in the journal *Nature Communications*.

The study involved 102 college students from the United States and Germany who played 200 rounds of a game that is often used in

psychology and economics experiments. In each round, played on a computer, the participants chose between two ways of splitting up a real sum of money. Both choices favored the person playing the game, but one choice shared more of the money with the unseen partner.

"The participants had to decide whether to give up some of their own money to increase the other person's payoff and reduce the inequality between them," Krajbich said.

The decision scenarios were very different. In some cases, the participants would have to give up only, say, $1 to increase their partner's payoff by $10. In others, they might have to give up $1 to give their partner an extra $1. And in other cases, they would have to make a large sacrifice - for example, give up $10 to give their partner an extra $3.

The key to this study is that participants didn't always have the same amount of time to decide, Krajbich said.

In some cases, participants had to decide within two seconds how they would share their money as opposed to other cases, when they were forced to wait at least 10 seconds before deciding. And in additional scenarios, they were free to choose at their own pace, which was usually more than two seconds but less than 10.

The researchers used a model of the "normal" decisions to predict how a participant's decisions would change under time pressure and time delay.

"We found that time pressure tends to magnify the predisposition that people already have, whether it is to be selfish or pro-social," Krajbich said.

"Under time pressure, when you have very little time to decide, you're going to lean more heavily than usual on your predisposition or bias of how to act."

The situation was different when participants were forced to wait 10 seconds before deciding.

"People may still approach decisions with the expectation that they will act selfishly or pro-socially, depending on their predisposition. But now they have time to consider the numbers and can think of reasons to go against their bias," he said.

"Maybe you're predisposed to be selfish, but see that you only have to give up $1 and the other person is going to get $20. That may be enough to get you to act more pro-socially."

The results may help explain why some previous studies found that time pressure makes people more selfish, while others found that it makes people more pro-social.

"It really depends on where you're starting, on how you're predisposed to decide," Krajbich said.

http://bit.ly/2NjBj2k

AI beats doctors at predicting heart disease deaths

A model developed using artificial intelligence (AI) is better at predicting risk of death in patients with heart disease than models designed by medical experts, a new study from the Francis Crick Institute shows.

The study, published in *PLOS One*, adds to the growing evidence that AI could revolutionise healthcare in the UK and beyond. So far, the emphasis has been on the potential of AI to help diagnose and treat various diseases, but these new findings suggest it could also help predict the likelihood of patients dying too.

"It won't be long before doctors are routinely using these sorts of tools in the clinic to make better diagnoses and prognoses, which can help them decide the best ways to care for their patients," says Crick scientist Andrew Steele, first author of the paper.

"Doctors already use computer-based tools to work out whether a patient is at risk of heart disease, and machine-learning will allow more accurate models to be developed for a wider range of conditions."

Data-driven model

The model was designed using the electronic health data of over 80,000 patients, collected as part of routine care, and available for researchers on the CALIBER platform.

Scientists at the Crick, working collaboratively with colleagues at the Farr Institute of Health Informatics Research and University College London Hospitals NHS Foundation Trust, wanted to see if they could create a model for coronary artery disease - the leading cause of death in the UK - that outperforms experts using self-taught machine learning techniques.

Coronary artery disease develops when the major blood vessels that supply the heart with blood, oxygen and nutrients become damaged, or narrowed by fatty deposits. Eventually restricted blood flow to the heart can lead to chest pain and shortness of breath, while a complete blockage can cause a heart attack.

An expert-constructed prognostic model for coronary artery disease which this work was compared against made predictions based on 27 variables chosen by medical experts, such as age, gender and chest pains. By contrast, the Crick team got their AI algorithms to train themselves, searching for patterns and picking the most relevant variables from a set of 600.

Outperforming experts

Not only did the new data-driven model beat expert-designed models at predicting patient mortality, but it also identified new variables that doctors hadn't thought of.

"Along with factors like age and whether or not a patient smoked, our models pulled out a home visit from their GP as a good predictor of patient mortality," says Andrew. "Home visits are not something a cardiologist might say is important in the biology of heart disease, but perhaps a good indication that the patient is too unwell to make it to the doctor themselves, and a useful variable to help the model make accurate predictions."

This study was a proof-of-principle to compare expert-designed models to machine learning approaches, but a similar model could be implemented in the clinic in the not too distant future.

"Machine learning is hugely powerful tool in medicine and has the ability to revolutionise how we deliver care to patients over the next few years," says Andrew.

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Ohio State scientists identify hormone link between diabetes and hypertension

Increased levels of aldosterone can play a significant role in the development of diabetes

Physician researchers with The Ohio State University College of Medicine at the Wexner Medical Center say increased levels of the hormone aldosterone, already associated with hypertension, can play a significant role in the development of diabetes, particularly among certain racial groups.

"This research is an important step toward finding new ways to prevent a major chronic disease," said Dr. K. Craig Kent, dean of the College of Medicine. "This shows how our diabetes and metabolism scientists are focused on creating a world without diabetes."

Results of this study were published online today by the Journal of the American Heart Association.

"Aldosterone is produced by the adrenal gland. We've known for some time that it increases blood pressure. We've recently learned it also increases insulin resistance in muscle and impairs insulin secretion from the pancreas. Both actions increase a person's risk of developing type 2 diabetes, but the question was - how much," said Dr. Joshua J. Joseph, lead investigator and an endocrinologist at Ohio State Wexner Medical Center.

Joseph and his team followed 1,600 people across diverse populations for 10 years as part of the Multi-Ethnic Study of Atherosclerosis. They found, overall, the risk of developing type 2

diabetes more than doubled for people who had higher levels of aldosterone, compared to participants with lower levels of the hormone. In certain ethnicities, the effect was even greater. African Americans with high aldosterone levels have almost a three-fold increased risk. Chinese Americans with high aldosterone are 10 times more likely to develop diabetes.

"I looked into this as a promise to my father. He had high levels of aldosterone that contributed to his hypertension, and he thought it also might be linked to his diabetes. As my career progressed, I had the opportunity to research it, and we did find a link to diabetes," Joseph said.

One question that remains is why there are wide differences in risk among various ethnic groups. Joseph said it could be genetics or differences in salt sensitivity or something else, and it needs further study.

Just over 30 million Americans have diabetes and nearly a fourth of them don't know it, according to the Centers for Disease Control and Prevention. Another one in three Americans has prediabetes. Despite current preventive efforts, the numbers continue to climb among various racial/ethnic groups.

Next, Joseph will lead a federally funded clinical trial at Ohio State Wexner Medical Center to evaluate the role of aldosterone in glucose metabolism. African American participants who have prediabetes will take medication to lower their aldosterone levels. Researchers will study the impact on blood glucose and insulin in those individuals.

"We know there's a relationship between aldosterone and type 2 diabetes. Now we need to determine thresholds that will guide clinical care and the best medication for treatment," Joseph said.

He expects to start enrolling patients in that trial later this year.

http://bit.ly/2oNbV7c

Going up! Japan to test mini 'space elevator'

The space-elevator test equipment will be launched on a Japanese H-2B rocket next week

A Japanese team working to develop a "space elevator" will conduct a first trial this month, blasting off a miniature version on satellites to test the technology.

The test equipment, produced by researchers at Shizuoka University, will hitch a ride on an H-2B rocket being launched by Japan's space agency from southern island of Tanegashima next week.

The test involves a miniature elevator stand-in—a box just six centimetres (2.4 inches) long, three centimetres wide, and three centimetres high.

If all goes well, it will provide proof of concept by moving along a 10-metre cable suspended in space between two mini satellites that will keep it taut. The mini-elevator will travel along the cable from a container in one of the satellites.

"It's going to be the world's first experiment to test elevator movement in space," a university spokesman told AFP on Tuesday.

The movement of the motorised "elevator" box will be monitored with cameras in the satellites.

It is still a far cry from the ultimate beam-me-up goals of the project, which builds on a long history of "space elevator" dreams.

The idea was first proposed in 1895 by Russian scientist Konstantin Tsiolkovsky after he saw the Eiffel Tower in Paris, and was revisited nearly a century later in a novel by Arthur C. Clarke.

But technical barriers have always kept plans stuck at the conceptual stage.

Japanese construction firm Obayashi, which is collaborating with the Shizuoka university project, is also exploring other ways to build its own space elevator to put tourists in space in 2050.

The company has said it could use carbon nanotube technology, which is more than 20 times stronger than steel, to build a lift shaft 96,000 kilometres (roughly 60,000 miles) above the Earth.

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Weapons Against Superbugs Might Lurk in Your Stomach

A new weapon in the battle against antibiotic resistance could be hiding in your stomach.

By Stephanie Pappas, Live Science Contributor

A new study suggests that short amino-acid chains found in human gastric juices can kill foodborne pathogens and stymie skin infections. These molecules, called peptides, may never make it through human trials — they've been studied only in mice so far — but the researchers hope that by digging into small molecules found in odd places, scientists can uncover new possibilities for drug treatments.

That's important, said study leader Cesar de la Fuente-Nunez, a postdoctoral researcher at the Massachusetts Institute of Technology, because bacteria are increasingly becoming resistant to the antibiotics typically used to treat infections. In 2013, the Centers for Disease Control and Prevention (CDC) reported that at least 2 million people in the U.S. are infected with antibiotic-resistant bacteria each year, and 23,000 die as a direct result. [6 Superbugs to Watch Out For]

"One of the advantages of these peptides is [that] because they target many different things at once, they make it very difficult for bacteria to become resistant," Fuente-Nunez told Live Science.

Fuente-Nunez and his colleagues discovered the new peptides using the biological equivalent of a search engine, poring over databases of human proteins to find particular amino acid sequences known to be common in anti-microbial peptides. (Amino acids are the building blocks of proteins. Peptides are chains of amino acids too short to qualify as full proteins.)

The researchers found that a subset of peptides, originating from an enzyme found in the human stomach called pepsin A, were particularly intriguing, the team reported Aug. 20 in the journal ACS Synthetic Biology. These peptides most likely help quash nascent bacterial infections when nasty pathogens enter the digestive tract, traveling with food and water, Fuente-Nunez said.

To study the peptides in action, the researchers engineered *Escherichia coli* bacteria to produce the three peptides. Then, the scientists tested the peptides on bacterial cells such as *Salmonella* in a lab dish, and found that the peptides could kill the pathogens. When mixed with human cells in a lab dish, the peptides did not harm them.

In another experiment, the researchers used the peptides as a topical treatment for another type of bacterial infection, a *Pseudomonas aeruginosa* infection, on the skin of mice. The treatment killed the bacteria, which can also cause serious skin infections in people, especially in hospitals.

Topical treatments are likely the most promising route for turning peptides into pharmaceuticals, said Peter Belenky, a professor of microbiology and immunology at Brown University in Rhode Island who was not involved in the research. The immune system can easily recognize foreign peptides, so they're often attacked and cleared from the body before they can do any good.

"They're great as potential therapeutics," Belenky told Live Science, "but they're more suited to things like the experiment they did here, where it's a topical peptide."

To investigate the stomach peptides' potential as drugs, Fuente-Nunez and his team plan to study in more detail how these substances interact with the human body. The researchers are in talks to partner with drug-development companies to explore the peptides more thoroughly, he said.

https://wb.md/2MVEtK8

What Do You Owe Patients When You Move On?

Severing the Relationship the Right Way

Gregory A. Hood, MD

If you're planning to close your practice in the near future—to relocate, retire, or even for health reasons—you'll have to consider the best way to let your patients know of your plans.

How should you take on this task? This question, at its heart, is both simple and complex. It's simple because there are established rules and protocols that cover the medicolegal aspects of closing a practice, including how medical records should be handled. Doctors who fail to follow the appropriate guidelines do so at their peril.

However, the practice of medicine and physician-patient relationships are fundamentally human endeavors. Bringing a typically long-standing relationship to a close isn't black and white. Rather, the unique and imperfect natures of human communication, human emotion, and platonic desires can cloud the process, or at least its perception.

So if you're getting ready to close your practice (or move on to another one), the letter of the law is clear. To end the physician-patient relationship, whether it be with an individual patient or with an entire practice, you'll need to follow a number of steps within specific time frames; failure to do so may constitute "abandonment." We've all heard of examples in which a patient showed up at their doctor's office only to find that it has been shut down. Scenes like this constitute a grave abrogation of a physician's professional responsibilities.

Never 'Abandon' a Former Patient

To be fair, it's not always the physician's fault. Having closed or left three practices in my career, and observing many partners come and go, I can say that sometimes the patient's surprise is more a factor of today's short attention spans than abandonment by the physician. It's hard to blame the doctor after a patient has received a series of letters and phone calls but still shows up at the office months later, "unaware" that the physician has long since left.

In fact, I know of one doctor who made a total of seven contacts—three letters and four phone calls—to each patient before relocating her practice out of state, yet someone still came to the old office 2 months after the transition was complete, expecting to be seen.

Don't Leave the Patient in the Lurch

Abandonment isn't just about notifying patients, however. It can also be created when the departing doctor fails to provide the name of an appropriate practitioner or practice with whom the patient(s) may continue care. Claims of negligence may be raised if the patient insists that he or she was harmed as a result of the physician's substandard conduct in providing continuity of care.

Even if you're leaving an established, continuing practice, abandonment may become an issue for you and/or the group if the remaining clinicians can't absorb your patient panel. This can be especially problematic given today's shortage of physicians in primary care and certain specialties.

In all cases, but especially when the practice is closing, it's helpful to explain to patients how to explore their options with other practices in the community. When the closure to the practice will create such an influx of patients seeking new doctors into the community, it can be wise to try to develop agreements with specific local practices or health systems that will agree to accommodate the displaced patients. Avoid giving the patient any more information than names and phone numbers, however. Don't use superlatives such as "great," "world class," or "highly skilled" in describing these practices or any specific physicians. You don't want to make "guarantees" that could create problems if a former patient has a bad experience down the road.

Another potential resource may be the county medical society, from which patients may learn of doctors who are accepting new patients. So when closing your practice, it may make sense to provide your patients with the phone number of the county medical society in all correspondences.

In Closing a Practice, Timing Is Everything

Many physicians, I've found, wait as long as possible before announcing that their practice is closing. This may be understandable, given their fears that patients may up and leave too soon. Depending on the circumstances, shrinking receipts in the last months of a practice can be disastrous financially.

However, this tactic of delaying the announcement can unlock a Pandora's box of complications. Take, for instance, the current climate regarding controlled substance prescribing. Even patients who have been vetted carefully, monitored closely, and have a documented history of following their treatment plan may find it very difficult to find a new doctor, because many physicians are unwilling to "inherit" patients on controlled substances. This makes it even more important to begin the transition process as soon as you can.

Breaking Up Is Hard to Do

In helping all patients find a new physician, it's imperative that their treatment plan be disrupted as little as possible. For example, if you're retiring in May and your patient takes a simple and stable medicine, such as amlodipine for controlled hypertension, you might consider giving enough refills to last until the patient's October physical.

This may seem like a potential liability, given that you won't be in a position to monitor or react to problems the patient may have after you leave practice. But such concerns are generally overstated. In this era of mail-order pharmacies, it's a given that many patients will have months of refills already in place. Also, if the letter explaining the transition in practice is worded properly, it should both encourage the patient to make the next-step arrangements as promptly as possible and also identify his or her options.

Again, these precautions take on particular significance regarding controlled substances and medications that require special monitoring. It's important to recognize the greater risk to the patient in the abrupt cessation of either of these classifications of medicine, as well as the potential that the patient may encounter some difficulties in partnering with a new physician who is capable and comfortable in assuming such prescriptions. Although the medicines need to be continued for at least 30 days beyond the date when the physician leaves practice, alternative timelines may be considered, in appropriate circumstances. In any case, it's essential to not exceed the prescribing limits for the medication(s) in question, including what state and federal regulations permit.

Providing for patients taking controlled substances is just one example of the difficult balancing act between the regulatory aspects of the clinical relationship and the human relationship that physicians who are leaving practice must face. As with any breakup, it's not an easy process to go through, but it has to be done and done right.

I've read a number of letters that have been written by physicians or, sometimes, by their soon-to-be-previous employer on their behalf. Some letters are so curt as to scarcely cover the basic requirements. Others clearly have more personality and humanity behind them. When I left my practice in California, I went to great lengths to make the letter read exactly as I wanted it to. The large group I was with was so pleased with it that the human relations department asked permission to use it as a sample letter for future physician departures.

If you're not a great writer, find someone—a friend or colleague who has a way with words, a professional writer, or even a college student majoring in journalism or creative writing—who can help you get your thoughts across while still meeting the proper notification requirements. Depending, too, on your practice setting and employment status, some larger healthcare organizations may have a template available. (The American College of Physicians provides a checklist for closing a practice, including a sample notification letter for patients, here.)

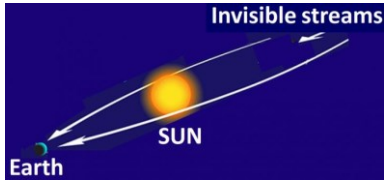
The experience of closing a practice is a very personal one for the physician, as well as for the patients. So try to make this transition as sincere and smooth as possible. This is a big moment in your life. It's a big moment in theirs as well.

http://bit.ly/2PIm6Fo

Researchers find unexpected planetary dependence in 1-10 percent of melanoma diagnoses

Correlation and possible cause and effect between otherwise invisible dark matter particles and melanoma

In a paper to be published in the September 2018 issue of *Biophysical Reviews and Letters*, researchers have discovered that there is a correlation and possible cause and effect between otherwise invisible dark matter particles and melanoma, a type of skin cancer. This opens the door to more research in the interdisciplinary fields of physics and medicine.



A schematic illustration of the gravitational focusing by the sun of an incoming low-speed stream during alignment Earth-Sun-Stream. **Dr. Konstantin Zioutas**

In a recent study, Dr. Konstantin Zioutas from the Physics Department at the University of Patras and Dr. Edward L Valachovic from the Department of Epidemiology and Biostatistics of the University at Albany - State University of New York discovered that there is a correlation and possible cause and effect between otherwise invisible dark matter particles and melanoma, a type of skin cancer.

Recent physics observations and analysis of melanoma data in the USA showed an unexpected planetary correlation in 1-10% of the diagnoses of melanoma (significance >5σ). It is proposed that streaming invisible dark matter, whose flux can be temporally enhanced via solar gravitational focusing, may be interacting with the human body.

The research aims to find out, for the first time, whether planetary correlations exist also in medical data. Monthly melanoma rates in USA in the 38-year period from 1973 to 2011 were analysed. The duo observed fast oscillatory behavior of melanoma diagnoses, which should be a random distribution in the absence of any periodic impact. They then performed complex statistical analyses as well as computer simulations with available planetary data, and discovered that the melanoma appearance shows a short periodicity which strikingly coincides with the orbital period of Mercury (88 days).

With the unexpected statistical correlation, the centuries old mystery of possible interactions between stars/planets and human body has been revisited. The driving idea is that streams of "invisible matter" get occasionally enhanced towards the Earth, due to gravitational focusing effects by the Sun and/or the other planets, increasing the interaction rate with the human body accordingly. This seems, as for the physics observations , the only viable explanation for the otherwise unexpected planetary relationship of melanoma appearance. This would mean that humans are the overlooked target and detector of the "Dark Universe" we are living in.

The conclusion from this research is that streaming invisible matter from the dark universe, whose flux can be occasionally enhanced towards the Earth via planetary gravitational focusing, and, even much stronger by the Sun, may be the explanation for 1-10% of melanoma diagnoses.

Recovering more precisely when and where the cancer diagnoses were made, more research could unravel the nature of the assumed streaming invisible matter as well as the interaction processes at the microscopic level.

The lead author, Dr. Konstantin Zioutas remarked that: "This out-of-the-box interdisciplinary work is based on the heretic assumption that not all dark matter constituents interact extremely feebly with normal matter. A follow-up systematic investigation might bring us closer to

the origin of melanoma, unravelling also the nature of the dark universe we are living in."

Co-author Dr. Edward L Valachovic further commented on the discovery: "The underlying cause of cancer manifestation is an enduring mystery. The widely discussed dark universe may well be part of biological and physiological processes, as advocated by the statistical data analysis of this work. Where the periodic diagnoses, which coincide with planetary orbital periods, of some sub-classes of melanoma can lead us, is open to speculation and new suggestions. In order to advance this research approach in medicine the template of relevant Tables must be re-defined. The main conclusion is to record medical data daily or at least weekly."

"This 'first' observation in medicine is a spin-off from the CAST experiment at CERN, but we have to wait for more to come," added Dr. Zioutas.

The corresponding author of this paper is Dr. Konstantin Zioutas, zioutas@cern.ch.
For more insight into the research described, readers are invited to access the paper on Biophysical Reviews and Letters.

http://bit.ly/2oM0a0Y

Russian space chief vows to find "full name" of technician who caused ISS leak

"We want to find out the full name of who is at fault—and we will."

Eric Berger - 9/5/2018, 6:10 AM

Last week, a pressure leak occurred on the International Space Station. It was slow and posed no immediate threat to the crew, with the atmosphere leaving the station at a rate such that depressurization of the station would have taken 14 days.

Enlarge / The source of the leak on the International Space Station. **NASA TV**

Eventually, US and Russian crew members traced the leak to a 2mm breach in the orbital module of the Soyuz MS-09 vehicle that had flown to the space station in June. The module had carried Russian cosmonaut Sergey Prokopyev, European Space Agency astronaut Alexander Gerst, and NASA's Serena M. Auñón-Chancellor.

The crew on the station was in no danger, and, over the course of several hours, Russian engineers devised a fix that involved epoxy. A preliminary analysis concluded that the vehicle is safe for return to Earth (the orbital module detaches from the small Soyuz capsule before entry into Earth's atmosphere).

The drama might have ended there, as it was initially presumed that the breach had been caused by a tiny bit of orbital debris. However, recent Russian news reports have shown that the problem was, in fact, a manufacturing defect. It remains unclear whether the hole was an accidental error or intentional. There is evidence that a technician saw the drilling mistake and covered the hole with glue, which prevented the problem from being detected during a vacuum test.

"We are able to narrow down the cause to a technological mistake of a technician. We can see the mark where the drill bit slid along the surface of the hull," Dmitry Rogozin, head of the Russian space agency Roscosmos, told RIA Novosti. (A translation of the Russian articles in this story was provided to Ars by Robinson Mitchell). "We want to find out the full name of who is at fault—and we will."

Ongoing technical problems

NASA spokesman Dan Huot, based in Houston where the space station program is managed, deferred all comment on the issue to Roscosmos.

The spacecraft was manufactured by Energia, a Russian corporation. A former employee of the company who is now a professor at Moscow State University told another Russian publication that these kinds of incidents have occurred before at Energia.

“I have conducted investigations of all kinds of spacecraft, and after landing, we discovered a hole drilled completely through the hull of a re-entry module," the former Energia employee, Viktor Minenko, said in Gazeta.RU. "But the technician didn't report the defect to anyone but sealed up the hole with epoxy. We found the person, and after a commotion he was terminated,” said Minenko.

In this case, the technician used glue instead of epoxy. As the Soyuz hull is made from an aluminum alloy, it could have been properly repaired on Earth by welding, had the technician reported the mistake.

The Soyuz manufacturing issue represents another significant problem for the Russian space agency's suppliers and its quality control processes. Already, the manufacturer of Proton rockets, Khrunichev, has had several serious problems that have led to launch failures. Rogozin was recently installed as the leader of Roscosmos to try to clean up corruption and address these kinds of issues.

He has his work cut out for him.

http://bit.ly/2oJxbuz

Popular painkiller linked to cardiac risk

Over-the-counter pharma product associated with 50% hike in heart risk compared to non-users.

Geetanjali Rangnekar reports.

The most commonly used anti-inflammatory drug in the world has been linked to an increased risk of cardiovascular events, new research has found.

Diclofenac, as it is known in the US, is also marketed under several brand names. In Australia, it is present in several pharmacy products, the best known being Voltaren. It is a non-steroidal anti-inflammatory drug (NSAID), and works to reduce inflammation, pain, and fever.

The study is published in the *British Medical Journal* and was carried out by a team of researchers led by Morten Schmidt from Aarhus University, Denmark.

Data accumulated over a decade from the Danish National Prescription and Patient Registries was used to track and observe the drug habits and health outcomes of 6.3 million individuals.

The researchers compared the outcomes between patients using diclofenac; those taking two other common NSAIDs, ibuprofen and naproxen; non-users of NSAIDs; and patients on paracetamol, which is not an NSAID.

After just 30 days of follow-up, diclofenac patients suffered cardiac events – including abnormal rhythms, heart attacks, heart failure and stroke – at a significantly higher rate than those in all other groups.

Individual group comparisons showed that diclofenac initiators were 50% more likely to have cardiac events compared to non-users, 30% more likely compared to naproxen users, and 20% more likely compared to paracetamol or ibuprofen users.

This effect persisted when the researchers examined the relationship between diclofenac and cardiovascular disease by stratifying the study population according to low, moderate or high baseline cardiovascular risk.

They found an increased risk of cardiac events and death in people on both low and high doses of the drug (defined as less than 100 milligram and 100 milligram tablets), males and females, and across all age groups.

Diclofenac takers also had a two-fold risk of gastrointestinal bleeds compared to those on ibuprofen and paracetamol, and a four-fold risk compared to non-users.

A 2013 study raised concerns about the cardiovascular risk elicited by other NSAIDs, knows as “coxibs”, compared to non-use of NSAIDs, and led to calls to rethink prescribing them.

Schmidt and colleagues acknowledge that in the latest study, the mechanisms linking diclofenac and adverse cardiac are not explored, and the results are observational only.

However, they caution that the ease of its availability — over the counter in most countries — could prove to be a major public health concern.

They hope that the results of this study provide pause and make clinicians consider the use of other safer NSAIDs and non-NSAIDs in patients over diclofenac.

http://bit.ly/2CBdMG7

Excessive airway nerves tied to more severe asthma symptoms, study finds

OHSU researchers now see 'both the forest and the trees' with 3D imaging method

A new study implicates remodeling of nerves in the airways as a key contributor to heightened sensitivity and airway constriction in patients with asthma.

The study published today in the journal *Science Translational Medicine*.

The results provide new insight into a little-understood factor in the development of asthma, a condition that affects about 235 million people worldwide. The study is the first to demonstrate that inflammatory cells can alter nerve structure in the lungs to cause disease.

Airway nerves sense inhaled particles, such as pollen and smoke, in the environment and help regulate airway constriction. In asthma, these nerves become more sensitive, causing patients to develop symptoms of wheezing and cough. Although previous research had shown that two-thirds of patients with asthma have an overabundance of a type of immune cell, called eosinophils, the effects of eosinophils on airway nerves were not fully understood.

To study airway nerves in asthma, researchers used OHSU's state-of-the-art confocal microscopes to generate three-dimensional imagery capturing a complete picture of airway nerves and their interactions with eosinophils.

"Picture the branches of trees in a forest," said lead author Matthew Drake, M.D., assistant professor of medicine (pulmonary and critical care medicine) in the OHSU School of Medicine in Portland, Oregon. "In previous studies, researchers could only visualize small sections of the branches, which meant you could never see the whole tree or how multiple trees fit together. With our new method, you can see both the forest and the trees."

Using this new 3-D method, Drake's team studied the length of nerves and how often they branch in the airways of healthy patients and in patients with asthma. They found that in asthma, airway nerves are denser.

"In essence, the trees are growing more branches," Drake said. "As a result of those changes, nerves are more easily irritated, which leads to exaggerated responses that constrict the airway."

The research also showed that having more eosinophils increased the likelihood of having denser nerves and that increased nerves connected with more severe asthma symptoms.

"Changes in nerve structure are clearly tied to worse lung function in asthma," Drake said.

However, future studies are needed to determine whether these changes are preventable, or if this process is reversible once it is established, either by treating with currently available asthma drugs or by developing new medications, Drake said.

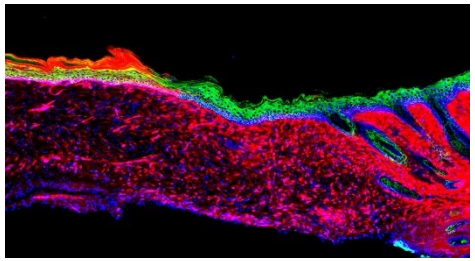
The work was supported by NIH National Institutes of Health Heart, Lung, and Blood Institute grant nos. HL124165, AR061567, HL131525, HL121254 and UL1GM118964; by the American Thoracic Society Foundation grant No. 1012827; by the Health Research Board of Ireland Clinician Scientist Award; and by the Health Effects Institute award No. 4905 RFPA10-3/11-6.

http://bit.ly/2PGaPpm

The alchemy of healing: Researchers turn open wounds into skin

Salk scientists develop new technique to heal large ulcers by reprogramming wound cells into skin cells

LA JOLLA - Plastic surgery to treat large cutaneous ulcers, including those seen in people with severe burns, bedsores or chronic diseases such as diabetes, may someday be a thing of the past. Scientists at the Salk Institute have developed a technique to directly convert the cells in an open wound into new skin cells. The approach relies on reprogramming the cells to a stem-cell-like state and could be useful for healing skin damage, countering the effects of aging and helping us to better understand skin cancer.



"Our observations constitute an initial proof of principle for in vivo regeneration of an entire three-dimensional tissue like the skin, not just individual cell types as previously shown," says Salk Professor Juan Carlos Izpisua Belmonte, holder of the Roger Guillemin Chair and senior author of the new paper, published in the journal *Nature* on September 5, 2018. "This knowledge might not only be useful for enhancing skin repair but could also serve to guide in vivo regenerative strategies in other human pathological situations, as well as during aging, in which tissue repair is impaired."

The image represents the first proof of principle for the successful regeneration of a functional organ (the skin) inside a mammal, by a technique known as AAV-based in vivo reprogramming. Epithelial (skin) tissues were generated by converting one cell type (red: mesenchymal cells) to another (green: basal keratinocytes) within a large ulcer in a laboratory mouse model. **Salk Institute**

Cutaneous ulcers--wounds that can extend through multiple layers of the skin--are typically treated surgically, by transplanting existing skin to cover the wound. However, when the ulcer is especially large, it can be difficult for surgeons to graft enough skin. In these cases, researchers are able to isolate skin stem cells from a patient, grow them in the lab and transplant them back into the patient. However, such a procedure requires an extensive amount of time, which may put the patient's life at risk and is sometimes not effective.

Izpisua Belmonte and Salk Research Associate Masakazu Kurita, who has a background in plastic surgery, knew that a critical step in wound recovery was the migration--or transplantation--of basal keratinocytes into wounds. These stem-cell-like cells act as precursors to the different types of skin cells. But large, severe wounds that have lost multiple layers of skin no longer have any basal keratinocytes. And even as these wounds heal, the cells multiplying in the area are mainly involved in wound closure and inflammation, rather than rebuilding healthy skin.

Izpisua Belmonte and Kurita wanted to directly convert these other cells into basal keratinocytes--without ever taking them out of the body. "We set out to make skin where there was no skin to start with," says Kurita.

The researchers first compared the levels of different proteins of the two cell types (inflammation and keratinocytes) to get a sense of what they'd need to change to reprogram the cells' identities. They pinpointed 55 "reprogramming factors" (proteins and RNA molecules) that were potentially involved in defining the distinct identity of the basal keratinocytes. Then, through trial and error and further experiments on each potential reprogramming factor, they narrowed the list down to four factors that could mediate the conversion to basal keratinocytes.

When the team topically treated skin ulcers on mice with the four factors, the ulcers grew healthy skin (known as epithelia) within 18

days. Over time, the epithelia expanded and connected to the surrounding skin, even in large ulcers. At three and six months later, the generated cells behaved like healthy skin cells in a number of molecular, genetic and cellular tests.

The researchers are planning more studies to optimize the technique and begin testing it in additional ulcer models.

"Before going to the clinic, we have to do more studies on the long-term safety of our approach and enhance the efficiency as much as possible," says Kurita.

In addition to Kurita and Izpisua Belmonte, authors of the new paper were Toshikazu Araoka, Tomoaki Hishida, David D. O'Keefe, Yuta Takahashi, Akihisa Sakamoto, Masahiro Sakurai, Keiichiro Suzuki, Jun Wu, Mako Yamamoto, Reyna Hernandez-Benitez, Alejandro Ocampo, Pradeep Reddy and Maxim Nikolaievich Shokhirev of the Salk Institute; Pierre Magistretti of King Abdullah University of Science and Technology; Estrella Núñez Delicado of Universidad Católica San Antonio de Murcia; and Hitomi Eto and Kiyonori Harii of Kyorin University School of Medicine.

The work and the researchers involved were supported by grants from Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT); Kyorin University; the Japan Society for the Promotion of Science; the Uehara Memorial Foundation; the National Cancer Institute; the G. Harold and Leila Y. Mathers Charitable Foundation; The Leona M. and Harry B. Helmsley Charitable Trust; The Moxie Foundation; The Evergreen Foundation; Fundacion Dr. Pedro Guillen; and Universidad Católica San Antonio de Murcia.

https://wb.md/2CmceiZ

Test All Pregnant Women for Syphilis Early, USPSTF Says

All pregnant women should undergo early screening for syphilis, according to an updated recommendation statement from the US Preventive Services Task Force (USPSTF).

Troy Brown, RN

This newest guidance reaffirms the statement published in 2009 and is an "A" recommendation, which means there is high certainty of a substantial net benefit.

"Syphilis is an infection that is primarily sexually transmitted. Untreated syphilis infection in pregnant women can also be transmitted to the fetus (congenital syphilis) at any time during pregnancy or at birth. Congenital syphilis is associated with stillbirth, neonatal death, and significant morbidity in infants" stress the authors, led by Susan J. Curry, PhD, from the University of Iowa, Iowa City, and colleagues.

The recommendation statement along with an evidence report were published in the September issue of *JAMA*, and an accompanying editorial was published online September 4 in *JAMA Dermatology*.

Gaps in Public Health and Clinical Practice Remain

Although women accounted for only 11% of primary and secondary syphilis cases in the United States in 2016, the incidence of primary and secondary syphilis among women doubled from 2012 to 2016.

"Not surprisingly, the incidence of congenital syphilis...closely tracks the incidence of primary and secondary syphilis among women. Indeed, cases of congenital syphilis incidence nearly doubled from 2012 (8.4 cases/100,000 live births) to 2016 (15.7 cases/100,000 live births)," says Kenneth A. Katz, MD, associate editor, *JAMA Dermatology*, and Department of Dermatology, Kaiser Permanente San Francisco Medical Center, California, in the editorial.

"Those rather abstract epidemiologic measures translate to very real harms. In addition to stillbirth and neonatal death, congenital syphilis is associated with acute morbidity from rash, hemorrhagic rhinitis, jaundice, lymphadenopathy, hepatosplenomegaly, skeletal abnormalities, and lasting damage from bone deformities and neurologic impairment," he stresses.

Emphasizing that this advice for screening of pregnant women for syphilis at the earliest opportunity doesn't differ from the recommendation issued in 2009, Katz says. "Clearly...gaps in public health and clinical practice remain," he notes, citing figures from a 2014 study of 458 mothers of infants with congenital syphilis which

found that approximately 20% had received no prenatal care and another 10% had no available information on prenatal care.

Of those with one or more prenatal visits, 30% were inadequately treated for syphilis and 43% were not treated at all because they were not tested during pregnancy, they tested negative early in pregnancy but later developed syphilis, or they received no treatment despite testing positive.

Women who have received no prenatal care should undergo testing for syphilis when they present for delivery, the recommendations stress.

We Must Do Better

Katz also notes that the Task Force recommendation statement refers to guidelines from the Centers for Disease Control and Prevention and joint guidelines from the American Academy of Pediatrics and American College of Obstetricians and Gynecologists, which endorse repeated screening during the third trimester and at delivery for pregnant women at higher risk of syphilis, including those with a history of syphilis infection, incarceration, or drug use; those with multiple or concurrent sex partners; those who live in high-prevalence areas; and those who have a sexually transmitted infection.

He also notes that disparities in congenital syphilis exist, with a higher incidence among black, American Indian/Alaska Native, Hispanic, and Asian populations compared with white populations. Geography matters too, with higher rates in the West and South compared with the Northeast and Midwest.

Most states legally require prenatal syphilis screening, he stresses, and from a financial perspective, under the Affordable Care Act "the 'A' recommendation means that insurance companies must cover syphilis screening in pregnant women without requiring cost-sharing by patients." "Public health authorities and physicians, including dermatologists, must do better," he urges.

Dermatologists Have An Important Role in Prevention and Control

Katz singles out dermatologists, who he says need to stay abreast of rising rates of primary and secondary syphilis among women, as well as increasing rates of congenital syphilis.

"Primary and secondary syphilis, by definition, have mucocutaneous manifestations, and mucocutaneous manifestations are common in congenital syphilis," he said.

"Dermatologists might well help diagnose and manage these patients. Keeping syphilis in mind when formulating a differential diagnosis — especially for a disease known as the 'great mimicker' — can reduce the chance of missing a diagnosis and offers an opportunity for prompt treatment that can improve outcomes, including in congenital syphilis," he explains.

As well as being aware of the USPSTF recommendations on syphilis screening in pregnant women, dermatologists should also consider nonpregnant adults and adolescents at increased risk for syphilis, he notes.

"Clinical encounters with persons who meet syphilis screening criteria but who lack signs or symptoms of syphilis should trigger recommendations and/or referrals for syphilis screening," Katz adds.

Screening for syphilis infection involves two steps. Traditionally, the first test is a "nontreponemal" antibody test — a venereal disease research laboratory (VDRL) or rapid plasma reagin (RPR) test, followed by a "treponemal" antibody detection test — a fluorescent treponemal antibody absorption or Treponema pallidum particle agglutination test — for confirmation.

Now the reverse sequence screening algorithm is also available, in which an automated treponemal antibody test such as an enzyme-linked, chemiluminescence, or multiplex flow immunoassay, is performed initially, followed by a confirmatory nontreponemal

VDRL or RPR test. A second treponemal test is performed if the test results are discordant.

USPSTF members received reimbursement for travel expenses to and from USPSTF meetings and have disclosed no other relevant financial relationships. Katz has disclosed no relevant financial relationships.

JAMA. 2018;320:911-917. Recommendation Statement

JAMA. 2018;320:918-925. Evidence Report

JAMA Dermatology. Published online September 4, 2018. Editorial

http://bit.ly/2wSPZfl

A new theory for phantom limb pain points the way to more effective treatment

New theory for the origin of 'phantom limb pain', hypothesis builds upon work on a revolutionary treatment

Dr Max Ortiz Catalan of Chalmers University of Technology, Sweden, has developed a new theory for the origin of the mysterious condition, 'phantom limb pain'. Published in the journal Frontiers in Neurology, his hypothesis builds upon his previous work on a revolutionary treatment for the condition, that uses machine learning and augmented reality.

Sufferers of PLP describe a variety of sensations, from burning, aching, and throbbing to crushing and shooting pain.: **Yen Strandqvist/Chalmers University of Technology**

Phantom limb pain is a poorly understood phenomenon, in which people who have lost a limb can experience severe pain, seemingly located in that missing part of the body. The condition can be seriously debilitating and can drastically reduce the sufferer's quality of life. But current ideas on its origins cannot explain clinical findings, nor provide a comprehensive theoretical framework for its study and treatment.

Now, Max Ortiz Catalan, Associate Professor at Chalmers University of Technology, has published a paper that offers up a promising new theory - one that he terms 'stochastic entanglement'.

He proposes that after an amputation, neural circuitry related to the missing limb loses its role and becomes susceptible to entanglement with other neural networks - in this case, the network responsible for pain perception.

"Imagine you lose your hand. That leaves a big chunk of 'real estate' in your brain, and in your nervous system as a whole, without a job. It stops processing any sensory input, it stops producing any motor output to move the hand. It goes idle - but not silent," explains Max Ortiz Catalan.

Neurons are never completely silent. When not processing a particular job, they might fire at random. This may result in coincidental firing of neurons in that part of the sensorimotor network, at the same time as from the network of pain perception. When they fire together, that will create the experience of pain in that part of the body.

"Normally, sporadic synchronised firing wouldn't be a big deal, because it's just part of the background noise, and it won't stand out," continues Max Ortiz Catalan. "But in patients with a missing limb, such event could stand out when little else is going on at the same time. This can result in a surprising, emotionally charged experience - to feel pain in a part of the body you don't have. Such a remarkable sensation could reinforce a neural connection, make it stick out, and help establish an undesirable link."

Through a principle known as 'Hebb's Law' - 'neurons that fire together, wire together' - neurons in the sensorimotor and pain perception networks become entangled, resulting in phantom limb pain. The new theory also explains why not all amputees suffer from the condition- the randomness, or stochasticity, means that simultaneous firing may not occur, and become linked, in all patients.

In the new paper, Max Ortiz Catalan goes on to examine how this theory can explain the effectiveness of Phantom Motor Execution (PME), the novel treatment method he previously developed. During PME treatment, electrodes attached to the patient's residual limb pick up electrical signals intended for the missing limb, which are then translated through AI algorithms, into movements of a virtual limb in real time. The patients see themselves on a screen, with a digitally rendered limb in place of their missing one, and can then control it just as if it were their own biological limb . This allows the patient to stimulate and reactivate those dormant areas of the brain.

"The patients can start reusing those areas of brain that had gone idle. Making use of that circuitry helps to weaken and disconnect the entanglement to the pain network. It's a kind of 'inverse Hebb's law' - the more those neurons fire apart, the weaker their connection. Or, it can be used preventatively, to protect against the formation of those links in the first place," he says.

The PME treatment method has been previously shown to help patients for whom other therapies have failed. Understanding exactly how and why it can help is crucial to ensuring it is administered correctly and in the most effective manner. Max Ortiz Catalan's new theory could help unravel some of the mysteries surrounding phantom limb pain, and offer relief for some of the most affected sufferers.

More Information

Phantom Motor Execution undergoing global trial

Dr Max Ortiz Catalan developed Phantom Motor Execution (PME) as a treatment for phantom limb pain, in which phantom movements are decoded from the residual limb using machine learning, and then visualised via virtual and augmented reality. The new hypothesis provides an explanation for the clinical successes observed for this therapy. PME has been shown to reduce phantom limb pain in chronic sufferers, for whom other treatments failed. At present, PME is being tested in clinics around the world, from Canada to Australia, with the majority of patients treated in Europe. A device allowing for this treatment is being commercialized by Integrum AB, a Swedish medical device company, and a large international clinical trial in 7 countries is currently in progress. On-going brain imaging studies on these patients treated with PME will support or challenge Max Ortiz Catalan's theories. See a video presentation of PME here.

More on the research

Dr. Mx Ortiz Catalan is an Associate Professor at Chalmers University of Technology, Sweden and head of the Biomechatronics and Neurorehabilitation Laboratory.

?? He has previously attracted international attention, for his pioneering work on osseointegrated bionic limbs, published in Science Translational Medicine , and for his Phantom Motor Execution treatment for phantom limb pain, published in The Lancet.

His new paper, 'The stochastic entanglement and phantom motor execution hypotheses: a theoretical framework for the origin and treatment of PLP' is published in the journal Frontiers of Neurology.

http://bit.ly/2wSHVKR

How olive oil and sleep could stave off heart attacks and strokes: New study examines plasma protein's role

Apolipoprotein A-IV linked with thrombosis in new study

TORONTO - Foods high in unsaturated fats may protect against cardiovascular disease, and new research published today in *Nature Communications* has uncovered why.

Apolipoprotein A-IV, known as ApoA-IV, is a plasma protein. Levels of ApoA-IV increase after the digestion of foods, particularly foods high in unsaturated fats, such as olive oil. Higher levels of ApoA-IV in the blood have been reported to be associated with lower rates of cardiovascular disease.

New research from the Keenan Research Centre for Biomedical Science (KRCBS) of St. Michael's Hospital demonstrates that ApoA-IV is an inhibitory factor for platelets, which are small blood cells that play a key role in multiple diseases, particularly in bleeding and cardiovascular diseases.

These new findings suggest that ApoA-IV is a blocker of platelet surface glycoproteins GPIIbIIIa (also named integrin αIIβ3). Integrin αIIβ3 is a platelet receptor that is necessary for platelets to clump together in the blood (called platelet aggregation). Platelet aggregation can cause vessel occlusion that blocks blood flow,

leading to thrombosis, which is the most common cause of mortality and morbidity worldwide.

"Platelet aggregation can save lives, because it can stop bleeding in damaged vessels," said Dr. Heyu Ni, Platform Director for Hematology, Cancer and Immunological Diseases at the KRCBS, who is the principal investigator of this study. "But we usually don't want platelets to block blood flow in the vessels. This is thrombosis, and if vessel occlusion occurs in the heart or brain, it can cause heart attack, stroke or death."

Platelets bind together with a series of connectors. For one platelet to bond to another, the platelet receptor integrin αIIβ3 first binds to fibrinogen - an abundant protein that bridges platelets in blood - and fibrinogen molecules then bind another integrin αIIβ3 on a second platelet. Then fibrinogen and likely also other proteins allow many platelets to bind one another, leading to platelet aggregation.

Examining both lab models and humans, Dr. Ni, who is also a scientist at Canadian Blood Services Centre for Innovation, and his team have shown that ApoA-IV can link to the integrin αIIβ3 and block fibrinogen binding, decreasing platelet aggregation in a vessel. The ApoA-IV protein can also change its shape to accommodate increased blood flow, and become more effective to protect vessels from complete blockage.

"This is the first study to link ApoA-IV with platelets and thrombosis," Dr. Ni said. "With this work, we have also explained why higher levels of ApoA-IV can slow down plaque build-up in blood vessels, known as atherosclerosis, because this process is also related to platelet function."

The researchers also examined ApoA-IV's interaction with food. After every meal, platelets are stimulated, which makes it easier for them to bond together or bond to white blood cells. ApoA-IV increases in circulating blood almost immediately after meals containing unsaturated fats and decreases platelet hyperactivity and bonding, thus reducing the inflammation after meals and the risk of heart attack and stroke.

The study also found that ApoA-IV has its own circadian rhythm. It is most active overnight and least active in the morning.

"Mother Nature wants us to sleep well," Dr. Ni said. "So we are protected by this protein while we sleep, and most likely to experience a cardiovascular event after waking up in the morning."

Dr. Ni and his team are excited about these findings because they show that foods with high unsaturated fats, along with appropriate sleep patterns, create the perfect combination for the protein ApoA-IV to play a positive role in reducing the chances of cardiovascular disease in the form of atherosclerosis, heart attack, or stroke.

This new knowledge has many potential applications, Dr. Ni explained. Future studies will focus on better understanding this protein and how to harness its protective potential to build therapies targeted at cardiovascular disease and other diseases that arise from platelet activation and aggregation.

http://bit.ly/2M5GMoI

Why Probiotics May Not Always Help, And Could Actually Do Harm

Study suggests that some people may not benefit as much as others from these so-called good bacteria

By Rachael Rettner, Senior Writer | September 6, 2018 03:13pm ET

Plenty of people take probiotics in food or supplements in the hope of boosting their digestive health. But a new, small study suggests that some people may not benefit as much as others from these so-called good bacteria.

The study found that, when people consumed standard probiotic bacterial strains, some people's guts appeared resistant to the bacteria, meaning the bacteria failed to successfully live in or colonize their guts. But for others, the bacteria readily grew and flourished in the gut.

The study suggests that not everyone may benefit equally from standard probiotic treatments, the researchers said.

"This suggests that probiotics should not be universally given as a 'one-size-fits-all' supplement," study co-senior author Eran Elinav, an immunologist at the Weizmann Institute of Science in Israel, said in a statement. However, it may be possible to tailor probiotic treatments to the individual, based on the types of microbes already in his or her gut, as well as other factors, so that he or she gets the most benefit from probiotics, the researchers said.

In addition, a second study by the same group of researchers suggests that probiotics could have a potentially harmful effect if taken after antibiotics. Because both studies were small, however, more research is needed to confirm the findings.

The study was published today (Sept. 6) in the journal Cell.

Probiotic "resistance"

Probiotics are live bacteria that are consumed with the aim of improving or maintaining the microbiome, or the many "good" bacteria that are found naturally in our guts, according to the Mayo Clinic.

A number of probiotic products are on the market, including yogurts containing probiotics, as well as supplements and skin creams, and an estimated 3.9 million Americans use such products. Some studies suggest that probiotics may help with diarrhea or symptoms of irritable bowel syndrome (IBS), but strong evidence to support their use for most health conditions is lacking, according to the National Center for Complementary and Integrative Health.

In addition, most studies that have looked at the effects of probiotics have used participants' stool samples as a proxy for what's going on in their guts. But it's unclear whether stool samples really reflect the bacteria living in the gut, or whether some bacteria are shed in stool more easily, perhaps without properly settling in the gut.

In the new study, the researchers analyzed information from 15 healthy volunteers who took either a probiotic product containing 11 strains of bacteria, or a placebo, for four weeks. The participants also underwent colonoscopies and upper endoscopies before they took the probiotics or the placebo, and again after the four-week treatment period. (An upper endoscopy looks at the upper part of the digestive tract.) During these procedures, the researchers took samples from inside participants' guts.

The researchers found that the probiotic bacteria were able to colonize the gut in six participants. The rest, however, were "resisters," meaning the bacteria did not colonize their guts, even though the probiotic bacteria were shed in their stool.

"Although all of our probiotic-consuming volunteers showed probiotics in their stool, only some of them showed them in their gut, which is where they need to be," co-senior author Eran Segal, a computational biologist at the Weizmann Institute, said in the statement. "If some people resist and only some people permit them, the benefits of the standard probiotics we all take can't be as universal as we once thought."

After further analyzing the data, the researchers found that they could predict whether the probiotics would take hold in people's guts by examining their microbiome and gene expression in the gut taken at the start of the study. However, this prediction method needs to be confirmed in future studies. The researchers called for further research to better understand why some people resist colonization by probiotics, as that future research may enable researchers to counteract the resistance.

Harmful effects?

In a separate study involving 21 healthy volunteers, also published today in Cell, the same group of researchers found that taking probiotics after treatment with broad spectrum antibiotics may actually delay the return of people's normal gut microbiome. This

goes against the idea that probiotics can help "repopulate" people's gut bacteria after antibiotics wipe them out.

"Contrary to the current dogma that probiotics are harmless and benefit everyone, these results reveal a new potential adverse side effect of probiotic use with antibiotics," Elinav said.

The finding also highlighted the need for personalized probiotic treatments to protect people's gut health "without compromising microbiome recolonization" after antibiotics, the researchers said.

Dr. Arun Swaminath, director of Inflammatory Bowel Disease Program at Lenox Hill Hospital, who was not involved in the study, said these findings "raise concerns about whether probiotics actually delay…the return of [a] healthy bacteria ecosystem after" a person takes certain antibiotics.

However, whether the findings hold up in patients with specific medical conditions, and with exposure to different antibiotics, "remains to be seen," Swaminath told Live Science. "But it clearly shows that probiotics may have an undeserved status, in the way they are currently thought of in popular culture as natural and unarguably healthy."

The researchers also noted that they did not look at clinical outcomes, such as whether probiotics helped to alleviate people's gastrointestinal symptoms.

http://bit.ly/2wSjGNE

Single-dose drug can shorten flu symptoms by about a day, studies suggest

No significant side effects noted in pair of clinical trials in U.S., Japan

A single dose of a new influenza drug can significantly shorten the duration of the illness in teens and adults, according to a study published in the prestigious *New England Journal of Medicine*.

The article reports the results of two multicenter, double-blind, randomized clinical trials. Both found that the drug, baloxavir marboxil, shortened the duration of flu symptoms by about one day and more quickly cleared virus compared with placebo in otherwise healthy teens and adults. The larger, phase 3 trial also found that baloxavir's effect on symptoms was similar to that of a five-day course of oseltamivir but that baloxavir had significantly greater antiviral potency. The studies identified no important side effects.

"Baloxavir shows remarkable antiviral potency in uncomplicated influenza, and if approved by the Food and Drug Administration, it would be an important addition to our treatment options for influenza," said researcher Frederick G. Hayden, MD, of the University of Virginia School of Medicine. "Of note, because baloxavir has a novel antiviral action in inhibiting the endonuclease of the virus, the drug is inhibitory for influenza A and B viruses including those that may be resistant to currently available drugs."

Flu Study Findings

The first trial was conducted in Japan in 2016 and evaluated the drug's safety and effectiveness in 389 adults, ages 20 to 64. Study participants received either the drug or a placebo. Median flu symptom duration among those who received the drug was 23.4 to 28.2 hours shorter than among participants who received the placebo. (Baloxavir, developed by drug company Shionogi, was approved for use in Japan in children and adults in February 2018.)

The second study was conducted in the United States and Japan in the 2016-17 influenza season. It compared baloxavir with both a placebo and an approved drug, oseltamivir, in 1,064 otherwise healthy study participants ages 12 to 64, with proven influenza. The median time to resolution of flu symptoms was 26.5 hours shorter among those who received baloxavir than the 80.2 hours reported among those who were given placebos. Baloxavir and oseltamivir produced similar reductions in symptom duration, but baloxavir required only a single dose compared with the standard five-day oseltamivir regimen.

"Single-dose baloxavir was without evident safety concerns, was superior to placebo in alleviating influenza symptoms and was superior to both oseltamivir and placebo in reducing the viral load one day after initiation of the trial regimen," the researchers note in their new paper.

In both trials, the rate of adverse events reported by study participants was similar regardless of whether participants had been given a placebo or baloxavir.

Next Steps

To become available in the United States, baloxavir would need approval from the U.S. Food and Drug Administration (FDA). The drug was accepted for priority review by the FDA in June, so that a decision is expected by Dec. 24 at the latest.

The drug was tested for its safety and effectiveness among flu sufferers with a higher risk of complications during the past influenza season, but the results of that testing have not yet been formally presented. (For more details on that trial, visit https://clinicaltrials.gov/ct2/show/NCT02949011,) Studies of its effectiveness in hospitalized influenza patients, likely in combination with other influenza antivirals, and in preventing transmission of influenza virus are planned.

About the Authors

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http://bit.ly/2NnbsXg

Could AI robots develop prejudice on their own?

Computer science and psychology experts suggest discrimination is also a non-human phenomenon that could make autonomous machines susceptible

Showing prejudice towards others does not require a high level of cognitive ability and could easily be exhibited by artificially intelligent machines, new research has suggested.

Computer science and psychology experts from Cardiff University and MIT have shown that groups of autonomous machines could demonstrate prejudice by simply identifying, copying and learning this behaviour from one another.

It may seem that prejudice is a human-specific phenomenon that requires human cognition to form an opinion of, or to stereotype, a certain person or group.

Though some types of computer algorithms have already exhibited prejudice, such as racism and sexism, based on learning from public records and other data generated by humans, this new work demonstrates the possibility of AI evolving prejudicial groups on their own.

The new findings, which have been published in the journal Scientific Reports, are based on computer simulations of how similarly prejudiced individuals, or virtual agents, can form a group and interact with each other.

In a game of give and take, each individual makes a decision as to whether they donate to somebody inside of their own group or in a different group, based on an individual's reputation as well as their own donating strategy, which includes their levels of prejudice towards outsiders.

As the game unfolds and a supercomputer racks up thousands of simulations, each individual begins to learn new strategies by copying others either within their own group or the entire population.

Co-author of the study Professor Roger Whitaker, from Cardiff University's Crime and Security Research Institute and the School of Computer Science and Informatics, said: "By running these simulations thousands and thousands of times over, we begin to get an understanding of how prejudice evolves and the conditions that promote or impede it.

"Our simulations show that prejudice is a powerful force of nature and through evolution, it can easily become incentivised in virtual populations, to the detriment of wider connectivity with others. Protection from prejudicial groups can inadvertently lead to individuals forming further prejudicial groups, resulting in a fractured population. Such widespread prejudice is hard to reverse."

The findings involve individuals updating their prejudice levels by preferentially copying those that gain a higher short term payoff, meaning that these decisions do not necessarily require advanced cognitive abilities.

"It is feasible that autonomous machines with the ability to identify with discrimination and copy others could in future be susceptible to prejudicial phenomena that we see in the human population," Professor Whitaker continued.

"Many of the AI developments that we are seeing involve autonomy and self-control, meaning that the behaviour of devices is also influenced by others around them. Vehicles and the Internet of Things are two recent examples. Our study gives a theoretical insight where simulated agents periodically call upon others for some kind of resource."

A further interesting finding from the study was that under particular conditions, which include more distinct subpopulations being present within a population, it was more difficult for prejudice to take hold.

"With a greater number of subpopulations, alliances of non-prejudicial groups can cooperate without being exploited. This also diminishes their status as a minority, reducing the susceptibility to prejudice taking hold. However, this also requires circumstances where agents have a higher disposition towards interacting outside of their group," Professor Whitaker concluded.

http://bit.ly/2NndnuW

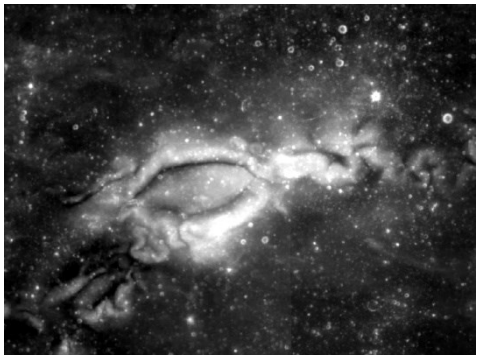
Mysterious 'lunar swirls' point to moon's volcanic, magnetic past

Unique patterns, visible from backyard telescopes, may be produced by strongly magnetized lava

The mystery behind lunar swirls, one of the solar system's most beautiful optical anomalies, may finally be solved thanks to a joint Rutgers University and University of California Berkeley study.

The solution hints at the dynamism of the moon's ancient past as a place with volcanic activity and an internally generated magnetic field. It also challenges our picture of the moon's existing geology.

Lunar swirls resemble bright, snaky clouds painted on the moon's dark surface. The most famous, called Reiner Gamma, is about 40 miles long and popular with backyard astronomers. Most lunar swirls share their locations with powerful, localized magnetic fields. The bright-and-dark patterns may result when those magnetic fields deflect particles from the solar wind and cause some parts of the lunar surface to weather more slowly.



The lunar swirl known as Reiner Gamma (60 km width), seen at 750 nm by the Clementine spacecraft. **U.S. Government - Clementine Mission**

"But the cause of those magnetic fields, and thus of the swirls themselves, had long been a mystery," said Sonia Tikoo, coauthor of the study recently published in the *Journal of Geophysical Research - Planets* and an assistant professor in Rutgers University-New Brunswick's Department of Earth and Planetary Sciences. "To solve

it, we had to find out what kind of geological feature could produce these magnetic fields - and why their magnetism is so powerful."

Working with what is known about the intricate geometry of lunar swirls, and the strengths of the magnetic fields associated with them, the researchers developed mathematical models for the geological "magnets." They found that each swirl must stand above a magnetic object that is narrow and buried close to the moon's surface.

The picture is consistent with lava tubes, long, narrow structures formed by flowing lava during volcanic eruptions; or with lava dikes, vertical sheets of magma injected into the lunar crust.

But this raised another question: How could lava tubes and dikes be so strongly magnetic? The answer lies in a reaction that may be unique to the moon's environment at the time of those ancient eruptions, over 3 billion years ago.

Past experiments have found that many moon rocks become highly magnetic when heated more than 600 degrees Celsius in an oxygen-free environment. That's because certain minerals break down at high temperatures and release metallic iron. If there happens to be a strong enough magnetic field nearby, the newly formed iron will become magnetized along the direction of that field.

This doesn't normally happen on earth, where free-floating oxygen binds with the iron. And it wouldn't happen today on the moon, where there is no global magnetic field to magnetize the iron.

But in a study published last year, Tikoo found that the moon's ancient magnetic field lasted 1 billion to 2.5 billion years longer than had previously been thought - perhaps concurrent with the creation of lava tubes or dikes whose high iron content would have become strongly magnetic as they cooled.

"No one had thought about this reaction in terms of explaining these unusually strong magnetic features on the moon. This was the final piece in the puzzle of understanding the magnetism that underlies these lunar swirls," Tikoo said.

The next step would be to actually visit a lunar swirl and study it directly. Tikoo serves on a committee that is proposing a rover mission to do just that.

http://bit.ly/2NVcdE5

Jet-air dryers should not be used in hospital toilets

Jet-air hand dryers in hospital toilets spread more germs than disposable paper towels and should not be used, say researchers.

Writing in the *Journal of Hospital Infection*, they argue that the official guidance about how to prevent bacterial contamination in hospital buildings needs to be strengthened.

At the moment, the official Department of Health guidance says air dryers can be placed in toilets in the public areas of a hospital but not in clinical areas: not because of the risks they pose for cross contamination but because they are noisy.

Mark Wilcox, Professor of Medical Microbiology at the University of Leeds who supervised the international study, said the guidance needs to focus on the infection risks given new evidence.

The new study looked at bacterial spread in a real world setting - in two toilets in each of three hospitals, which were in the UK, France and Italy. Each of the toilets had paper towel dispensers and jet-air dryers, but only one of these was in use on any given day.

Professor Wilcox said: "The problem starts because some people do not wash their hands properly.

"When people use a jet-air dryer, the microbes get blown off and spread around the toilet room.

"In effect, the dryer creates an aerosol that contaminates the toilet room, including the dryer itself and potentially the sinks, floor and other surfaces, depending on the dryer design and where it is sited. If people touch those surfaces, they risk becoming contaminated by bacteria or viruses.

"Jet-air dryers often rely on no-touch technology to initiate hand drying. However, paper towels absorb the water and microbes left on

the hands and if they are disposed of properly, there is less potential for cross-contamination."

The study, led by researchers from the University of Leeds and Leeds Teaching Hospitals Trust, was the largest of its type to investigate whether the way people dry their hands has an impact on the spread of bacteria.

This research follows a previous laboratory-based study led by the same team, which found that jet-air dryers were much worse than paper towels or traditional warm air hand dryers when it came to spreading germs.

The hospitals used in the study were the Leeds General Infirmary in Yorkshire, the hospital of Saint Antoine (Assistance Publique-Hôpitaux de Paris) in France, and the Hospital of Udine in Italy.

On each day, over 12 weeks, levels of bacterial contamination in the toilets were measured, allowing comparisons to be made when either paper towels or jet-air dryers were in use. Samples were taken from the floors, air and surfaces in each of the toilets.

The main target bacteria were:

- ***Staphylococcus aureus*: responsible for a range of conditions from minor skin and wound infections to life-threatening septicaemia.**
- **Enterococci: bacteria that can cause difficult-to-treat infections, including in immunocompromised patients.**
- **Enterobacteria: including *Escherichia coli*. These bacteria cause a wide range of infections, including gastroenteritis, pneumonia and septicaemia.**

Across the three hospitals, bacterial counts were significantly higher in the toilets on the days that jet-air dryers were in use.

In Leeds and Paris, at least five times more bacteria were recovered from the floors when jet-air dryers were in use, compared with paper towels.

In Leeds, *Staphylococcus aureus* (including MRSA) was found three times more often and in higher amounts on the surface of the jet-air dryers compared with the paper towel dispensers. Significantly more enterococci and multidrug resistant bacteria were recovered from either the floors or dust of toilets when the jet-air dryers rather than paper towels were in use.

In Italy, the researchers found significantly fewer bacteria on the surface of paper towel dispensers compared with the jet-air dryers, although no significant difference on the floors.

Professor Wilcox said: "We found multiple examples of greater bacterial contamination on surfaces, including by faecal and antibiotic-resistant bacteria, when jet-air dryers rather than paper towels were in use. Choice of hand drying method affects how likely microbes can spread, and so possibly the risk of infection."

Frédéric Barbut, Professor of Microbiology at Saint Antoine (Assistance Publique-Hôpitaux de Paris), said: "The higher environmental contamination observed when using jet air-dryers compared with paper towels increases the risk for cross-contamination.

"These results confirm previous laboratory-based findings and support the recent French guidelines regarding hand hygiene, which discourage using jet-air dryers in clinical wards".

The study was funded by the European Tissue Symposium, a trade organisation representing companies that manufacture paper towels. However, the research was independently conceived, designed, conducted and interpreted, and was peer-reviewed by experts not involved in the study.

Notes to editors

The paper 'Multicentre study to examine the extent of environmental contamination by potential bacterial pathogens, including antibiotic resistant bacteria, in hospital washrooms according to hand-drying method' is published in the Journal of Hospital Infection on 7 September.

http://bit.ly/2NUGZNh

Ancient farmers spared us from glaciers but profoundly changed Earth's climate

Ancient farmers may unknowingly have been fundamentally altering the climate of the Earth

MADISON - Millenia ago, ancient farmers cleared land to plant wheat and maize, potatoes and squash. They flooded fields to grow rice. They began to raise livestock. And unknowingly, they may have been fundamentally altering the climate of the Earth.

A study published in the journal *Scientific Reports* provides new evidence that ancient farming practices led to a rise in the atmospheric emission of the heat-trapping gases carbon dioxide and methane - a rise that has continued since, unlike the trend at any other time in Earth's geologic history.

It also shows that without this human influence, by the start of the Industrial Revolution, the planet would have likely been headed for another ice age.

"Had it not been for early agriculture, Earth's climate would be significantly cooler today," says lead author, Stephen Vavrus, a senior scientist in the University of Wisconsin-Madison Center for Climatic Research in the Nelson Institute for Environmental Studies. "The ancient roots of farming produced enough carbon dioxide and methane to influence the environment."

The findings are based on a sophisticated climate model that compared our current geologic time period, called the Holocene, to a similar period 800,000 years ago. They show the earlier period, called MIS19, was already 2.3 degrees Fahrenheit (1.3 C) cooler globally than the equivalent time in the Holocene, around the year 1850. This effect would have been more pronounced in the Arctic, where the model shows temperatures were 9-to-11 degrees Fahrenheit colder.

Using climate reconstructions based on ice core data, the model also showed that while MIS19 and the Holocene began with similar carbon dioxide and methane concentrations, MIS19 saw an overall steady drop in both greenhouse gases while the Holocene reversed direction 5,000 years ago, hitting peak concentrations of both gases by 1850. The researchers deliberately cut the model off at the start of the Industrial Revolution, when sources of greenhouse gas emissions became much more numerous.

For most of Earth's 4.5-billion-year history, its climate has largely been determined by a natural phenomenon known as Milankovitch cycles, periodic changes in the shape of Earth's orbit around the sun - which fluctuates from more circular to more elliptical - and the way Earth wobbles and tilts on its axis.

Astronomers can calculate these cycles with precision and they can also be observed in the geological and paleoecological records. The cycles influence where sunlight is distributed on the planet, leading to cold glacial periods or ice ages as well as warmer interglacial periods. The last glacial period ended roughly 12,000 years ago and Earth has since been in the Holocene, an interglacial period. The Holocene and MIS19 share similar Milankovitch cycle characteristics.

All other interglacial periods scientists have studied, including MIS19, begin with higher levels of carbon dioxide and methane, which gradually decline over thousands of years, leading to cooler conditions on Earth. Ultimately, conditions cool to a point where glaciation begins.

Fifteen years ago, study co-author William Ruddiman, emeritus paleoclimatologist at the University of Virginia, was studying methane and carbon dioxide trapped in Antarctic ice going back tens of thousands of years when he observed something unusual.

"I noticed that methane concentrations started decreasing about 10,000 years ago and then reversed direction 5,000 years ago and I also noted that carbon dioxide also started decreasing around 10,000 years ago and then reversed direction about 7,000 years ago," says Ruddiman. "It alerted me that there was something strange about this interglaciation ... the only explanation I could come up with is early agriculture, which put greenhouse gases into the atmosphere and that was the start of it all."

Ruddiman named this the Early Anthropogenic Hypothesis and a number of studies have recently emerged suggesting its plausibility. They document widespread deforestation in Europe beginning around 6,000 years ago, the emergence of large farming settlements in China 7,000 years ago, plus the spread of rice paddies - robust sources of methane - throughout northeast Asia by 5,000 years ago.

Ruddiman and others have also been working to test the hypothesis. He has collaborated with Vavrus, an expert in climate modeling, for many years and their newest study used the Community Climate System Model 4 to simulate what would have happened in the Holocene if not for human agriculture. It offers higher resolution than climate models the team has used previously and provides new insights into the physical processes underlying glaciation.

For instance, in a simulation of MIS19, glaciation began with strong cooling in the Arctic and subsequent expansion of sea ice and year-round snow cover. The model showed this beginning in an area known as the Canadian archipelago, which includes Baffin Island, where summer temperatures dropped by more than 5 degrees Fahrenheit.

"This is consistent with geologic evidence," says Vavrus.

Today, the Arctic is warming. But before we laud ancient farmers for staving off a global chill, Vavrus and Ruddiman caution that this fundamental alteration to our global climate cycle is uncharted territory.

"People say (our work) sends the wrong message, but science takes you where it takes you," says Vavrus. "Things are so far out of whack now, the last 2,000 years have been so outside the natural bounds, we are so far beyond what is natural."

The reality is, we don't know what happens next. And glaciers have long served as Earth's predominant source of freshwater.

"There is pretty good agreement in the community of climate scientists that we have stopped the next glaciation for the long, foreseeable future, because even if we stopped putting carbon dioxide into the atmosphere, what we have now would linger," says Ruddiman. "The phenomenal fact is, we have maybe stopped the major cycle of Earth's climate and we are stuck in a warmer and warmer and warmer interglacial."

http://bit.ly/2Qcq62c

No 'changing room moment' for men as they age

Men don't face the same 'changing room moment' as do women when they look in the mirror and realise that an item is 'too young'

The research, published in the journal *Ageing and Society*, was conducted by Professor Julia Twigg from the School of Social Policy, Sociology and Social Research.

For the research on how men respond to fashion and clothing choices as they age Professor Twigg conducted 24 in-depth interviews with men aged between 58 and 85 from a variety of social backgrounds and sexual orientations.

From this, it was clear that men did not face the same 'changing room moment' as did women when they saw themselves in the mirror and realised that the item was now 'too young'. Most remained comfortable in the outfits they had worn earlier in their lives, particularly if their careers required them to dress in a certain way.

For instance, those from 'creative' industries continued to dress in stylish, fashionable manner while others had a smart-casual style, mixing blazers with trousers and ties and shirts as they wanted. Others embraced retirement as a chance to expand their wardrobe and add more colour to their clothing, with some embracing the shift in cultural norms that means pink is now an acceptable colour for men, for example.

Furthermore, they saw clothing worn by younger men that they did acknowledge as 'too young' for them - such as hoodies, trainers, and

tight jeans - as 'silly' and viewed it with contempt and so something they would never want to wear.

However, the men interviewed did have a strong negative reaction to clothing that they thought would mark a clear end to masculinity and the onset of a decline of life - with elasticated trousers viewed with horror.

This concern of a loss of masculinity in clothing choices also related to the idea of wearing dirty or unkempt clothing. Several of the men interviewed relayed stories of men they knew who they viewed with a mix of mild disdain or pity when they saw them in a poorly dressed state, as it suggested to them that they had lost their inherent masculinity and were effectively giving up.

Notably, many linked this situation to the loss of a wife who was seen as previously responsible for ensuring this did not happen.

Finally, despite being confident in their dress choices, several men admitted that changes in body size that come with old age impacted their ability to dress as they wished, with some noting the ways clothes 'shrink in the wardrobe'.

Commenting on the research Professor Twigg said: 'It is clear men have a different relationship to dress from women, and the research shows that this continues into later life. There is less in the way of age anxiety in their choices, but there are clearly issues that affect how they dress and how this changes as they get older.'

Professor Twigg has conducted numerous in-depth studies on the cultural and social responses people have to the clothing they wear. This includes a prior study of how age impacts female responses to clothing and the perception that there is a cut-off point at which certain items become 'unwearable' to women for fear of appearing 'foolish'.

The research, entitled Dress, gender and the embodiment of age: men and masculinities, has been published in the journal Ageing and Society.

http://bit.ly/2QcKVub

Exercise's Benefits to Dementia Can Be Made Chemically

Boosting both neurogenesis and a brain-derived growth factor can mimic the cognitive benefits of exercise in a mouse mode of Alzheimer's disease.

Ruth Williams

Mice that model a severe form of Alzheimer's disease tend to exhibit improved memory after exercise-induced neuron production, according to a report in *Science* today (September 6). Similar improvements are also possible with an exercise work-around, by giving the animals a treatment to ramp-up neurogenesis together with a dose of brain-derived neurotrophic factor (BDNF).

"This paper was really exciting. . . . It's is a proof of principle, in an animal model, that you can replace exercise by a bottled therapy," says Alzheimer's disease researcher Tara Spires-Jones of the University of Edinburgh who wrote a commentary about the paper, but was not involved in the research. However, "we're a pretty long way from translating this study from mice into humans," she adds.

Alzheimer's disease is the most common form of age-related dementia, affecting approximately 5.5 million people in the US alone. The disease's characteristic brain pathology includes the deposition of β-amyloid plaques, the development of neurofibrillary tangles, neuronal loss, and brain inflammation. But, exactly how these developments lead to cognitive impairment is unclear, and therapies aimed at clearing amyloid have so far failed to halt disease progression, says Spires-Jones.

Recently, evidence from mice and postmortem human brains has indicated that altered neurogenesis may also play a part in Alzheimer's disease pathology. On top of that, exercise, which promotes neurogenesis, counteracts Alzheimer's pathology in mice.

In humans, exercise and a healthy lifestyle are linked to a reduced risk of developing the disease.

The production of new cells in the brain mainly occurs in the hippocampus—a region involved in memory formation that is particularly hard-hit in Alzheimer's—says neurologist Rudolph Tanzi of Harvard Medical School and Massachusetts General Hospital who led the research. "But what we did not know was, how does neurogenesis—the lack of it, or induction of it—affect Alzheimer's pathology and symptoms."

To find out, Tanzi's team turned to a mouse model of the disease. The team first eliminated the ability of young animals to generate new neurons and discovered that the mice developed a much more severe form of dementia.

They next asked, "If we induce neurogenesis, can we make the mice better?" says Tanzi.

Using either pharmacological or genetic approaches, the team ramped up the production of new neurons in the animals' brains. But, to their surprise, "it had no effect at all on pathology or symptoms," Tanzi says.

Upon investigation, the researchers discovered that the new neurons weren't surviving long-term. As Tanzi puts it, new neurons being produced in the Alzheimer's brain is like "babies being born in a battle zone. They don't survive and they can't help you."

If the team promoted neurogenesis by allowing the mice to exercise, however, the new cells did survive and differentiate. Moreover, the animals' cognitive abilities improved.

So, what was different between the exercise and the experimentally induced production of neurons? The team discovered that, in addition to ramping up neurogenesis, exercise leads to an increase in the levels of BDNF—a factor that promotes both the survival and differentiation of brain cells. When the team genetically or pharmacologically increased BDNF levels in addition to neurogenesis in sedentary animals, "voila," says Tanzi, "we were able to mimic the effects of exercise."

"This [work] continues to emphasize the importance of physical exercise in sustaining the brain and fighting off brain degeneration," says neurologist Samuel Gandy of the Icahn School of Medicine at Mount Sinai in New York who was not part of the research team. "It also highlights particular molecules that we might target in order to optimize the benefits of exercise, or [for patients who are disabled or frail], to take the place of the exercise altogether."

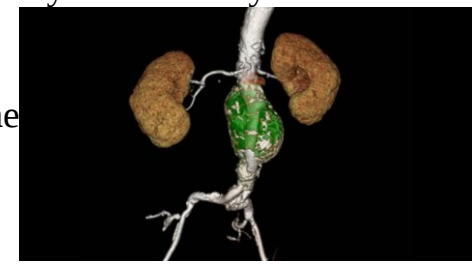
S.H. Choi et al., "Combined adult neurogenesis and BDNF mimic exercise effects on cognition in an Alzheimer's mouse model," Science, 361:eaan8821, 2018.

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

How to warn of a pulsating artery that could burst any time

A genomic test predicts whether a crucial artery has become enlarged and weakened.

Genome sequences and electronic health records have been combined to yield clues for identifying those at risk of a life-threatening rupture of the aorta, the body's main artery.



An abdominal aortic aneurysm (green), a bulge in the lower aorta, can rupture catastrophically at a moment's notice. **Ronald L. Dalman**

Genetic factors are known to contribute to the risk of abdominal aortic aneurysm, a fragile bulge in the aorta's lower section. But the condition is complex and difficult to study.

Philip Tsao and Michael Snyder of Stanford University in California sequenced the full genomes of 268 people with the condition, and 133 controls. They then used a machine-learning method to analyse both the genetic data and information from electronic health records, such as cholesterol levels. A model based on both data sets made

highly accurate predictions of which sample came from a person with the disease.

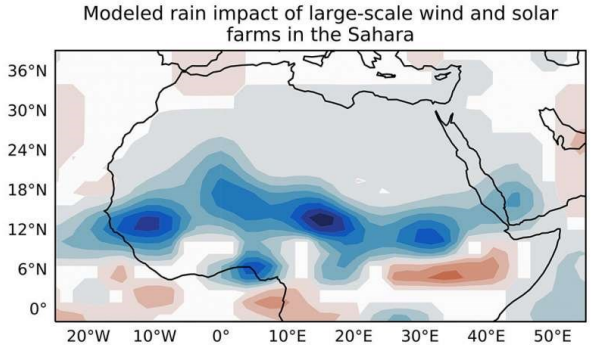
The genetic analysis singled out 60 genes that were more likely to carry mutations in individuals with abdominal aortic aneurysms than in the controls. These genes tended to be expressed at higher levels in tissue taken from people with the disease, compared to those without it. *Cell* (2018)

http://bit.ly/2NZP3wn

Large wind and solar farms in the Sahara would increase heat, rain, vegetation

Wind and solar farms are known to have local effects on heat, humidity and other factors that may be beneficial—or detrimental—to the regions in which they are situated.

A new climate-modeling study finds that a massive wind and solar installation in the Sahara Desert and neighboring Sahel would increase local temperature, precipitation and vegetation. Overall, the researchers report, the effects would likely benefit the region.



Large-scale wind and solar installations in the Sahara would increase precipitation, a new study finds. **Map by Eviatar Bach CC BY 4.0**

The study, reported in the journal *Science*, is among the first to model the climate effects of wind and solar installations while taking into account how vegetation responds to changes in heat and precipitation, said lead author Yan Li, a postdoctoral researcher in natural resources and environmental sciences at the University of Illinois.

"Previous modeling studies have shown that large-scale wind and solar farms can produce significant climate change at continental scales," Li said. "But the lack of vegetation feedbacks could make the modeled climate impacts very different from their actual behavior.

The new study, co-led with Eugenia Kalnay and Safa Motesharrei at the University of Maryland, focused on the Sahara for several reasons, Li said.

"We chose it because it is the largest desert in the world; it is sparsely inhabited; it is highly sensitive to land changes; and it is in Africa and close to Europe and the Middle East, all of which have large and growing energy demands," he said.

The wind and solar farms simulated in the study would cover more than 9 million square kilometers and generate, on average, about 3 terawatts and 79 terawatts of electrical power, respectively. "In 2017, the global energy demand was only 18 terawatts, so this is obviously much more energy than is currently needed worldwide," Li said.

The model revealed that wind farms caused regional warming of near-surface air temperature, with greater changes in minimum temperatures than maximum temperatures.

"The greater nighttime warming takes place because wind turbines can enhance the vertical mixing and bring down warmer air from above," the authors wrote. Precipitation also increased as much as 0.25 millimeters per day on average in regions with wind farm installations.

"This was a doubling of precipitation over that seen in the control experiments," Li said. In the Sahel, average rainfall increased 1.12 millimeters per day where wind farms were present.

"This increase in precipitation, in turn, leads to an increase in vegetation cover, creating a positive feedback loop," Li said.

Solar farms had a similar positive effect on temperature and precipitation, the team found. Unlike the wind farms, the solar arrays had very little effect on wind speed.

"We found that the large-scale installation of solar and wind farms can bring more rainfall and promote vegetation growth in these

regions," Kalnay said. "The rainfall increase is a consequence of complex land-atmosphere interactions that occur because solar panels and wind turbines create rougher and darker land surfaces.

"The increase in rainfall and vegetation, combined with clean electricity as a result of solar and wind energy, could help agriculture, economic development and social well-being in the Sahara, Sahel, Middle East and other nearby regions," Motesharrei said.

More information: *Y. Li el al., "Climate model shows large-scale wind and solar farms in the Sahara increase rain and vegetation," Science (2018). science.sciencemag.org/cgi/doi … 1126/science.aar5629*

http://bit.ly/2wXrjlT

Humans Are Destroying Animals' Ancestral Knowledge

Bighorn sheep and moose learn to migrate from one another. When they die, that generational know-how is not easily replaced.

Ed Yong

In the 1800s, there were so many bighorn sheep in Wyoming that when one trapper passed through Jackson Hole, he described "over a thousand sheep in the cliffs above our campsite." No such sights exist today. The bighorns slowly fell to hunters' rifles, and to diseases spread from domestic sheep. Most herds were wiped out, and by 1900, a species that once numbered in the millions stood instead in the low thousands.

In the 1940s, the Wyoming Game and Fish Department began trying to move bighorns back into their historic habitats. Those relocations continue today, and they've been increasingly successful at restoring the extirpated herds. But the lost animals aren't just lost bodies. Their knowledge also died with them—and that is not easily replaced.

Bighorn sheep, for example, migrate. They'll climb for dozens of miles over mountainous terrain in the spring, "surfing" the green waves of newly emerged plants. They learn the best routes from one another, over decades and generations. And for that reason, a bighorn sheep that's released into unfamiliar terrain is an ecological noob. It's not the same as an individual that lived in that place its whole life and was led through it by a knowledgeable mother.

"The translocated animals were literally let out of a livestock trailer and started looking around at their new environment," says Matthew Kauffman from the University of Wyoming. "And they almost entirely failed to migrate."

Kauffman knows this because the translocated sheep were often fitted with radio collars, allowing him and his colleagues to compare their movements to those of bighorns that lived in the same place for centuries. Within those longstanding herds, between 65 and 100 percent of the sheep migrated. But in the translocated herds, fewer than 9 percent migrated—only the sheep that had been moved into established populations that already knew the land.

The team also used satellite images to measure how closely the sheep were tracking the waves of emerging greenery. Then, they compared the animals' performance to two kinds of simulated sheep—naive ones that moved around at random, and omniscient ones that had perfect knowledge of the local plants. "Some of the recently translocated herds tracked the green wave no better than the ones that wandered randomly," says Brett Jesmer, who led the work. The older herds did far better—"not as well as the omniscient ones, but closer," he says.

"This changes how we think about wildlife habitats," Kauffman adds. "Wildlife researchers have always focused on the physical landscape. How much grass is there? How many conifers? Then you can ask how good that habitat is for a sage grouse or a grizzly bear. But our work suggests that the true measure of habitat quality for mobile animals is both the physical attributes of the landscape *and* the knowledge that animals have of how to make a living there. Put naive animals into awesome habitats and they may perform really poorly,

while animals that know how to exploit landscapes that have been degraded could do really well."

Scientists have long wondered how migrating animals know where to go. In some cases, that knowledge is innate. Sea-turtle hatchlings read the Earth's magnetic field to head off in specific directions, while hybrid songbirds will travel along routes that are halfway between those of their parents. In other cases, learning clearly matters. Whooping cranes get better at migration with age, and groups that include at least one elder are much better at staying on course.

Ecologists have long speculated that ungulates—hooved animals such as deer, bison, and sheep—also learn to migrate, since many species seem to adopt the movement patterns of their mothers and peers. By studying the translocated bighorns, using data gleaned from their collars, Kauffman's team has finally confirmed this long-standing assumption.

To an extent, ungulates can find emerging greenery through local smells and sights. "But they also possess excellent spatial memory," Jesmer says. "They can remember when a path greened up and time their movements to go to that area the next spring." Their mental maps are the foundation of migration. They're the difference between an animal that's just going after nearby shoots, and one that's moving long distances across the terrain in anticipation of greenery that it knows will arrive.

That knowledge takes time to accrue, which the team showed by studying both the bighorns and five groups of translocated moose. The more time these animals spent in a new place, the better their surfing ability was, and the more likely they were to migrate. Jesmer thinks this process likely occurs over generations: Individuals learn to move through the world by following their mothers, and then augment that inherited know-how with their own experiences. "Each generation, you get this incremental increase in knowledge," Jesmer says. For sheep, he says, learning how to effectively exploit their environment takes around 50 to 60 years. Moose need closer to a century.

That knowledge allows the animals to find plants early, when they're young, tender, and more easily digested. And by eating high-quality plants, they can more easily pack on the fat and protein that gets them through harsh winters. "When they lose that knowledge, their populations will suffer," Jesmer says.

Wildlife conservation isn't just about raising the numbers on a population count. It's also an act of cultural preservation. When rangers stop poachers from killing an elephant matriarch, they're also saving her memories. When conservationists preserve routes over which bighorn sheep can travel, they're keeping the animals' traditional knowledge alive for future generations.

Cultural losses are harder to see than disappearing habitats or declining populations, but they're no less important, says Isabelle-Anne Bisson from the Smithsonian Conservation Biology Institute. "It's another angle that's crucial to document, in the face of unprecedented landscape and climate changes," she said. Humans have increasingly parceled the landscape into smaller and smaller chunks. We lay roads, erect fences, and build towns—all of which restrict the movements of wild animals and make migration more challenging.

Recognizing these problems, conservationists have increasingly tried to modify fences, create overpasses, and minimize development along so-called migration corridors. But Kauffman emphasizes that these corridors aren't real physical things, like tracks or roads. "The corridor exists in *the minds* of these animals," he says. "If you sever it with a highway and then un-sever it with an overpass, the animals wouldn't necessarily immediately start using it again, because they wouldn't automatically have the memory of it. They'd need to relearn."

http://bit.ly/2wT3iLX

New research suggest Pluto should be reclassified as a planet

The reason Pluto lost its planet status is not valid, according to new research from the University of Central Florida in Orlando.

In 2006, the International Astronomical Union, a global group of astronomy experts, established a definition of a planet that required it to "clear" its orbit, or in other words, be the largest gravitational force in its orbit.

Since Neptune's gravity influences its neighboring planet Pluto, and Pluto shares its orbit with frozen gases and objects in the Kuiper belt, that meant Pluto was out of planet status. However, in a new study published online Wednesday in the journal Icarus, UCF planetary scientist Philip Metzger, who is with the university's Florida Space Institute, reported that this standard for classifying planets is not supported in the research literature.

Should Pluto be reclassified a planet again? UCF scientist Philip Metzger says yes based on his research. **NASA**

Metzger, who is lead author on the study, reviewed scientific literature from the past 200 years and found only one publication - from 1802 - that used the clearing-orbit requirement to classify planets, and it was based on since-disproven reasoning.

He said moons such as Saturn's Titan and Jupiter's Europa have been routinely called planets by planetary scientists since the time of Galileo.

"The IAU definition would say that the fundamental object of planetary science, the planet, is supposed to be a defined on the basis of a concept that nobody uses in their research," Metzger said. "And it would leave out the second-most complex, interesting planet in our solar system."

"We now have a list of well over 100 recent examples of planetary scientists using the word planet in a way that violates the IAU definition, but they are doing it because it's functionally useful," he said.

"It's a sloppy definition," Metzger said of the IAU's definition. "They didn't say what they meant by clearing their orbit. If you take that literally, then there are no planets, because no planet clears its orbit."

The planetary scientist said that the literature review showed that the real division between planets and other celestial bodies, such as asteroids, occurred in the early 1950s when Gerard Kuiper published a paper that made the distinction based on how they were formed.

However, even this reason is no longer considered a factor that determines if a celestial body is a planet, Metzger said.

Study co-author Kirby Runyon, with Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland, said the IAU's definition was erroneous since the literature review showed that clearing orbit is not a standard that is used for distinguishing asteroids from planets, as the IAU claimed when crafting the 2006 definition of planets.

"We showed that this is a false historical claim," Runyon said. "It is therefore fallacious to apply the same reasoning to Pluto," he said.

Metzger said that the definition of a planet should be based on its intrinsic properties, rather than ones that can change, such as the dynamics of a planet's orbit.

"Dynamics are not constant, they are constantly changing," Metzger said. "So, they are not the fundamental description of a body, they are just the occupation of a body at a current era."

Instead, Metzger recommends classifying a planet based on if it is large enough that its gravity allows it to become spherical in shape.

"And that's not just an arbitrary definition, Metzger said. "It turns out this is an important milestone in the evolution of a planetary body, because apparently when it happens, it initiates active geology in the body."

Pluto, for instance, has an underground ocean, a multilayer atmosphere, organic compounds, evidence of ancient lakes and multiple moons, he said.

"It's more dynamic and alive than Mars," Metzger said. "The only planet that has more complex geology is the Earth."

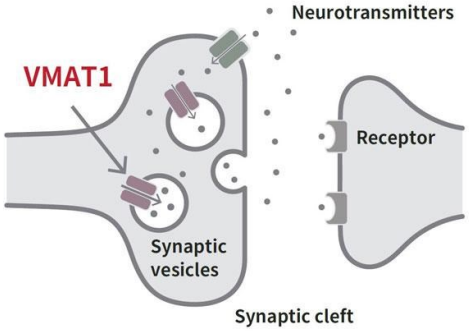
Co-authors on the research included Mark Sykes, of the Planetary Science Institute; Alan Stern, of the Southwest Research Institute; and Runyon of Johns Hopkins University Applied Physics Laboratory.

http://bit.ly/2wYBWEq

Evolution of psychiatric disorders and human personality traits

Evolution of a gene related to human-unique characteristics such as highly social behavior, languages and complex culture

How and why human-unique characteristics such as highly social behavior, languages and complex culture have evolved is a long-standing question. A research team led by Tohoku University in Japan has revealed the evolution of a gene related to such human-unique psychiatric traits.

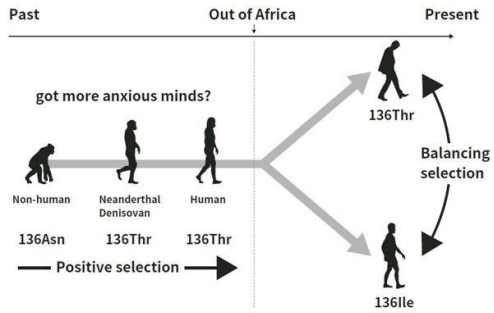


VMAT1 (vesicular monoamine transporter 1) is encoded by the SLC18A1 gene, which is involved in transfer monoamises, such as dopamine and serotonin. **Daiki Sato**

PhD candidate Daiki Sato and Professor Masakado Kawata have discovered SLC18A1 (VMAT1), which encodes vesicular monoamine transporter 1, as one of the genes evolved through natural selection in the human lineage. VMAT1 is mainly involved in the transport of neurochemicals, such as serotonin and dopamine in the body, and its malfunction leads to various psychiatric disorders. VMAT1 has variants consisting of two different amino acids, threonine (136Thr) and isoleucine (136Ile), at site 136.

Several studies have shown that these variants are associated with psychiatric disorders, including schizophrenia, bipolar disorder, anxiety, and neuroticism (a personality trait). It has been known that individuals with 136Thr tend to be more anxious and more depressed and have higher neuroticism scores. They showed that other mammals have 136Asn at this site but 136Thr had been favored over 136Asn during human evolution. Moreover, the 136Ile variant had originated nearly at the Out-of-Africa migration, and then, both 136Thr and 136Ile variants have been positively maintained by natural selection in non-African populations.

The study by Sato and Kawata indicates that natural selection has possibly shaped our psychiatric traits and maintained its diversity. The results provide two important implications for human psychiatric evolution. First, through positive selection, the evolution from Asn to Thr at site 136 on SLC18A1 was favored by natural selection during the evolution from ancestral primates to humans, although individuals with 136Thr are more anxious and have more depressed minds.



Evolutionary changes of VMAT1 during human evolution. **Daiki Sato**

Second, they showed that the two variants of 136Thr and 136Ile have been maintained by natural selection using several population genetic methods. Any form of natural selection that maintains genetic diversity within populations is called "balancing selection". Individual differences in psychiatric traits can be observed in any

human population, and some personality traits are also found in non-human primates. This suggests the possibility that a part of genetic diversity associated with personality traits and/or psychiatric disorders are maintained by balancing selection, although such selective pressure is often weak and difficult to detect.

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How a Cream for Genital Warts Might Also Help with Flu Pandemics

Researchers testing whether a cream commonly used to treat genital warts could also help boost the protection of flu vaccines

By Rachael Rettner, Senior Writer | September 7, 2018 07:38am ET

Genital warts and the flu don't seem to have much in common, other than that they are both caused by viruses. But now, researchers are testing whether a cream that's commonly used to treat genital warts could also help boost the protection of flu vaccines in the event of a pandemic.

In a study that began earlier this summer, researchers at Baylor College of Medicine in Houston will look at whether the cream, called imiquimod, can improve people's immune responses to vaccines against H5N1, a potentially deadly strain of bird flu, according to the National Institutes of Health (NIH).

Currently, H5N1 is very rare in people and does not spread easily. But researchers are concerned that if the virus were to undergo certain genetic changes, it could spread more easily and cause a pandemic, the NIH said in a statement.

That's why scientists have already made a vaccine against H5N1, which is stored in the National Pre-Pandemic Influenza Vaccine Stockpile. But if there were a way to boost the vaccine's effectiveness, researchers could stretch the supply further and vaccinate more people in the event of a pandemic.

Enter imiquimod. The cream activates the part of the body's immune system that helps fight viruses and other pathogens. That's how it helps with genital warts caused by human papillomavirus (HPV), according to Mayo Clinic. Preliminary studies conducted in Hong Kong suggest that the cream may also enhance people's immune response to flu vaccines.

The new study aims to enroll 50 healthy adults who are 18 to 50 years old. Participants will be randomly assigned to receive either imiquimod or a placebo before their flu shot. The cream or placebo will be rubbed into participants' upper arms, and about 5 to 15 minutes later, they will receive a flu shot where the cream was applied. The vaccine will be delivered into the skin using a "microneedle injector," the NIH said.

Participants will then be tracked for seven months and have blood samples taken so that the researchers can evaluate their immune response to the vaccine. The study began in June and researchers hope to have early results by the end of the year.

http://bit.ly/2N0r2J1

Cuba's "Sonic Attack" on the U.S. Embassy Could Have Been Merely Sounds Emitted by a Listening Device

A Penn bioengineer disputes a recent* New York Times *report suggesting microwaves accounted for what occurred at the U.S. embassy in Havana

By Kenneth Foster on September 7, 2018

It reads like a bad spy thriller. Between November 2016 and October 2017, a strange illness afflicted 24 diplomatic staff members working at the U.S. embassy in Havana, Cuba. Employees reported symptoms such as headaches, confusion, hearing loss. They talked about hearing strange sounds, triggering speculation the Cubans were employing a new acoustic weapon to harass embassy employees. Other scientists dismissed the idea of a sonic weapon as impractical. On September 1 science reporter William Broad jumped into this morass with a long article in *The New York Times*. His theory: the

Cubans were employing a microwave weapon against U.S. embassy employees, causing sonic delusions and "very real brain damage". He based his theory on the microwave auditory effect, in which pulses of microwave energy of the sort emitted by radar elicits auditory sensations in exposed individuals.

As the scientist who first proposed the now-accepted explanation of the effect in my 1974 *Science* article, I find the theory wildly implausible. To elicit auditory sensations, individuals must be exposed to intense but brief (microsecond) pulses of microwave energy. The pulses are sufficient to heat brain tissue by a few microdegrees in a few microseconds, and the resulting thermal expansion launches an acoustic wave in the brain that the subject perceives as sound. The acoustic pressures are many orders of magnitude too weak to cause tissue damage. They elicit audible sensations only because of the exquisite sensitivity of the human auditory system, and represent a near-threshold hearing phenomenon. To actually damage the brain, the microwaves would have to be so intense they would actually burn the subject, which has never happened in any of these incidents.

To induce such an effect, one could cobble together a device from a military radar set or a commercial microwave generator, such as the one I used in my original experiments, and then direct a beam at a distant target. But the difficulty of aiming the beam at a person's head some distance away would be daunting. You would have to know exactly where the victim's head is located. You could use a much higher power radar such as that used for airport traffic control and spray the beam over a wide area, but the equipment then would be very large and cumbersome. Microwave antennas could also be embedded within the embassy walls, along with some kind of aiming device, but they would be easy to detect.

But why bother with a device that produces near-threshold hearing sensations? There are simpler ways to harass people if that is the goal. Even now, a year after the incidents were reported, the facts of the matter remain unclear. A follow-up medical examination of 21 of the affected individuals by a neuroscience group led by Doug Smith at the University of Pennsylvania (my colleagues, in fact) found equivocal evidence the individuals had sustained "injury to widespread brain networks". Neuroskeptic, a neuroscientist who blogs anonymously in *Discover* magazine, brutally reviewed the Penn study. The blogger and other critical scientists suggested the findings were statistical artifacts due to the many tests the Penn group employed on the subjects. Other scientists have argued psychological factors were involved instead. Taken together, the results seem too scattered to allow firm conclusions to be drawn.

In October 2017 Josh Lederman and Michael Weissenstein from the Associated Press made recordings available of the sounds that the employees reported hearing. If those indeed were the sounds, that would rule out the microwave auditory effect where the microwave-induced vibrations exist only within the head. Chen Yan, Kevin Fu and Wenyuan Xu (of Zhejiang University and the University of Michigan) showed the sounds in the AP recordings are characteristic of those produced by the interaction of two inaudible ultrasound beams via an effect known as intermodulation distortion. Ultrasound is widely used in burglar detectors, room occupancy sensors and other increasingly common appliances, and some individuals report unpleasant audible sensations from such devices. Intermodulation distortion is increasingly being employed to jam microphones used to record concert music illegally or for eavesdropping. Yan and colleagues report ultrasound can be used for eavesdropping purposes as well, by picking up vibrations in objects produced by human speech.

In short, it is reasonable to guess the sounds were inadvertently produced by ultrasound devices, possibly even spytech, but without malicious intent against the embassy personnel, The incidents

occurred about the time of the 2016 U.S. election, and the Cubans undoubtedly were desperate for intelligence about U.S. intentions.

There is even a historical parallel to the recent incidents: In 1972 it became publicly known the Soviets had been irradiating the U.S. embassy in Moscow with low-level microwave energy from the 1950s through the 1970s. Neither side disclosed the reason for this. (A reasonable guess is the Russians were trying to disrupt U.S. listening equipment or to collect data from their own bugs in the building.) The media published hyperbolic stories about supposed attempts to harm the embassy staff, fueling a generation of speculation about microwave "neurowarfare."

We don't know all the facts about the earlier incidents or the current ones, and no government is likely to provide them. Much of the information available is distinctly anecdotal. The *Times* story is not "fake news" but the real facts of the matter may be quite different from those presented by its distinguished journalist.

https://nyti.ms/2Nn0Rf5

Vaccines Against H.I.V., Malaria and Tuberculosis Unlikely, Study Says

Unless the $3 billion spent annually on research triples, the world may not be able to invent vaccines or rapid cures for many ills of the poor.

By Donald G. McNeil Jr.*

Vaccines against H.I.V., malaria and tuberculosis — three major killers of the world's poor — are unlikely to be produced in the foreseeable future unless vastly more money is committed to finding them, a new study has concluded.

Other worthy goals that appear out of reach for now include a hepatitis C vaccine, a combination vaccine against the four leading causes of deadly diarrhea, a rapid cure for people who have caught tuberculosis and new treatments for a dozen neglected diseases, such as leprosy, dengue fever and sleeping sickness.

To make real progress against this variety of infectious diseases by 2030, the study concluded, the world must increase research spending to nearly $9 billion a year; it now spends only about $3 billion.

But the world is moving in the opposite direction. The combined amount that government donors, private foundations and pharmaceutical companies spend on the cause soared in the early 2000s. But, except for some recent emergency funding of Ebola research, it has slowly declined since the 2009 fiscal crisis.

"The current development pipeline is not likely to give us all the pieces to fight these diseases," said Gavin Yamey, director of Duke University's Center for Policy Impact in Global Health and the study's lead author. "Donors are cutting back on funding at a time when we should be stepping on the gas." The study, which assessed 538 products being developed for 35 diseases afflicting the world's poor, was the first to analyze such a large portfolio.

Asked about it, leaders of two major funders of global health research — the Bill and Melinda Gates Foundation and the National Institute of Allergy and Infectious Diseases — said they agreed with many of its conclusions but thought it was overly pessimistic about prospects for some new inventions, including a tuberculosis vaccine.

The study was funded by the Gates Foundation and the Swiss Agency for Development and Cooperation and published on Gates Open Research, an open access website.

Dr. Trevor Mundel, the foundation's president for global health, said he thought the study was right that prospects were dim for a fully protective H.I.V. vaccine or for a malaria vaccine that worked for more than six months. But even six months' protection would keep newborns alive until their immune systems are stronger, he said.

The foundation still hopes to show that booster doses of BCG, a century-old childhood tuberculosis vaccine, can protect adolescents and that a vaccine candidate it is developing with GlaxoSmithKline,

the pharmaceutical company, will stop latent tuberculosis from becoming active.

Asked why the foundation would pay for a study that was likely to cast a pall on projects it has poured hundreds of millions of dollars into, Dr. Mundel said: “We’re interested in looking at the whole portfolio — it gives you a good baseline.” Rather than discouraging other donors, “I hope it will encourage them,” he said.

Dr. Anthony S. Fauci, director of the N.I.A.I.D., agreed with Dr. Yamey that the world “is behind on what we need to spend.”

The United States accounts for nearly half the $3 billion the world spends annually on such research, and Dr. Fauci’s institute is one of the chief conduits for that money.

But the study’s gloomy conclusions could be misinterpreted, he said. Like Dr. Mundel, he argued that even imperfect vaccines could save lives. “I think the jury’s still out on whether we’ll have a TB vaccine,” he said. In addition, tests on two new H.I.V. vaccines should be finished by 2021. “I don’t think we’ll ever get 98 percent protection as we do with measles, but a vaccine with 50 to 60 percent protection is deployable,” he said.

The study did not try to judge the medical value or odds for success of each invention, but assessed where each was in the development pipeline and how much it typically cost to get similar innovations from conception to launch.

On an optimistic note, the study concluded that about 125 new products are likely to be approved in the next 12 years. Over half will be new diagnostic tests, which do not need years of safety testing.

But the winners are also likely to include vaccines against typhoid and staphylococcus, better combinations of existing drugs for malaria, TB and hepatitis C, better drugs for flu and better flu shots for people age 65 and older.

[*] *Donald G. McNeil Jr. is a science reporter covering epidemics and diseases of the world’s poor. He joined The Times in 1976, and has reported from 60 countries.*

https://wb.md/2NuSC0r

Fewer Deaths After Sepsis Protocol Mandate

Deaths from sepsis declined after state mandate requiring hospitals to follow sepsis care bundles and report on patient outcomes

Veronica Hackethal, MD

Deaths from sepsis declined during the 2 years following implementation of a state mandate requiring hospitals to follow sepsis care bundles and report on patient outcomes, according to a study published online September 7 in the *American Journal of Respiratory and Critical Care Medicine*.

The study results demonstrate "improved care for patients with sepsis as evidenced by increased compliance with performance metrics and decreased risk-adjusted mortality over the first 2 years of the ongoing initiative. A state-wide initiative using regulations and non-financial incentives appears to have substantially changed care," Mitchell M. Levy, MD, from the Division of Pulmonary, Critical Care and Sleep Medicine, Department of Medicine, Alpert Medical School at Brown University, Providence, Rhode Island, and colleagues write.

The mandate required hospitals to develop and submit for approval evidence-based sepsis care bundles, as well as report on sepsis care and patient mortality. Hospitals were allowed to tailor bundles for their specific hospitals, but were required to include the following:

- ***3-hour bundle (all severe sepsis patients): administration of antibiotics and measurement of lactate levels within 3 hours of sepsis diagnosis, with collection of blood cultures before giving antibiotics***
- ***6-hour bundle (for septic shock: systolic blood pressure <90 mmHg, or lactate ≥4 mmol/L): intravenous fluid bolus (300 cc/kg), vasopressors for refractory hypotension, remeasurement of lactate levels within 6 hours of triggering the bundle***

To investigate the impact of the sepsis initiative, the researchers analyzed data on 91,357 adult patients with sepsis and septic shock

(median age, 71 years) seen at 183 hospitals from April 2014 to June 2016.

Results showed that for 81.3% of these patients (n = 74,293), a sepsis bundle was triggered. Use of the 3-hour bundle increased from 53.4% to 64.7% ($P < .001$), and use of the 6-hour bundle among eligible patients increased from 23.9% to 30.8% ($P < .001$).

Among patients who received the sepsis bundle, risk-adjusted mortality decreased from 28.8% before the initiative to 24.4% after it ($P < .001$).

That translates to a 4.4% absolute decrease and a 15% relative decrease in risk-adjusted mortality during the study period.

Hospitals with greater compliance with the sepsis bundles had lower mortality than those with less compliance. Risk-adjusted mortality for the least compliant hospitals was 29.8% vs 23.5% for the most compliant. Also, for hospitals with greater compliance, lengths of stays were shorter.

Although the study cannot prove that the sepsis bundles directly improved mortality, the authors write, "there is reason to believe that this may be the case," particularly because bundle initiation and completion correlated with improved patient outcomes.

History of the Sepsis Mandate

In 2013, New York state introduced the nation's first mandated public reporting initiative for sepsis. The New York state initiative was motivated by the death of 12-year old Rory Staunton, who died from undiagnosed sepsis after developing an infection from a scrape. The issue gained widespread attention from the media, as well as from advocacy groups, the Centers for Medicare & Medicaid Services, and from the governor of New York.

"Governor Andrew Cuomo and then Commissioner of Health Nirav Shah responded to Rory's preventable death by mandating public reporting of sepsis process and outcomes, with the goal of improving earlier diagnosis and management of sepsis," Levy said in a news release.

"The reason the state adopted these particular bundles is that our group had published evidence that there was a strong association between compliance with these interventions and improved survival in sepsis," he added.

"The New York State sepsis initiative provides strong evidence that compliance with sepsis performance measures is associated with improved survival in these critically ill patients," Levy explained. "At least in sepsis, our study strongly supports the value of public reporting of outcomes."

The study was funded by the New York Department of Health. One or more authors report having received grants from one or more of the following organizations: the National Institutes of Health, the Veterans Affairs Health Services Research and Development Investigator-Initiated Research program, and IPRO.

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http://bit.ly/2wV3Php

The synthetic biology revolution is now – here's what that means

We live in an era where biotechnology, information technology, manufacturing and automation all come together to form a capability called synthetic biology.

Claudia Vickers * **Ian Small** **

Technological revolutions are significant because they shape the future of social and cultural development – as is evident for the industrial revolution, the "green revolution", and the information technology revolution.

Now synthetic biology is shaping up to be the dominant technology of this century, and Australia has made clear moves to be on board.

What is synthetic biology?

Synthetic biology is the design and construction of new, standardised biological parts and devices, and getting them to do useful things.

Parts are encoded using DNA and assembled either in a test tube or in living cells – and then applied to deliver many different kinds of outcomes.

"Cell factories" for production of industrial chemicals is one way synthetic biology is applied.

The chemical butanediol is used to make 2.5 million tonnes of plastics and other polymers each year, including half a million tonnes of Spandex (Lycra). In 2011 all of this molecule came from petrochemicals. Biotech and chemical companies Genomatica and BASF collaborated to engineer a commercially viable synthetic biology production route for butanediol – it went from lab to commercial scale in just five years.

Many other global businesses are also investing heavily in the use of whole cells – so-called chassis cells – to produce useful chemicals.

Medicine, the environment and agriculture

Significant medical breakthroughs are happening via synthetic biology. The antimalarial treatment artimisinin can now be produced by yeast, avoiding the need to isolate it from Chinese sweet wormwood plant. This helps to stabilise global prices.

In 2016 a new immune cell engineering treatment resulted in a 50% complete remission rate in terminally ill blood cancer patients, with a 36% remission rate achieved in a 2017 trial. A similar approach has been used just recently to cure an advanced breast cancer.

Biomonitoring is another exciting area for synthetic biology developments. Highly specific, tiny biosensors can be engineered to detect an enormous range of molecules – such as hydrocarbon pollutants, sugars, heavy metals, and antibiotics.

These can be applied to measure aspects of health, and in environmental sensing systems to identify contaminants.

Synthetic biology also has agricultural applications. It can provide more precision and sophistication than earlier gene technologies to help increase crop and livestock yields, while reducing environmental impact by limiting the use of chemicals and fertilisers. More efficient plant use of water and nutrients, photosynthetic performance, nitrogen fixation and better resistance to pests and diseases are all being developed using synthetic biology. Consumer benefits may include nutritional improvements, enhanced flavour and the removal of allergenic proteins from milk, eggs and nuts.

Most of these synthetic biology applications rely on altering, adding or deleting gene functions by targeted genetic modifications. Based on past consumer resistance to genetically modified food products, progress in this area is more likely to be limited by the degree of public acceptance than it is by the technological possibilities.

Synthetic biology also provides the opportunity to use agricultural production systems for cheap, large-scale production of products such as drugs and antibodies for medical treatments.

On the up and up

International growth in synthetic biology is remarkable. In 2015 the synthetic biology component market (DNA parts) was worth $US5.5 billion – by 2020, it will approach $US40 billion. Those figures don't count sales revenue from synthetic biology products.

Product markets are also growing dramatically. In 2008, bio-based chemicals were only 2% of the US$1.2 trillion dollar global chemical market. In 2025, that will rise to 22%, driven by development of synthetic microbial factories.

Government investment into synthetic biology has been very strong over recent years. Road-maps and associated development structures have been developed through public agencies in many advanced economies, including the US, UK, EU, China, Singapore and Finland.

Private investment in synthetic biology is also growing at a remarkable rate. According to the US-based synthetic biology advocacy organisation Synbiobeta, American synbio companies raised around US$200 million in investment in 2009. In 2017 it rose

to US$1.8 billion and as of July 2018 it was already US$1.5 billion, with a projected 2018 investment of just over US$3 billion.

Australia is catching up

In Australia, synthetic biology is less developed – but things are moving fast. In 2014, the professional society Synthetic Biology Australasia formed, and several specialist synthetic biology conferences and workshops have been held.

In 2016, CSIRO invested A$13 million into the CSIRO Synthetic Biology Future Science Platform (SynBioFSP). Internal reporting shows SynBioFSP is now a A$40 million research and development portfolio driven by a collaborative community of over 200 scientists from CSIRO and over 40 national and international partner organisations, contributing to 60 research projects.

Synthetic biology was recognised as a priority area in the 2016 National Research Infrastructure Roadmap. A special call for synthetic biology was made in 2017 and a steering committee to examine Australia's synthetic biology infrastructure needs has recently been created.

This week the Australian Council of Learned Academies released Synthetic Biology in Australia: An Outlook to 2030 as part of its horizon scanning series. We are two of the authors on this report, which examines the opportunities and challenges for getting the most out of synthetic biology in the Australian context.

Synthetic biology is an extremely fast-moving technology with extraordinarily diverse applications. It offers massive potential for Australia in terms of developing new markets, and in future proofing in the long term.

Disclosure statement

Director, Synthetic Biology Future Science Platform, CSIRO

Claudia Vickers receives funding from the Australian Research Council, the Queensland Government, the Human Frontier Science Program, the European Union 7th Framework Programme, The University of Queensland, and CSIRO. She is Director of the CSIRO Synthetic Biology Future Science Platform and a Group Leader at the The University of Queensland's Australian Institute for Bioengineering and Nanotechnology. She was the founding President of Synthetic Biology Australasia and currently serves on the Executive as Immediate Past President. She is a co-author of the ACOLA report 'Synthetic Biology in Australia: An outlook to 2030'. She collaborates with, and provides consulting advice and fee-for-service research for, various industrial biotechnology companies.

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Ian Small receives funding from the Australian Research Council and the international agricultural co-operative group Limagrain. Ian is a Fellow of the Academy of Science and a co-author of the ACOLA report 'Synthetic Biology in Australia: An outlook to 2030'.

http://bit.ly/2CPaLlF

Japan culls livestock after hog cholera outbreak

Japan is suffering its first outbreak of pig cholera in more than 25 years, authorities said Sunday after culling more than 600 animals and suspending pork exports.

A farm in central Japan saw 80 pigs die last week after catching the highly-contagious disease, an agricultural ministry official told AFP.

Early tests showed negative results for classical swine fever, as the illness is officially known. But follow-up tests came out positive Sunday, prompting the cull of all 610 pigs at the farm, he added.

"We are now processing the livestock there and disinfecting the farm," he said, adding that officials had set up sterilisation points on access roads to the affected farm.

The government has set up a team of specialists to analyse possible infection routes, the agricultural ministry said in a statement.

Tokyo halted pork exports after the outbreak was confirmed. The nation sold roughly $9 million in raw pork meat to foreign markets last year. Japan saw its last case of classic swine fever, which does not affect humans, in 1992. The disease continues to rage in many parts of Asia, Europe and Latin America.

http://bit.ly/2Mq97Jc

"Lighthouse Detector" can distinguish between many sources of radiation

The detector can be used to keep workers safe from contaminated areas.

Megan Geuss - 9/10/2018, 4:00 AM

A lighthouse is built to shed light on rocky waters, turning at the top of a tower to illuminate sections of a dark shoreline that might harm incoming boats. Researchers from Los Alamos National Laboratory (LANL) and a company called Quaesta Instruments have drawn from that age-old design and assembled a sort of reverse-lighthouse to detect radiation in an area. Instead of sending light out, a Lighthouse Detector senses when radiation is coming in.

Although most radiation detectors like Geiger counters are omni-directional, the Lighthouse Detector uses a blocking material to allow gamma rays or neutrons to hit a sensor on only one side of the detector. Measurements are taken from all sides, and the Lighthouse Detector sends that information back to a computer that can figure out the direction of the source of radiation. The directional approach to radiation detection also allows the person measuring an area to distinguish between multiple sources of radiation in an area, as well as determine the shape and size of a potentially large area that's emitting radiation.

The detector's ability to ignore background radiation and pinpoint different primary sources of radiation could potentially make it useful to verify materials that are in storage. Alternatively, it can send an alert if certain materials pass a checkpoint. "This applies not only to large power plants or plutonium facilities, it can also extend to cancer centers working with radioactive therapies or academic labs studying materials properties," a report from LANL states.

The latest research on radiation detectors has focused on making them more automated—and more precise. One of these recent developments was RadPiper, a radiation-detecting robot built by Carnegie Mellon University to detect contamination within pipes at a defunct uranium processing facility in Ohio. The Department of Energy estimated that RadPiper would save the Ohio decommissioning process tens of millions of dollars in labor costs, not to mention keeping employees out of a potentially dangerous situation.

The common thread between the Lighthouse Detector and RadPiper is that their precision can speed up cleanup efforts. Highly accurate radiation detectors, preferably placed on top of robots, can pinpoint exactly which areas of a structure are contaminated, allowing cleanup efforts to be focused there, rather than cleaning up a much wider swath of area to greater expense in the hopes of eliminating the radioactive material.

The sensitive part of the Lighthouse Detector is facing down here. **Los Alamos National Laboratory and Quaesta Instruments**

The Lighthouse Detector's creators also hope that the detector will be used to designate "safe" areas. "Conversely, it is just as significant to verify that a specific area is free of radioactive materials," LANL writes. This is possibly for the detector to do, "even among high levels of noise."

It's a long way from wearing a strip of unexposed film, a common practice among people who handled radioactive materials in the 1950s. Radiation would expose parts of the film, so workers would know, after the fact, if they had had too much exposure themselves.

Currently, the Lighthouse Detector is a few steps away from being available to the public, but Jonathan Dowell, a LANL scientist and the Lighthouse Detector project lead, tells Ars that the technology is in quite advanced stages. Researchers have tested it at the Trinity Nuclear Test Site in New Mexico, and they plan on running additional tests on the sea floor to show that the machinery works in the most challenging of environments.