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Quick test finds signs of sepsis in a single drop of blood

A new portable device can quickly find markers of deadly, unpredictable sepsis infection from a single drop of blood.

CHAMPAIGN, Ill. - A team of researchers from the University of Illinois and Carle Foundation Hospital in Urbana, Illinois, completed a clinical study of the device, which is the first to provide rapid, point-of-care measurement of the immune system's response, without any need to process the blood.

This can help doctors identify sepsis at its onset, monitor infected patients and could even point to a prognosis, said research team leader Rashid Bashir, a professor of bioengineering at the U. of I. and the interim vice dean of the Carle Illinois College of Medicine. The researchers published their findings in the journal Nature Communications.

Sepsis is triggered by an infection in the body. The body's immune system releases chemicals that fight the infection, but also cause widespread inflammation that can rapidly lead to organ failure and death. Sepsis strikes roughly 20 percent of patients admitted to hospital intensive care units, yet it is difficult to predict the inflammatory response in time to prevent organ failure, said Dr. Karen White, an intensive care physician at Carle Foundation Hospital. White led the clinical side of the study.

"Sepsis is one of the most serious, life-threatening problems in the ICU. It can become deadly quickly, so a bedside test that can monitor patient's inflammatory status in real time would help us treat it sooner with better accuracy," White said.

Sepsis is routinely detected by monitoring patients' vital signs - blood pressure, oxygen levels, temperature and others. If a patient shows signs of being septic, the doctors try to identify the source of the infection with blood cultures and other tests that can take days - time the patient may not have. The new device takes a different approach.

"We are looking at the immune response, rather than focusing on identifying the source of the infection," Bashir said. "One person's immune system might respond differently from somebody else's to the same infection. In some cases, the immune system will respond before the infection is detectable. This test can complement bacterial detection and identification. We think we need both approaches: detect the pathogen, but also monitor the immune response."

The small, lab-on-a-chip device counts white blood cells in total as well as specific white blood cells called neutrophils, and measures a protein marker called CD64 on the surface of neutrophils. The levels of CD64 surge as the patient's immune response increases.

The researchers tested the device with blood samples from Carle patients in the ICU and emergency room. When a physician suspected infection and ordered a blood test, a small drop of the blood drawn was given to the researchers, stripped of identifying information to preserve patient confidentiality. The team was able to monitor CD64 levels over time, correlating them with the patient's vital signs. Researchers found that the results from the rapid test correlated well with the results from the traditional tests and with the patients' vital signs. "By measuring the CD64 and the white cell counts, we were able to correlate the diagnosis and progress of the patient - whether they were improving or not," said Umer Hassan, a postdoctoral researcher at Illinois and the first author of the study. "We hope that this technology will be able to not only diagnose the patient but also provide a prognosis. We have more work to do on that."

Bashir's team is working to incorporate measurements for other inflammation markers into the rapid-testing device to give a more complete picture of the body's response, and to enable earlier detection. They also have a startup company, Prenosis Inc., that is working to commercialize the device. "We want to move the diagnosis point backward in time," Bashir said. "The big challenge in sepsis is that no one knows when you get infected. Usually you go to the

hospital when you already feel sick. So the goal is that someday you can be testing this at home, to detect infection even earlier if you can."

The Center for Integration of Medicine and Innovative Technology Innovation in Boston supported this work through a Point-of-Care Technology Research Center in Primary Care grant. Additional support came from Carle Foundation Hospital and the University of Illinois.

Editor's notes: To reach Rashid Bashir, call 217-333-1867; email rbashir@illinois.edu.

The paper "A Point-of-Care Microfluidic Biochip for Quantification of CD64 Expression from Whole Blood for Sepsis Stratification" is available from the U. of I. News Bureau. DOI: 10.1038/NCOMMS15949

http://bit.ly/2uSzNHy

Generic drug prices increase when market competition decreases

Decreased market competition causes generic drug prices to rise significantly, according to an article published in Annals of Internal Medicine.

This trend appears likely to continue unless policies are enacted to stabilize generic drug markets in response to a decrease in competition. Prices for some generic drugs have increased in recent years, adversely affecting patients who rely on them. One review found that the price of digoxin (a commonly prescribed heart medication) increased by 2,800 percent in a single year. Many factors have been linked to these price increases, including shortages in the manufacturing supply chain (leading to reduced production) and a reduction in the number of manufacturers of a drug (resulting in insufficient competition). Although increases in generic drug prices are thought to be the result of insufficient competition, no study has examined this relationship.

Investigators studied prescription drug claims from commercial health plans between 2008 and 2013 to determine the association between market competition levels and changes in generic drug prices. Based on 1.08 billion prescription claims, a cohort of 1,120 generic drugs was identified. The drugs were categorized as having high, medium, or low competition levels. After controlling for other factors, a generic drug in the highest marketing competition group was expected to see a decrease of 32 percent in price over the study period, while a generic drug in the lowest market competition was expected to see a price increase of 47 percent over the same period. In addition, researchers found low market competition levels had a more pronounced correlation with drug prices in lower-priced generic drugs compared with their higher-priced counterparts.

The authors suggest that understanding the connection between competition and price may be helpful in identifying older prescription drugs at higher risk for price change in the future.

Abstract: http://annals.org/aim/article/doi/10.7326/M16-1432

http://bit.ly/2uSqBcZ

Blood of SIDS infants contains high levels of serotonin

Findings from NIH-funded study could provide basis for forensic SIDS test

Blood samples from infants who died of Sudden Infant Death Syndrome (SIDS) had high levels of serotonin, a chemical that carries signals along and between nerves, according to a study funded in part by the National Institutes of Health. The finding raises the possibility that a test could be developed to distinguish SIDS cases from other causes of sleep-related, unexpected infant death. The study, led by Robin L. Haynes, Ph.D., of Boston Children's Hospital and Harvard Medical School, appears in the Proceedings of the National Academy of Sciences. NIH's Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) provided funding for the work.

SIDS is the sudden death of an infant under one year of age that remains unexplained after a complete autopsy and death scene investigation. In the current study, researchers reported that 31 percent of SIDS infants (19 of 61) had elevated blood levels of serotonin. In previous studies, the researchers reported multiple serotonin-related brain abnormalities in SIDS cases, including a decrease in serotonin in regions involved in breathing, heart rate patterns, blood pressure, temperature regulation, and arousal during sleep.

Taken together, the researchers wrote, the findings suggest that an abnormality in serotonin metabolism could indicate an underlying vulnerability that increases SIDS risk and that testing blood samples for serotonin could distinguish certain SIDS cases from other infant deaths. However, they caution that more research is needed.

NICHD's Safe to Sleep campaign provides information on ways to reduce the risk of SIDS and other sleep-related causes of infant death.

Rosemary Higgins, M.D., of the NICHD Pregnancy and Perinatology Branch, which oversaw the study, is available for comment.

Haynes, RL, et al. High Serum Serotonin in Sudden Infant Death Syndrome. Proceedings of the National Academy of Sciences.

http://bbc.in/2sUBG54

Frog evolution linked to dinosaur asteroid strike

The huge diversity of frogs we see today is mainly a consequence of the asteroid strike that killed off the dinosaurs, a study suggests.

A new analysis shows that frog populations exploded after the extinction event 66 million years ago. It would appear to contradict earlier evidence suggesting a much more ancient origin for many key frog groups. The work by a US-Chinese team of researchers is outlined in the journal PNAS.

The green-and-black poison dart frog is native to Central America and the north-west part of South America **Science Photo Library**

Frogs became one of the most diverse groups of vertebrates, with more than 6,700 described species. But a lack of genetic data has hampered efforts to trace their evolutionary history.

The new study shows that three major lineages of modern frogs - which together comprise about 88% of living frog species - appeared almost simultaneously. This impressive diversification of species appears to have occurred on the heels of the asteroid, which struck what is now the edge of the Yucatan Peninsula in Mexico.

Releasing upwards of a billion times more energy than an atom bomb, the space impact wiped out three-quarters of all life on Earth. But it also appears to have set the stage for the rise of frogs.

The scientists sampled a core set of 95 genes from the DNA of 156 frog species. They then combined this data with genetic information from an additional 145 species to produce a detailed "family tree" of frogs, based on their genetic relationships.

Using frog fossils to provide "ground truth" for the genetic data, the researchers were able to add a timeline to their family tree. The three biggest frog groups - the hyloidea, microhylidae and the natatanura - all trace their origins to an expansion that occurred after 66 million years ago.

"Nobody had seen this result before," said co-author Peng Zhang, from Sun Yat-Sen University in Guangzhou, China. "We re-did the analysis using different parameter settings, but the result remained the same. I realised the signal was very strong in our data. What I saw could not be a false thing."

Another author, David Blackburn, from the Florida Museum of Natural History, explained: "Frogs have been around for well over 200 million years, but this study shows it wasn't until the extinction of the dinosaurs that we had this burst of frog diversity that resulted in the vast majority of frogs we see today." Dr Blackburn said the speed at which frogs diversified after the impact suggests that the survivors were probably filling up new ecological niches.

The Chicxulub event would have destroyed a large proportion of the vegetation on Earth. But as forests began to recover after the event, frogs seem to have been one of the groups that made the most of the new habitats.

The researchers point out that none of the frog lineages that originate before the extinction and survive through the asteroid impact happen to be adapted to living in trees. "All origins of arboreality (e.g. within hyloids or natatanurans) follow the [Chicxulub extinction event]," the authors write in their PNAS paper. This, they argue "supports the

hypothesis that the [Chicxulub] mass extinction shaped the current diversity of frogs".

The study also indicates that global frog distribution tracks the break-up of the supercontinents, beginning with Pangaea about 200 million years ago and then Gondwana, which split into South America and Africa.

The fire-bellied toad (actually a frog) belongs to a minority of frogs whose lineages arose before the extinction event **Science Photo Library**

The data suggests frogs likely used Antarctica, not yet encased in ice sheets, as a stepping stone from South America to Australia.

"I think the most exciting thing about our study is that we show that frogs are such a strong animal group. They survived... the mass extinction that completely erased dinosaurs," said Peng Zhang.

However, frogs - like other amphibians - face many challenges today, including habitat loss due to logging and diseases such as the chytrid fungus and ranavirus.

http://bit.ly/2uSCbOq

Shingles increases risk of heart attack, stroke

Study says it's important patients with shingles are made aware of heart disease risk

Contracting shingles, a reactivation of the chickenpox virus, increases a person's risk of stroke and heart attack, according to a research letter published today in the Journal of the American College of Cardiology.

According to the Centers for Disease Control and Prevention, almost 1 out of every 3 people in the United States will develop shingles in their lifetime. Anyone who has suffered from chickenpox may develop shingles; however, the risk of shingles increases as a person gets older.

Researchers in South Korea used the National Health Insurance Service's "medical check-up" database to identify patients with newly diagnosed herpes zoster--or shingles, stroke and heart attack using the relevant International Classification of Disease-10 diagnostics codes.

A total of 519,880 patients were followed from 2003-2013, during this period there were 23,233 cases of shingles. The final cohort of 23,213 was matched with the same number of shingles-free patients to serve as control subjects.

Patients with shingles were more likely to be female and common risk factors for stroke and heart attack, such as old age, high blood pressure, diabetes and high cholesterol, were also more commonly seen in these patients. However, this group was also less likely to smoke, have a lower alcohol intake, more exercise and be part of a higher socioeconomic class.

Shingles was found to raise the risk of a composite of cardiovascular events including heart attack and stroke by 41 percent, the risk of stroke by 35 percent and the risk of heart attack by 59 percent. The risk for stroke was highest in those under 40 years old, a relatively younger population with fewer risks for atherosclerosis. The risks of both stroke and heart attack were highest the first year after the onset of shingles and decreased with time. However, these risks were evenly distributed in the shingles-free group.

"While these findings require further study into the mechanism that causes shingles patients to have an increased risk of heart attack and stroke, it is important that physicians treating these patients make them aware of their increased risk," said Sung-Han Kim, MD, PhD, a physician in the department of infectious diseases at Asan Medical Center in Seoul and one of the study authors.

http://nyti.ms/2tpH5EL

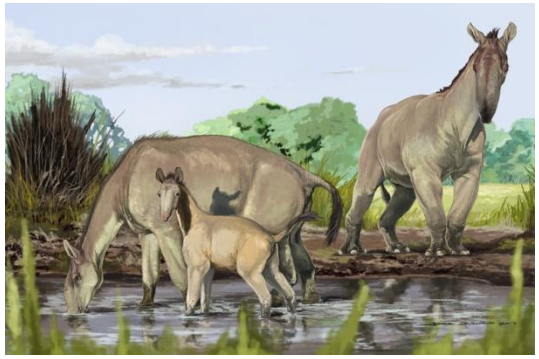
Strange Mammals That Stumped Darwin Finally Find a Home

It looked like many different animals and, at the same time, like no other animal at all.

By STEPH YIN JULY 3, 2017

From afar, you might think it was a large, humpless camel. Tall, stout legs ending in rhino feet carried a body weight potentially equal to that of a small car. Its neck stretched like a giraffe's before giving way to a face resembling a saiga antelope's. From this face extended a fleshy protuberance, similar to a mini elephant trunk or a tapir's proboscis.

When Charles Darwin first found its fossils in southern Patagonia during his Beagle voyage, he was baffled. He sent specimens to Richard Owen, an English paleontologist, who guessed the animal was a gigantic, llamalike beast and named it Macrauchenia, meaning "large llama."



Fossils of Macrauchenia patachonica, as depicted in this artist's reconstruction, baffled Darwin. The odd mammals disappeared about 12,000 years ago. **Jorge Blanco**

Since then, many researchers have taken a stab at pinning Macrauchenia to the tree of life. Their speculations differed wildly, grouping the extinct beasts with animals as varied as elephants and aardvarks or camels and hippos.

Now, 180 years after Darwin's discovery, scientists have confirmed that Macrauchenia were distant relatives of horses, rhinos and tapirs, members of a group known as Perissodactyla. In a study published last week in Nature Communications, the researchers estimated that Macrauchenia diverged from Perissodactyla between 56 million and 78 million years ago.

A group that "was basically homeless has now found its place," said Michael Hofreiter, a professor of genomics at the University of Potsdam in Germany and an author of the study.

Macrauchenia were herbivores that roamed open, grassy spaces across South America before disappearing with many other megafauna at the end of the last ice age, around 12,000 years ago. Over the years, paleontologists and excavators have found a fair number of Macrauchenia fossils, but studying bones and teeth alone has been misleading because the animals had such a jumble of traits, said Ross MacPhee, a curator at the American Museum of Natural History in Manhattan and another author of the study.

To gain a deeper understanding, Dr. Hofreiter, Dr. MacPhee and their colleagues turned to DNA. The team managed to find one toe bone, from a cave in southern Chile, that had enough Macrauchenia DNA to study.

When reconstructing ancient DNA sequences, scientists typically use the genome of a closely related living relative as a scaffold. But Macrauchenia doesn't have any close living relatives.

Instead, the researchers compared around 20,000 mitochondrial DNA snippets from their bone sample with the mitochondrial genomes of horses, rhinos, tapirs and wild llamas.

Dr. Hofreiter compared the process to assembling a jigsaw puzzle, under these conditions: You don't have the final picture you're constructing, but you have several pictures that are somewhat similar to help you place your pieces.

The researchers reconstructed about 80 percent of Macrauchenia's mitochondrial genome. Until now, Dr. Hofreiter said, "nobody had reconstructed an ancient DNA sequence where the next closest living relative was so distant."

By comparing this so-called mitogenome with the mitogenomes of many mammals, his team was able to place Macrauchenia as sister to Perissodactyla on the evolutionary tree.

The new findings largely confirmed those from a 2015 study, in which a group of scientists (including Dr. Hofreiter and Dr. MacPhee) studied Macrauchenia through ancient proteins.

The fact that "two entirely different approaches gave the same story is pretty convincing," said Matthew Collins, a bioarchaeologist at the University of York in Britain. Dr. Collins, an author of the 2015 study, was not involved in the current research.

In the future, as tools for studying ancient DNA continue to improve, scientists will be able to unlock the genetic sequences of more and more extinct species that inhabited warm climates, where DNA degrades quickly, Dr. MacPhee said. “That’s going to make a huge difference in how we understand the past,” he said.

http://bit.ly/2tpq3xe

Popular heartburn drugs linked to higher death risk

Risk increases the longer the drugs are used

Popular heartburn drugs called proton pump inhibitors (PPIs) have been linked to a variety of health problems, including serious kidney damage, bone fractures and dementia. Now, a new study from Washington University School of Medicine in St. Louis shows that longtime use of the drugs also is associated with an increased risk of death.

Millions of U.S. residents take proton pump inhibitors which are widely prescribed to treat heartburn, ulcers and other gastrointestinal problems. The drugs also are available over the counter under brand names that include Prevacid, Prilosec and Nexium.

For the study, the researchers examined medical records of some 275,000 users of PPIs and nearly 75,000 people who took another class of drugs - known as H2 blockers - to reduce stomach acid. The research is published online July 3 in the journal BMJ Open.

"No matter how we sliced and diced the data from this large data set, we saw the same thing: There's an increased risk of death among PPI users," said senior author Ziyad Al-Aly, MD, an assistant professor of medicine. "For example, when we compared patients taking H2 blockers with those taking PPIs for one to two years, we found those on PPIs had a 50 percent increased risk of dying over the next five years. People have the idea that PPIs are very safe because they are readily available, but there are real risks to taking these drugs, particularly for long periods of time."

Both PPIs and H2 blockers are prescribed for serious medical conditions such as upper gastrointestinal tract bleeding, gastroesophageal reflux disease and esophageal cancer. Over-the-counter PPIs are most often used for heartburn and indigestion.

PPIs have become one of the most commonly used classes of drugs in the United States with 15 million monthly prescriptions in 2015 for Nexium alone, according to WebMD.

A kidney doctor by profession, Al-Aly has previously published studies linking PPIs to kidney disease, and other researchers have shown an association with other health problems. Al-Aly, first author Yan Xie, PhD, a data scientist, and colleagues reasoned that since each of these side effects carries a small risk of death, together they may affect the mortality rate of PPI users.

To find out, the researchers sifted through millions of de-identified veterans' medical records in a database maintained by the U.S. Department of Veterans Affairs. They identified 275,933 people who had been prescribed a PPI and 73,355 people prescribed an H2 blocker between October 2006 and September 2008, and noted how many died and when over the following five years. The database did not include information on cause of death.

Al-Aly and colleagues found a 25 percent increased risk of death in the PPI group compared with the H2 blocker group. The researchers calculate that, for every 500 people taking PPIs for a year, there is one extra death that would not have otherwise occurred. Given the millions of people who take PPIs regularly, this could translate into thousands of excess deaths every year, Al-Aly said.

The researchers also calculated the risk of death in people who were prescribed PPIs or H2 blockers despite not having the gastrointestinal conditions for which the drugs are recommended. Here, the researchers found that people who took PPIs had a 24 percent increased risk of death compared with people taking H2 blockers.

Further, the risk rose steadily the longer people used the drugs. After 30 days, the risk of death in the PPI and H2 blocker groups was not significantly different, but among people taking the drugs for one to two years, the risk to PPI users was nearly 50 percent higher than that

of H2 blocker users. Although the recommended treatment regimen for most PPIs is short - two to eight weeks for ulcers, for example - many people end up taking the drugs for months or years.

"A lot of times people get prescribed PPIs for a good medical reason, but then doctors don't stop it and patients just keep getting refill after refill after refill," Al-Aly said. "There needs to be periodic re-assessments as to whether people need to be on these. Most of the time, people aren't going to need to be on PPIs for a year or two or three."

As compared with the H2 blocker group, people in the PPI group were older (64 years old, on average, versus 61) and also somewhat sicker, with higher rates of diabetes, hypertension and cardiovascular disease. But these differences cannot fully account for the increased risk of death since the risk remained even when the researchers statistically controlled for age and illness.

Over-the-counter PPIs contain the same chemical compounds as in prescription PPIs, just at lower doses, and there is no way to know how long people stay on them. The Food and Drug Administration recommends taking PPIs no longer than four weeks before consulting a doctor.

Al-Aly emphasizes that deciding whether to take a PPI requires a risk-benefit calculation. "PPIs save lives," Al-Aly said. "If I needed a PPI, I absolutely would take it. But I wouldn't take it willy-nilly if I didn't need it. And I would want my doctor to be monitoring me carefully and take me off it the moment it was no longer needed."

http://nyti.ms/2tWVcSQ

In Neanderthal DNA, Signs of a Mysterious Human Migration

With fossils and DNA, scientists are piecing together a picture of humanity's beginnings, an origin story with more twists than anything you would find at the movie theater.

Carl Zimmer

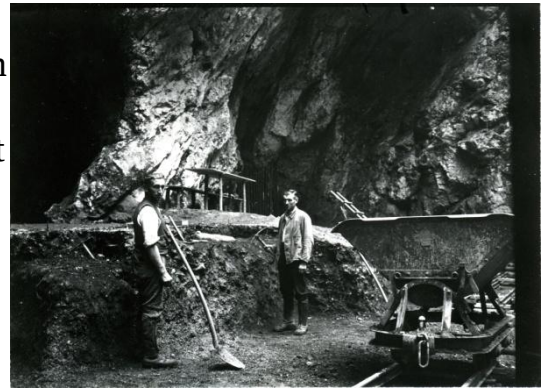
The expert consensus now is that Homo sapiens evolved at least 300,000 years ago in Africa. Only much later — roughly 70,000 years ago — did a small group of Africans establish themselves on other continents, giving rise to other populations of people today.

Part of a femur, or thigh bone, from a Neanderthal that was discovered in the Hohlenstein-Stadel cave in Germany. **Oleg Kuchar/Museum Ulm**

To Johannes Krause, the director of the Max Planck Institute for Human History in Germany, that gap seems peculiar. "Why did people not leave Africa before?" he asked in an interview. After all, he observed, the continent is physically linked to the Near East. "You could have just walked out."

In a study published Tuesday in Nature Communications, Dr. Krause and his colleagues report that Africans did indeed walk out — over 270,000 years ago.

Based on newly discovered DNA in fossils, the researchers conclude that a wave of early Homo sapiens, or close relatives of our species, made their way from Africa to Europe. There, they interbred with Neanderthals. Then the ancient African migrants disappeared. But some of their DNA endured in later generations of Neanderthals. "This is now a comprehensive picture," Dr. Krause said. "It brings everything together."



Excavations at the entrance of the Hohlenstein-Stadel cave in 1937, the year when the Neanderthal femur was found. **Museum Ulm**

Since the 1800s, paleontologists have struggled to understand how Neanderthals are related to us. Fossils show that they were

anatomically distinct, with a heavy brow, a stout body and a number of subtler features that we lack.

The oldest bones of Neanderthal-like individuals, found in a Spanish cave called Sima de los Huesos, date back 430,000 years. More recent Neanderthal remains, dating to about 100,000 years ago, can be found across Europe and all the way to southern Siberia. Then, 40,000 years ago, Neanderthals vanish from the fossil record.

As a graduate student in the mid-2000s, Dr. Krause traveled to museums to drill bits of bone from Neanderthal fossils. In some of them, he and his colleagues managed to find fragments of DNA that they could study.

Scientists who study ancient genes search for two kinds of genetic material. The vast majority of our genes are in a pouch in each cell called the nucleus. We inherit so-called nuclear DNA from both parents.

But we also carry a small amount of DNA in the fuel-generating factories of our cells, called mitochondria. We inherit mitochondrial DNA only from our mothers, because a father's sperm destroys its own mitochondrial DNA during fertilization.

Years ago, Dr. Krause and his colleagues started their search for ancient Neanderthal genes in a fossil by looking for mitochondrial DNA. After discovering mitochondrial DNA in some fossils, they later managed to find nuclear DNA.

The genes held some surprises. For example, bits of DNA in living people of non-African ancestry come from Neanderthals. When modern humans expanded out of Africa, they seem to have interbred several times with Neanderthals.

Those children became part of human society, passing on their genes.

But a finger bone and a tooth from a Siberian cave called Denisova left Dr. Krause and his colleagues with a baffling puzzle.

Inside those fossils, the scientists found sequences of mitochondrial DNA that were not human or Neanderthal, but something else — a distant branch of the family tree. The Neanderthal mitochondrial DNA was much closer to our own.

Later, the researchers managed to recover the nuclear DNA from the Denisovan finger bone, which showed Denisovans and Neanderthals were more closely related to each other.

As scientists found ancient DNA in more fossils, our history has come into sharper focus. Scientists now estimate that the common ancestor of modern humans, Neanderthals and Denisovans, lived between 765,000 and 550,000 years ago.

About 445,000 to 473,000 years ago, that common ancestor's descendants split into two lineages. One eventually led to modern humans, while the other led to Neanderthals and Denisovans.

After years of investigation, however, Dr. Krause still did not understand why the nuclear DNA and mitochondrial DNA of Neanderthals seemed to have different histories. The former pointed to a link with Denisovans, the latter to humans.

The entrance to the Hohlenstein-Stadel cave seen recently. In 2013, a researcher examined a Neanderthal fossil from the cave and was able to reconstruct all of its mitochondrial DNA. **Wolfgang Adler/Museum Ulm**

The mystery only deepened in 2013. Another team of researchers retrieved mitochondrial DNA from a Neanderthal-like fossil at Sima de los Huesos, dating back 430,000 years.

The researchers had expected the DNA to resemble that of later Neanderthals in Europe. Instead, the mitochondrial DNA looked like it belonged to Denisovans — even though the Denisova cave was 4,000 miles away in Siberia.

Last year, the researchers announced they had gathered a small fraction of the nuclear DNA from the same Sima de los Huesos fossil. That genetic material looked like it belonged to a Neanderthal, not a Denisovan.

Dr. Krause and his colleagues have now discovered new Neanderthal DNA that they believe can solve the mystery of this genetic mismatch.

In 2013, one of Dr. Krause's graduate students, Cosimo Posth, examined a Neanderthal fossil from a German cave called Hohlenstein-Stadel. He was able to reconstruct all of its mitochondrial DNA.

Dr. Posth estimated that the Neanderthal fossil was 120,000 years old and, more important, that it belonged to a branch of the Neanderthal family tree with a long history. He and his colleagues determined that all known Neanderthals inherited their mitochondrial DNA from an ancestor who lived 270,000 years ago.

All the data pointed to a sequence of events that could solve the puzzle that had bedeviled Dr. Krause for so long.

The common ancestors of Neanderthals and Denisovans spread across Europe and Asia over half a million years ago. Gradually the eastern and western populations parted ways, genetically speaking. In the east, they became Denisovans. In the west, they became Neanderthals. The 430,000-year-old fossils at Sima de los Huesos - Neanderthals with Denisovanlike genes - capture the early stage of that split.

At some point before 270,000 years ago, African humans closely related to us moved into Europe and interbred with Neanderthals. Their DNA entered the Neanderthal gene pool.

Over many generations, most of that new DNA disappeared. But the mitochondrial DNA survived, passed down from mothers to their children. In fact, eventually all the Neanderthals inherited it, for some reason discarding the mitochondrial DNA that the species once had.

Dr. Posth said it was possible that early members of our own species moved from North Africa into Europe. Supporting this idea was the discovery reported last month of fossils of Homo sapiens in Morocco dating back 300,000 years.

But Dr. Posth said it was too soon to rule out another possibility: that these migrants belonged to another species in Africa closely related to us that scientists have yet to document. "I feel uncomfortable to give a name to these humans," Dr. Posth said.

Adam C. Siepel, a geneticist at Cold Spring Harbor Laboratory on Long Island who was not involved in the new study, said the hypothesis fit the evidence. "I think that's absolutely possible," he said.

The new study raises a host of tantalizing implications about human history. It is not possible to know just how many times these early Africans interbred with Neanderthals. But somewhere in prehistory, at least one female human from Africa must have carried the child of a male Neanderthal. "Now you have this hybrid child, which is probably pretty unusual-looking," Dr. Siepel said. "One way or another, this hybrid individual was absorbed into Neanderthal society."

Dr. Siepel warned that the hypothesis hinges on the new DNA found in the Hohlenstein-Stadel fossil. Dr. Krause and his colleagues are now trying to retrieve nuclear DNA from the fossil.

The research at Sima de los Huesos shows just how far back in time scientists can now search for genes. The most revealing DNA might come from the mountains of Morocco.

There, scientists may be able to find genes from the earliest Homo sapiens, which they can then compare to Neanderthals'. "These are things that I never thought possible five years ago," Dr. Krause said.

http://bbc.in/2sXpnoP

Extreme gardening to help tackle malaria

Gardening could be a powerful weapon against malaria, culling mosquito populations by cutting off their food supply, say researchers.

By Michelle Roberts Health editor, BBC News online

A team tested their idea in nine villages in the arid Bandiagara district of Mali, West Africa. Removing flowers from a common shrub appeared to kill off lots of the older, adult, female, biting insects that transmit malaria. Without enough nectar the "granny" mosquitoes starve, experts believe.

Killing granny

Getting rid of the mature females can stop the cycle of malaria transmission. These Anopheles mosquitoes carry the malaria parasite in their salivary glands and pass it on to people when they bite and draw blood.

The Prosopis juliflora shrub occupies millions of hectares of Africa **Malaria Journal**

The infected person can then infect other younger, biting, female mosquitoes - which are looking for a rich blood meal as they become fertile and make eggs - because their blood now contains the parasite.

It takes about 10 days for a newly infected young female mosquito to become contagious to humans. That may not sound long, but for an insect, it is. By the time she can transmit malaria, she's pretty old.

Although she will feed on blood, she also relies on flower nectar for energy to stay alive.

Shrubbery

In the Bandiagara district of Mali, there is one invasive plant that researchers believe is a feeding ground for malaria-transmitting mosquitoes. The flowering Prosopis juliflora shrub is a bit of a horticultural thug and now occupies millions of hectares of the African continent. Native to Central and South America, it was introduced into Africa in the late 1970s in an attempt to reverse deforestation and "green up" the desert.

Experts in Mali, along with researchers from the Hebrew University of Hadassah Medical School, Israel, and the University of Miami in the US, set up a horticultural experiment to see if removing the flowers from this plant might help kill off local mosquitoes. They picked nine villages - six with lots of the flowering shrub and three without. In three of the six villages, they hacked down the flowers. They set light traps around all the villages to catch mosquitoes so they could see if the "gardening" had helped cull the insects.

Villages where they removed the flowers saw mosquito numbers collected in the traps fall - the total number of mosquitoes across these villages decreased by nearly 60% after removal of the flowers. Importantly, the number of old female mosquitoes dropped to similar levels recorded in the three villages without any of the shrubs.

They don't have direct proof, but the researchers believe the mosquitoes died of starvation.

The reported their findings in the journal Malaria Research.

Prof Jo Lines is a malaria control expert from the London School of Hygiene and Tropical Medicine. He says the novel approach holds amazing potential, alongside other malaria prevention strategies. "It appears to show that by changing the landscape, not using insecticides or drugs, we can make a difference." But he said it might not work so well in lush tropical regions where nectar-rich plants are in abundance.

http://bit.ly/2t1zt7Y

Probing psychopathic brains

Study shows psychopathic brains are wired in a way that can lead to dangerous and violent actions

Josh Buckholtz wants to change the way you think about psychopaths - and he's willing to go to prison to do it.

An Associate Professor of Psychology, Buckholtz is the senior author of a study that relies on brain scans of nearly 50 prison inmates to help explain why psychopaths make poor decisions that often lead to violence or other anti-social behavior.

What they found, he said, is psychopath's brains are wired in a way that leads them to over-value immediate rewards and neglect the future consequences of potentially dangerous or immoral actions. The study is described in a July 5 paper in Neuron.

"For years, we have been focused on the idea that psychopaths are people who cannot generate emotion and that's why they do all these terrible things," Buckholtz said. "But what what we care about with psychopaths is not the feelings they have or don't have, it's the choices they make. Psychopaths commit an astonishing amount of crime, and

this crime is both devastating to victims and astronomically costly to society as a whole.

"And even though psychopaths are often portrayed as cold-blooded, almost alien predators, we have been showing that their emotional deficits may not actually be the primary driver of these bad choices. Because it's the choices of psychopaths that cause so much trouble, we've been trying to understand what goes on in their brains when the make decisions that involve trade-offs between the costs and benefits of action.," he continued. "In this most recent paper...we are able to look at brain-based measures of reward and value and the communication between different brain regions that are involved in decision making."

Obtaining the scans used in the study, however, was no easy feat - where most studies face an uphill battle in bringing subjects into the lab, Buckholtz's challenge was in bringing the scanner to his subjects.

The solution came in form of a "mobile" scanner - typically used for cancer screenings in rural areas - that came packed in the trailer of a tractor trailer. After trucking the equipment to a two medium-security prisons in Wisconsin, the team - which included collaborators at the University of Wisconsin-Madison and University of New Mexico - would spend days calibrating the scanner, and then work to scan as many volunteers as possible as quickly as possible.

"It was a huge undertaking," he said. "Most MRI scanners, they're not going anywhere, but in this case, we're driving this inside a prison and then in very quick succession we have to assess and scan the inmates."

The team ultimately scanned the brains of 49 inmates over two hours as they took part in a type of delayed gratification test which asked them to choose between two options - receive a smaller amount of money immediately, or a larger amount at a later time. The results of those tests were then fit to a model that allowed researchers to create a measure of not only how impulsive each participant's behavior was, but to identify brain regions that play a role in assessing the relative value of such choices.

What they found, Buckholtz said, was people who scored high for psychopathy showed greater activity in a region called the ventral striatum - known to be involved in evaluating the subjective reward - for the more immediate choice.

"So the more psychopathic a person is, the greater the magnitude of that striatal response," Buckholtz said. "That suggests that the way they are calculating the value rewards is dysregulated - they may over-represent the value of immediate reward."

When Buckholtz and colleagues began mapping which brain regions are connected to the ventral striatum, it became clear why.

"We mapped the connections between the ventral striatum and other regions known to be involved in decision-making, specifically regions of the prefrontal cortex known to regulate striatal response," he said. "When we did that, we found that connections between the striatum and the ventral medial prefrontal cortex were much weaker in people with psychopathy."

That lack of connection is important, Buckholtz said, because this portion of the prefrontal cortex role is thought to be important for 'mental time-travel' - envisioning the future consequences of actions. There is increasing evidence that prefrontal cortex uses the outcome of this process to change how strongly the striatum responds to rewards. With that prefrontal modulating influence weakened, the value of the more immediate choice may become dramatically over-represented.

"The striatum assigns values to different actions without much temporal context" he said. "We need the prefrontal cortex to make prospective judgements how an action will affect us in the future - if I do this, then this bad thing will happen. The way we think of it is if you break that connection in anyone, they're going to start making bad choices because they won't have the information that would otherwise guide their decision-making to more adaptive ends."

The effect was so pronounced, Buckholtz said, that researchers were able to use the degree of connection between the striatum and the

prefrontal cortex to accurately predict how many times inmates had been convicted of crimes.

Ultimately, Buckholtz said, his goal is to erase the popular image of psychopaths as incomprehensible, cold-blooded monsters and see them for what they are - everyday humans whose brains are simply wired differently.

"They're not aliens, they're people who make bad decisions," he said. "The same kind of short-sighted, impulsive decision-making that we see in psychopathic individuals has also been noted in compulsive over-eaters and substance abusers. If we can put this back into the domain of rigorous scientific analysis, we can see psychopaths aren't inhuman, they're exactly what you would expect from humans who have this particular kind of brain wiring dysfunction."

This research was supported with funding from the Sloan Foundation, the Brain and Behavior Research Foundation, the Center for Law, Brain and Behavior at Massachusetts General Hospital, and the Canadian Institutes of Health Research.

http://bit.ly/2u0blXm

Medical tourism in spotlight as experts call for tighter regulation

Countries should unite to tackle unscrupulous advertising of unproven therapies involving stem cells, experts say.

An international group of leading experts has called for tighter regulation of so-called stem cell tourism. This involves patients travelling to other countries, where medical regulations are less strict, for treatment with potentially unsafe therapies.

Hundreds of medical centres around the world are offering therapies that involve transplantation of so-called stem cells -- which they claim have the ability to repair damaged tissues. Clinics are marketing the treatment for a range of conditions, including multiple sclerosis and Parkinson's disease.

Often these therapies are advertised directly to patients with the promise of a cure. But experts say there is often no evidence to show that the treatments will help anyone, or will not cause harm.

Researchers say the practice risks undermining the development of rigorously tested, validated therapies and puts lives at risk.

Writing in the journal Science Translational Medicine, the group has called for coordinated global action to tackle the problem.

They say tighter regulations on advertising stem cell therapies are needed, so that unsupported claims about potential clinical benefits do not go unchallenged.

Global regulatory authorities should agree international standards for the manufacture and testing of cell and tissue-based therapies, they add.

The group - which includes experts from the University of Edinburgh - also calls for the World Health Organization to help guide responsible clinical use of cells and tissues, as it does for medicines and medicinal devices.

Their appeal follows the deaths of two children at a clinic in Germany in 2010, which exploited a legal loophole to offer untested treatments. The clinic has since been closed.

Dr Sarah Chan, a Chancellor's Fellow at the University of Edinburgh, said: "Many patients feel that potential cures are being held back by red tape and lengthy approval processes. Although this can be frustrating, these procedures are there to protect patients from undergoing needless treatments that could put their lives at risk.

"Stem cell therapies hold a lot of promise but we need rigorous clinical trials and regulatory processes to determine whether a proposed treatment is safe, effective and better than existing treatments."

Some types of stem cell transplantation - mainly blood and skin stem cells -- have been approved to treat certain types of cancer and to grow skin grafts for patients with severe burns. These treatments have been rigorously tested in clinical trials.

Advice about the current state of research and risks associated with unproven stem cell therapies is available from the EuroStemCell website http://www.eurostemcell.org.

http://bit.ly/2sUcY9N

Cancer Vaccines Help Patients Get Tumor-Free in 2 Studies

Cancer vaccines — which are intended to help patients fight cancer by enlisting the individuals' own immune systems to attack cancer cells - showed promise in two small new studies.

By Charles Q. Choi, Live Science Contributor

In both studies, researchers used experimental cancer vaccines to treat patients who had the deadly skin cancer melanoma. And in both studies, tumors completely disappeared in more than half of the patients after they were given their cancer vaccines. The other patients were given another type of treatment that was aimed at further boosting the ability of the individuals' immune systems ' ability to fight cancer, and in some of those cases, these patients' tumors also disappeared.

Researchers are developing similar vaccines against other cancers as well, including a type of brain cancer called glioblastoma, kidney cancer, blood cell cancers and ovarian cancer, said Dr. Catherine Wu, a physician-scientist at the Dana-Farber Cancer Institute in Boston, who led one of the new studies. "Many other cancers might benefit from this approach," Wu said.

Ideally, any cancer treatment would target cancerous cells while sparing healthy cells. In the vaccine approach, scientists want to develop vaccines that carry molecules seen only on cancerous cells. Such vaccines could help the immune system recognize such cells as harmful, prompting the system to enlist its warriors, including T cells and other defender cells, to seek out and eliminate cancers.

In the new studies, two separate research teams used two different kinds of vaccines to attack melanoma. The scientists detailed their findings online today (July 5) in two studies in the journal Nature.

Melanomas often have mutations resulting from the exposure of skin to ultraviolet rays. Such mutations can result in abnormal proteins seen nowhere else in the human body and known as neoantigens, which can prove useful targets for vaccines, said Dr. Cornelius Melief, a physician-scientist at Leiden University Medical Center in the Netherlands, who did not take part in either study.

In one of the studies, Wu and her colleagues vaccinated six patients who had previously undergone tumor-removal surgery. The vaccine they used was personalized for each patient; the researchers analyzed the DNA of cancerous and healthy cells from each person to identify tumor-specific mutations and their associated neoantigens.

Wu and her colleagues then used computer models to predict which neoantigens might be the best for immune cells to recognize. The scientists next gave the patients vaccines containing up to 20 neoantigens specific to each patient's cancer.

The researchers found that the vaccines were safe and triggered immune responses. Four patients showed no sign of the cancers recurring after 25 months. The other two patients, who had progressive forms of melanoma, were later treated with so-called checkpoint-blockade therapies, which block the mechanisms by which cancer sometimes suppresses a person's immune system. After this additional treatment, both patients underwent complete tumor regression.

"We were delighted to see a strong and consistent response among the six patients we treated," Wu told Live Science. "Vaccines can focus and mobilize the body's standing army of T cells."

In another study, Dr. Ugur Sahin at the University Medical Center of the Johannes Gutenberg University and Biopharmaceutical New Technologies Corporation, both in Mainz, Germany, and his colleagues analyzed the cancers of 13 patients, choosing up to 10 mutations per person to create vaccines tailored to the patients' cancers. These vaccines were made of RNA molecules, the compounds that encode the instructions used to make proteins such as neoantigens.

Sahin and his colleagues found that the vaccines boosted immune responses in all of the patients. Eight of the 13 patients remained free

of tumors after 23 months. The remaining five had tumor relapses; however, one of these five experienced complete tumor regression after receiving checkpoint-blockade therapy.

Wu and her colleagues noted that treatment-related adverse events consisted of mild flu-like symptoms, injection site reactions, rash and fatigue. Sahin and his colleagues noted no serious adverse events.

Both studies were phase I clinical trials, meaning they were carried out with a small number of patients to test the safety of the treatment, and find the best dose of a new treatment with the fewest side effects.

"These are small-scale studies that need to be confirmed with larger numbers of patients," Melief said.

Still, "these are exciting times," Melief said. "I think we are in for game changers in cancer."

http://bit.ly/2t1G7uM

Without a sense of smell, fat burns away

Startling results from tests on the olfactory nerves of mice may hold a key to prevent and treat obesity, writes Tim Wallace.

A mouse with no sense of smell won't gain as much weight as another rodent fed the same high-fat diet; conversely, a rat with a super-sense of smell will put on more weight.

"It's one of the most interesting discoveries to come out of my lab," says Andrew Dillin, professor of molecular and cell biology at the University of California, Berkeley, of the research he and colleagues have just published in the journal Cell Metabolism.

The results may have profound implications for medical research on weight gain and loss. They also point to the complex interrelationships of physiological systems and show how emerging techniques designed to target specific conditions by switching particular proteins, genes or cells on or off may have unintended consequences.

In this case, the researchers from UC Berkeley, the Salk Institute for Biological Sciences, also in California, and the Max Planck Institute for Metabolism Research in Germany tested for a possible relationship between sense of smell ("olfactory perception") and fat-burning capability ("energy homeostasis") in both lean and obese mice by temporarily destroying their olfactory sensory nerves.

This was done using two techniques. The first involved mice genetically engineered with a diphtheria receptor in their olfactory neurons.

To check that the chance the genetic tinkering was not affecting more than just olfactory sensory neurons, a second technique involved an inhaled virus that similarly killed off the mice's olfactory sensory neurons when a diphtheria toxin was sprayed into their noses.

The result: the mice were resistant to diet-induced obesity, demonstrating increased burning of brown fat with the body's other form of fat, white fat, being transformed into brown fat. While control mice doubled their weight on the high-fat diet they were fed, the weight of the mice with no sense of smell increased by just 10%. The test mice that were already obese lost only fat weight, with no effect on muscle, organ or bone mass.

"Acute loss of smell perception after obesity onset not only abrogated further weight gain but also improved fat mass and insulin resistance," the researchers report.

Conversely, tests with a strain of mice that are mice that are supersmellers, developed by researchers at the Max Planck Institute, showed they gained more weight on a standard diet than did normal mice.

Lead author Céline Riera says this is one of the first studies to really show the relationship between the sense of smell and how the brain perceives and regulates energy balance.

"People with eating disorders sometimes have a hard time controlling how much food they are eating and they have a lot of cravings," she says. "We think olfactory neurons are very important for controlling the pleasure of food and if we have a way to modulate this pathway, we might be able to block cravings in these people and help them with managing their food intake."

http://bit.ly/2tCWKz8

A cholera pandemic has raged for 56 years. Time to stamp it out

Yemen is the latest victim of a cholera pandemic that began in 1961, one that could wreak havoc widely for decades to come, says Seth Berkley, CEO of Gavi, the vaccine alliance

By Seth Berkley

For six decades, a deadly pandemic has raged, killing millions of people and infecting tens of millions more. Yet because it has been eliminated from wealthy countries barely anyone in the West is aware that it is still ongoing.

Beginning in Indonesia in 1961, the current cholera pandemic – the seventh in modern history – has persisted for six decades. It has its own strain of the bacteria that causes the disease – called El Tor – which has spread to more than 150 countries, sometimes smouldering, sometimes blazing, but never fully extinguished. Almost all of those affected today are the poor and vulnerable in disaster zones or fragile states – think of the outbreak in Haiti in 2010.

The latest flare-up is in Yemen, where at least 1500 people have died and more than 185,000 have been infected amidst war and famine. Sadly, even with a million doses of cholera vaccine on their way to Yemen, things are likely to get worse before they get better.

For the pandemic as a whole, the prospects are also dire.

This is all the more tragic because the disease is as preventable as it is contagious. The World Health Organization (WHO) estimates that with the right strategy and funding, cholera could be eliminated from most of the world within a few years, to the point that it would no longer pose a global health threat.

Cholera hotspots

Outbreaks can be avoided by improving access to clean water, sanitation and hygiene in cholera hotspots, as well as vaccinating those at risk.

The challenge is that often these hotspots face protracted crises that limit the ability to make improvements, for example in Somalia and South Sudan. In such cases immunisation has an even bigger role, provided it can be done early enough.

The good news is that we have safe, effective and affordable vaccines. Before 2011 that wasn't the case. The only vaccine that met WHO safety and efficacy standards wasn't suited to developing countries because it needed to be administered using clean water.

But now with support from Gavi, the vaccine alliance I head, this year will see the production of 17 million doses of a vaccine that doesn't rely on clean water. This will also be used to maintain a global stockpile of 2 million doses for emergency use.

However, in practice, it is hard to get vaccines into crisis zones quickly enough to prevent an epidemic developing. Instead, vaccine use becomes more about control and containment.

Limited sanitation

Epidemics will become more likely, particularly in Africa, where the population is expected to double by 2050 and quadruple by 2100. This, combined with additional pressures from climate change, such as land degradation, rising seas, drought and famine, not to mention conflict, could see tens of millions of people displaced. Inevitably, more will be driven towards cities. In 1950, two-thirds of the world's population lived in rural areas, and just a third in urban areas. By 2050, this ratio is forecast to be reversed.

More people living in less space, placing more strain on already limited sanitation and drinking water systems, will provide a fertile breeding ground for cholera. At the same time, the sheer scale of modern megacities has the potential to outstrip vaccine supplies, limiting the ability to prevent or respond to outbreaks in this way.

It doesn't have to be like this. Yemen reinforces a crucial lesson: when it comes to cholera we need to be proactive, not reactive.

When we know there is a very high chance that the disease will appear, we need to vaccinate as soon as possible. To do so, we will need to

better understand how the infection initially spreads and which vaccination strategies would be best to prevent this.

In conflict-prone areas this is even more critical, because brief periods of peace may be few and far between. And wherever it is feasible we need to improve access to clean water, hygiene and sanitation. Ultimately, if we don't want this pandemic to last another six decades then we need to acknowledge it and treat it as a growing threat.

http://bit.ly/2sU7AUo

Biopsy tests may lead to inappropriate discards of donated kidneys

Most deceased donor kidneys with suboptimal biopsy results were still functioning 5 years after transplantation.

Washington, DC - Researchers have found that discarding donated kidneys on the basis of biopsy findings may be inappropriate. The findings, which appear in an upcoming issue of the Journal of the American Society of Nephrology (JASN), may help address the organ shortage by keeping valuable organs from being thrown away.

Discard rates for deceased donor kidneys in the United States are at an all-time high, and transplant centers frequently cite biopsy findings as the reason for not accepting kidneys obtained from donors for transplantation. The importance of biopsy results in determining how well a kidney will function post-transplant remains unclear, however.

To assess the true impact of biopsy results on long-term outcomes, Sumit Mohan, MD, MPH (Columbia University College of Physicians & Surgeons and New York Presbyterian Hospital) and his colleagues analyzed nearly 1000 kidney biopsy samples that were processed under ideal circumstances and read by experienced renal pathologists.

The investigators found that biopsy results did not appear to impact long-term patient outcomes following transplantation of kidneys from living donors. Also, living donor kidneys with suboptimal biopsy results had better outcomes than deceased donor kidneys with optimal results. Outcomes following kidney transplantation using deceased donor kidneys were influenced by biopsy findings; however, the team estimated that even transplantation with kidneys with the worst biopsy findings would result in several additional years of life for a patient compared with remaining on dialysis. "Also, 73% of deceased donor kidneys with suboptimal biopsy results were still functioning at 5 years, suggesting that discards based on biopsy findings may be inappropriate and merits further study," said Dr. Mohan. "Understanding the true impact of suboptimal biopsy findings is essential to reducing the inappropriate discard of valuable kidneys from deceased donors."

Study co-authors include Eric Campenot, MD, Mariana Chiles, MPH, Dominick Santoriello, MD, Eric Bland, MA, R. John Crew, MD, Paul Rosenstiel, MD, Geoffrey Dube, MD, Ibrahim Batal, MD, Jai Radhakrishnan, MD, MS, P. Rodrigo Sandoval, MD, James Guarrera, MD, Michael Stokes, MD, Vivette D'Agati, MD, David Cohen, MD, Lloyd Ratner, MD, MPH, and Glen Markowitz, MD.

Disclosures: This work was supported in part by the Laura and John Arnold Foundation, ASTS, and AST's Transplantation Immunology Research Network as well as the NIMHD.

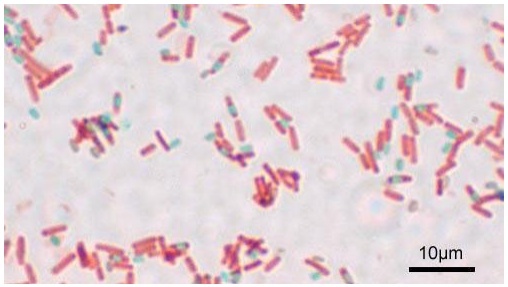
The article, entitled "Impact of Reperfusion Renal Allograft Biopsy Findings on Renal Transplantation Outcomes," will appear online at http://jasn.asnjournals.org/ on July 6, 2017, doi: 10.1681/ASN. 2016121330.

http://bit.ly/2t27x3I

Surface of Mars Hostile to Microbes

Researchers confirm that chemicals present in the dust of the Red Planet are highly toxic to bacteria.

By Bob Grant | July 6, 2017



WIKIMEDIA, Y TAMBE

Life is a daunting prospect on the surface of our nearest planetary neighbor, Mars. Not only is the Red Planet cold, constantly bathed in ultraviolet (UV) radiation, and devoid of oxygen, a toxic chemical pervades Martian soils.

Researchers at the University of Edinburgh have now confirmed that conditions on Mars—especially the presence of perchlorates, a form of chlorine—make it almost impossible for microbes to live on the

surface of the planet. They published their results today in *Scientific Reports*.

"We knew before that any life would have an incredibly hard time to survive on the surface, and this study experimentally confirms that," Dirk Schulze-Makuch, an astrobiologist at Washington State University who was not involved with the study, tells *Popular Science*.

Jennifer Wadsworth, a University of Edinburgh postdoc, and her adviser, astrobiologist Charles Cockell, subjected *Bacillus subtilis*, bacteria that commonly contaminate spacecraft, to Mars-like conditions in the lab. They found that when the microbes were exposed to perchlorates and then intense UV radiation, they all died within 30 seconds. Bacteria that were only exposed to the UV radiation died within 60 seconds. The bacterial cells fared a bit better when the researchers included silica disks, which simulated rocks, in the experiments.

This may mean that any microbes that existed on Mars when the planet harbored liquid water would have had a pretty tough time surviving, at least at the surface. "We don't know exactly how far reaching the effect of UV and perchlorate would penetrate the surface layers, as the precise mechanism isn't understood," Wadsworth tells *MailOnline*. "If it's the case of altered forms of perchlorate (such as chlorite or hypochlorite) diffusing through the environment, that might extend the uninhabitable zone. We may have to dig a little deeper to find a potential habitable environment."

http://bbc.in/2tvKnWY

Oral sex spreading unstoppable bacteria

Oral sex is producing dangerous gonorrhoea and a decline in condom use is helping it to spread, the World Health Organization has said.

By James Gallagher Health and science reporter, BBC News website

It warns that if someone contracts gonorrhoea, it is now much harder to treat, and in some cases impossible. The sexually transmitted infection is rapidly developing resistance to antibiotics. Experts said the situation was "fairly grim" with few new drugs on the horizon. About 78 million people pick up the STI each year and it can cause infertility.

The World Health Organization analysed data from 77 countries which showed gonorrhoea's resistance to antibiotics was widespread.

Dr Teodora Wi, from the WHO, said there had even been three cases - in Japan, France and Spain - where the infection was completely untreatable. She said: "Gonorrhoea is a very smart bug, every time you introduce a new class of antibiotics to treat gonorrhoea, the bug becomes resistant."

Worryingly, the vast majority of gonorrhoea infections are in poor countries where resistance is harder to detect. "These cases may just be the tip of the iceberg," she added.

Throat infection

Gonorrhoea can infect the genitals, rectum and throat, but it is the last that is most concerning health officials.Dr Wi said antibiotics could lead to bacteria in the back of the throat, including relatives of gonorrhoea, developing resistance. She said: "When you use antibiotics to treat infections like a normal sore throat, this mixes with the *Neisseria* species in your throat and this results in resistance."

Thrusting gonorrhoea bacteria into this environment through oral sex can lead to super-gonorrhoea. "In the US, resistance [to an antibiotic] came from men having sex with men because of pharyngeal infection," she added. A decline in condom use, which had soared because of fears of HIV/Aids, is thought to help the infection spread.

What is gonorrhoea?

The disease is caused by the bacterium called *Neisseria gonorrhoea*.

The infection is spread by unprotected vaginal, oral and anal sex.

Symptoms can include a thick green or yellow discharge from sexual organs, pain when urinating and bleeding between periods.

However, of those infected, about one in 10 heterosexual men and more than three-quarters of women, and gay men, have no easily recognisable symptoms. Untreated infection can lead to infertility,

pelvic inflammatory disease and can be passed on to a child during pregnancy. The World Health Organization is calling on countries to monitor the spread of resistant gonorrhoea and to invest in new drugs.

Dr Manica Balasegaram, from the Global Antibiotic Research and Development Partnership, said: "The situation is fairly grim. "There are only three drug candidates in the entire drug [development] pipeline and no guarantee any will make it out." But ultimately, the WHO said vaccines would be needed to stop gonorrhoea.

Prof Richard Stabler, from the London School of Hygiene & Tropical Medicine, said: "Ever since the introduction of penicillin, hailed as a reliable and quick cure, gonorrhoea has developed resistance to all therapeutic antibiotics. "In the past 15 years therapy has had to change three times following increasing rates of resistance worldwide. "We are now at a point where we are using the drugs of last resort, but there are worrying signs as treatment failure due to resistant strains has been documented."

Is oral sex more common now? By BBC World online

It's hard to say if more people around the world are having more oral sex than they used to, as there isn't much reliable global data available. Data from the UK and US show it's very common, and has been for years, including among teenagers. The UK's first National Survey of Sexual Attitudes and Lifestyles, carried out in 1990-1991, found 69.7% of men and 65.6% of women had given oral sex to, or received it from, a partner of the opposite sex in the previous year. By the time of the second survey during 1999-2001, this had increased to 77.9% for men and 76.8% for women, but hasn't changed much since.

A national survey in the US, meanwhile, has found about two-thirds of 15-24 year olds have ever had oral sex.

Dr Mark Lawton from the British Association for Sexual Health and HIV said people with gonorrhoea in the throat would be unlikely to realise it and thus be more likely to pass it on via oral sex. He recognises that while condoms would reduce the risk of transmission, many people wouldn't want to use them.

"My message would be to get tested so at least if you've got it you know about it," Dr Lawton said.

http://bit.ly/2t2bqOK

Experts urge action to cut child deaths from deadly lung virus

Vaccines to combat a virus that can lead to fatal lung infections are urgently needed to help prevent child deaths worldwide, research suggests.

Experts report that more than 115,000 children under five are dying each year from complications associated with the infection, called Respiratory Syncytial Virus (RSV). Almost half of those who die in hospital are younger than six months old and more than 99 per cent of deaths occur in developing countries, the study estimates. Half of the RSV deaths in these countries occur outwith hospital.

Five countries -- India, China, Nigeria, Pakistan and Indonesia -- account for half of the estimated cases of RSV worldwide. Researchers say more data are needed from Africa and South Asia, where the number of RSV infections may be even higher. Their findings highlight the pressing need for affordable treatments and vaccines as a priority.

The team led by the University of Edinburgh analysed data from 329 studies of RSV infections worldwide. Their estimates indicate there are more than 33 million cases of RSV infection in children under five each year worldwide.

Around three million are admitted to hospital each year with the virus, which causes breathing difficulties and wheezing. The study is part of an ongoing initiative to provide the most comprehensive assessment of the global burden of RSV infections to date.

RSV is a common and highly contagious virus that infects the respiratory tract of most children before their second birthday. For most babies and young children, it causes nothing more than symptoms of a cold. In some cases, however, it can lead to severe lung complications such as pneumonia or bronchiolitis.

The study was conducted by the RSV Global Epidemiology Network, which includes researchers from 78 institutions and 35 countries worldwide. It is published in The Lancet and was funded by the Bill & Melinda Gates Foundation.

Lead researcher Professor Harish Nair, of the University of Edinburgh's Usher Institute, said: "We are at an opportune time to step up efforts to prevent RSV infection in young children. With more than 60 candidate vaccines in clinical development, it is likely that an RSV vaccine will be available in the next 5-7 years. Our findings will provide better evidence to inform global funding priorities to accelerate vaccine development. It will assist policy makers and experts prepare for early introduction of this vaccine in developing countries."

Professor Nair is coordinating a €29m grant to establish the RSV Consortium in Europe (RESCEU), which aims to address several of the research gaps highlighted in this study. The five-year project is funded by the Innovative Medicines Initiative -- a joint undertaking between the European Union and the pharmaceutical industry association EFPIA.

http://s.nikkei.com/2sTPsKj

Japanese drugmakers launch Ph.D program on AI, big data in drug development

Program with University of Tokyo seeks to nurture specialists to create new medicines

TOKYO -- Seeking to remedy a shortage of specialists with know-how in artificial intelligence and data analysis are essential in drug development, Japan's drugmakers have teamed with the University of Tokyo to launch a doctorate program to groom individuals for the role.

A researcher at Ono Pharmaceutical

Fujifilm, Kyowa Hakko Kirin, Chugai Pharmaceutical and Ono Pharmaceutical hope the program will help create specialists who can apply big data to genetics for more effective development of drugs as well as for diagnosis.

Under the plan, the national university will introduce a three-year doctorate program in the academic year ending March 2020 to train students in medicine, AI and data processing.

The business-university collaboration comes in response to overseas drugmakers' increased efforts to introduce more sophisticated data analysis techniques to raise the efficiency of drug development. The Japanese drugmakers and the university aim to address the lack of know-how in that area in Japan.

Developing new drugs is increasingly expensive, but the chances of a new product making it to market have not improved. The situation is set to change, however, as progress in computer technology has made it possible to process huge amounts of data on genetic information and proteins. Therefore, specialists who can analyze such data and put it to effective use are expected to boost competitiveness in development efforts.

In the new program, the university will accept 20 to 30 students. Applicants are expected to include students who have completed a graduate course and individuals who are employed but are planning to return to school to earn a doctorate degree. The program is aimed at addressing practical aspects of the field by taking advantage of data gathered by labs that are developing new drugs.

The courses are taught by University of Tokyo staff. The cooperating companies will offer internship opportunities for the students. They also plan to offer financial assistance to students who need it.

Development of blockbuster drugs has become difficult. The success rate of such drugs is extremely low, with only one in 20,000 to 30,000 compounds actually making it to market.

Efforts are ongoing to reduce the cost and time required for development by taking advantage of big-data analysis and AI. While there are over 20,000 data-analysis specialists in the U.S., such personnel total just 3,000 in Japan, according to some estimates. Of those, fewer than 100 are also versed in medicine.

Seeing the need for individuals with knowledge in AI and data processing in the drug industry, the companies decided to join hands with each other as well as the University of Tokyo, rather than trying to train the needed personnel in-house.

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Sandbox Sickness: Diarrhea-Causing Bacteria Found in Playgrounds

What's lurking in the playground sandbox? A new small study from Spain may confirm some of parents' worst fears: There are dangerous germs in there.

By Sara G. Miller, Staff Writer | July 7, 2017 08:43am ET

In the new study, the researchers tested sandboxes, looking for the bacterium Clostridium difficile, or "C. diff." The scientists not only detected C. diff, but also found that it was drug-resistant.

As its name implies, C. diff is difficult to treat. The bacteria cause an intestinal infection that can lead to severe diarrhea. [27 Devastating Infectious Diseases]

C. diff infections have been traditionally thought of as "hospital-acquired" infections, meaning people get them during hospital stays. But the rates of C. diff infections acquired outside of the hospital are on the rise, according to the study, published today (July 7) in the journal Zoonoses and Public Health.

The new study points to sandboxes as one possible source of C. diff infections. The bacterium may wind up there from the feces of humans and other animals, and can survive for weeks or months outside the body.

C. diff in sandboxes poses a particular threat to kids, who are considered the main group of people at risk of being exposed to germs in the environment, the researchers wrote. This isn't only because children are the ones primarily playing at playgrounds (where they can be exposed to germs), but also because kids have high rates of "geophagia" — in other words, a lot of kids eat sand and dirt.

In the study, the researchers tested sand from 40 sandboxes in public parks in Madrid, including 20 that were designated for kids and 20 that were for dogs. They found C. diff in nine of the sandboxes for kids and 12 of the sandboxes for dogs.

When the researchers analyzed the C. diff samples, they found that two samples from the kids' sandboxes and six samples from the dogs' sandboxes had strains of the bacteria that were "toxigenic," meaning they produced toxins. Toxins from C. diff bacteria can damage the lining of the intestine, causing diarrhea, the Mayo Clinic says. Certain strains of C. diff produce more toxins than others.

And all the C. diff samples that the researchers found were resistant to at least two antibiotics, which could make the infection more difficult to treat.

The researchers noted that data on C. diff in sandboxes is still limited and more studies are needed to confirm the findings. However, other reports have also detected the germ in public play areas. For example, in a 2011 study, researchers found C. diff in about 7 percent of soil samples collected in public places in Zanesville, Ohio.

The new findings from Spain are a "call to action," said study co-author Dr. José Blanco, a professor of veterinary medicine at Complutense University in Madrid, in a statement. Because of the risk posed by C. diff, tests for the bacterium should be included in future environmental-risk assessments, the researchers wrote in the study.

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Litter bugs may protect chocolate supply

Microbiome from mother trees protects baby trees from disease

Those who crave brownies or hot cocoa may be happy to hear that heroes too small to be seen may help to protect the world's chocolate supply. Scientists at the Smithsonian Tropical Research Institute (STRI) in Panama found that exposing baby cacao plants to microbes from healthy adult cacao plants reduced the plant's chance of becoming infected with the serious cacao pathogen, Phytopthora palmivora, by half. The researchers' study was published in Proceedings of the Royal Society B on July 5.

"When human babies pass through the birth canal, their bodies pick up a suite of bacteria and fungi from their mother. These microbes strengthen their immune system and make the baby healthier," said

Natalie Christian, doctoral student at the University of Indiana and lead author of the paper. "We showed that an analogous process happens in plants: adult cacao trees also pass along protective microbes to baby cacao plants."

Researchers at STRI have investigated the interactions between plants and their microbes for the past 20 years. They were the first to show that in tropical forests, where cacao grows, every leaf is home to hundreds of different fungi and bacteria, and that applying helpful microbes to leaves in field treatments protected cacao from disease. Researchers found that specific fungal species, such as Colletotrichum tropicale, protect plants from their enemies--the pathogens and insects that eat them. Research at STRI has also shown that, as with humans, microbes stimulate plants' ability to defend themselves and has demonstrated the magnitude and extent of endophyte effects on host genetic expression.

On June 30, following on work published in the scientific journal Nature by STRI post-doctoral fellow, Scott Mangan, a group of 50 researchers from 12 countries published a paper in Science (lead author, Joe LaManna, Washington University in St. Louis) showing that close plant relatives make bad neighbors and that the negative interactions between relatives are stronger in the tropics, which may explain why tropical forests are so rich in species diversity: Because plants do not do well next to their relatives, there is more space for non-relatives to fill.

"Where you get a build-up of any given species, you get a build-up of the bad guys, their enemies," said STRI staff scientist and co-author, Allen Herre. "A mother tree can infect her babies with pathogens that can kill them if they are too close by. In this most recent study we show that parents can also have a positive effect by supplying babies with good microbiota."

The team first grew cacao plants from sterile seeds in sterile chambers so that they had no resident fungi in their leaves. Then they divided the baby plants into groups, placing dead leaves from healthy cacao plants in one set of pots, mixed leaves from the forest floor in another set and no leaves in the third set, giving different sets of microbes the first chance to land on and colonize the "virgin" leaves of the young plants.

Then the researchers took the plants out into the forest, mimicking the natural process by which young leaves are gradually colonized by fungi swirling in the air or contained in water droplets when it rains. Finally, the team brought the seedlings back into the greenhouse and infected them with the pathogen Phytopthora palmivora, (literally, "plant destroyer"), which accounts for 10 to 20 percent of the loss in cacao production worldwide.

Three weeks later, they took stock of the damage. The plants exposed to healthy cacao leaves experienced significantly less damage than plants grown without the exposure. In addition, the leaves of the seedlings grown with leaf litter from healthy cacao plants showed only half of the damage sustained by plants grown with mixed-leaf litter from the forest floor.

To see if this result could be explained by the microbes inside the leaves, the team used two different methods: the traditional method of placing leaf pieces on agar-coated petri plates to see what fungi grew and directly sequencing the DNA from surface-sterilized leaves.

"We discovered both by culturing the microbes from the leaves and also by directly sequencing fungal DNA from plant tissue, that one of the most common fungi on the cacao seedlings was their protector, Colletotricum tropicale. And not only that, but it was also much more common on the leaves of young plants grown with leaf litter from healthy cacao adults," said Christian. "What this means is that C. tropicale from leaf litter from adult trees is able to quickly get into young leaves and crowd out other microbes, including pathogens, thus keeping them from colonizing."

"Not only did this show us that starting seedlings out surrounded by leaves from healthy adults may vastly improve their health -- a result potentially very important to the cacao industry -- for the first time,

we are beginning to understand how microbial communities assemble on leaves of cacao and other species in nature and what may influence their ability to protect plants," said Herre.

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Snortable Chocolate Claimed to Boost Energy: Is It Safe?

New "snortable" chocolate product called is being marketed as a drug-free way to feel energized

By Rachael Rettner, Senior Writer | July 7, 2017 03:48pm ET

This chocolate isn't for dessert: A new "snortable" chocolate product called Coco Loko is being marketed as a drug-free way to feel energized. But some health experts said they are wary about the effects of inhaling chocolate through your nostrils.

"It's not generally a good idea to put anything in your nose that doesn't belong there" or isn't prescribed by a doctor, said Dr. David Hiltzik, director of otolaryngology at Staten Island University Hospital in New York. "It's quite clear that, at least empirically, chocolate does not belong in your nose."

The product contains raw cacao powder along with other ingredients, including taurine and guarana, often seen in energy drinks, according to The Washington Post. The company behind the product, Legal Lean, says that snorting Coco Loko "will give you a steady rush of euphoric energy and motivation." It's now available for purchase in the United States and costs $24.99 for a container of 10 servings.

The specific health effects of this product are unknown, because there haven't been any studies on its short- or long-term effects, Hiltzik said. However, it's usually not a good idea to snort substances, including powders, through your nose, because they can cause irritation to the nose, throat and lungs, Hiltzik said. [7 Foods You Can Overdose On]

It's not clear, either, if the product gets absorbed into the bloodstream after it is inhaled, he said. But substances that are absorbed into the blood through the nose tend to take effect faster than those that are digested, Hiltzik said. (Energy drinks, which contain high levels of caffeine along with ingredients such as taurine and guarana, have been linked with potentially harmful health effects, including elevated heart rate and high blood pressure.)

This isn't the first time anyone has marketed snorting chocolate. More than 10 years ago, the Belgian chocolatier Dominique Persoone invented a small, catapult-like device called the "chocolate shooter" for snorting chocolate powder. During a 2015 interview about that product, Dr. Jordan Josephson, a sinus and ear, nose and throat specialist at Lenox Hill Hospital in New York, told Live Science that snorting any type of powder can damage the tiny hairs in the nose, as well as nasal membranes. "Putting any foreign bodies — including smoke, cocaine and/or chocolate powder — [in your nose] is not safe and is not advised," he said.

Ultimately, Hiltzik said, he would not consider Coco Loko safe until there was more information available. He also noted that there is a perception that "natural" products are safe, but this is not always the case.

Legal Lean did not immediately respond to a request for comment about its product's health effects. On its website, the company says that its products "may impair your ability to drive a car or operate machinery and may cause health problems." The company also says their statements have not been evaluated by the Food and Drug Administration.

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Study finds rate of medication errors resulting in serious medical outcomes rising

Researchers advise parents to keep medication logs and store all medications up, away, and out of sight

Every 21 seconds someone in the United States calls Poison Control because of a medication error. A new study from the Center for Injury Research and Policy and the Central Ohio Poison Center at Nationwide Children's Hospital analyzed calls to Poison Control Centers across the country over a 13-year period about exposures to medication errors which resulted in serious medical outcomes. These

exposures, which occurred outside of health care facilities, primarily in the home, affected individuals of all ages and were associated with a wide variety of medications.

The study, published by Clinical Toxicology, found a 100 percent increase in the rate of serious medication errors per 100,000 U.S. residents (from 1.09 in 2000 to 2.28 in 2012). Medication error frequency and rates increased for all age groups except children younger than six years of age. Among children younger than six years, the rate of medication errors increased early in the study and then decreased after 2005, which was primarily associated with a decrease in the use of cough and cold medicines. According to the study authors, this decrease is likely attributable to the Food and Drug Administration's 2007 recommendation against administering these products to young children.

The medication categories most frequently associated with serious outcomes were cardiovascular drugs (21%), analgesics (i.e., painkillers) (12%), and hormones/hormone antagonists (11%). Most analgesic exposures were related to products containing acetaminophen (44%) or opioids (34%), and nearly two-thirds of hormone/hormone antagonist exposures were associated with insulin. Cardiovascular and analgesic medications combined accounted for more than two-thirds (66%) of all fatalities in this study.

"Drug manufacturers and pharmacists have a role to play when it comes to reducing medication errors," said Henry Spiller, MS, D.ABAT, a co-author of the study, and director of the Central Ohio Poison Center at Nationwide Children's. "There is room for improvement in product packaging and labeling. Dosing instructions could be made clearer, especially for patients and caregivers with limited literacy or numeracy."

Overall, the most common types of medication errors were taking or giving the wrong medication or incorrect dosage, and inadvertently taking or giving the medication twice. Among children, dosing errors and inadvertently taking or giving somoneone else's medication were also common errors. One-third of medication errors resulted in hospital admission.

"Managing medications is an important skill for everyone, but parents and caregivers have the additional responsibility of managing others' medications," said Nichole Hodges, PhD, lead author of the study and research scientist in the Center for Injury Research and Policy at Nationwide Children's. "When a child needs medication, one of the best things to do is keep a written log of the day and time each medication is given to ensure the child stays on schedule and does not get extra doses."

Everyone can follow a few guidelines to help prevent medication errors in their homes:

Write it down. Parents and caregivers can write down what time medications are given to prevent another caregiver from unintentionally giving the medication a second time. This is even helpful for adults taking more medication than usual.

Ask questions. Physicians and pharmacists can teach patients, parents, and caregivers how to take or give medications to minimize the likelihood of medication errors. Parents and patients can ask questions until they fully understand how and when to take medications. If a question arises at home, call your pharmacist or physician.

Child-resistant packaging. While most medications enter the home in child-resistant packaging, people who take multiple medications often repackage them into weekly pill planners. If you are going to use a pill planner, use a child-resistant one and store it up, away, and out of sight.

Data for this study were obtained from the National Poison Data System, which is maintained by the American Association of Poison Control Centers (AAPCC). The AAPCC receives data on calls to participating poison control centers that serve the US and its territories. Poison control centers receive phone calls through the Poison Help Line and document information about the product, route of exposure, individual exposed, exposure scenario, and other data.