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Do Giant Planets Contain "Dark" Hydrogen?

Laboratory research suggests that an unexpected layer of semimetallic, optically dark hydrogen lurks inside worlds like Jupiter and Saturn

By Caleb A. Scharf on June 27, 2016 1

On the surface of the Earth we live within a range of pressures and temperatures that sample a mere sliver of what the universe can dish up. Otherwise familiar compounds can behave very differently in some of the environments deep inside the planet, or in the environments arrayed across our solar system.

Gas giant planets are particularly good at creating some truly alien and, to us, unspeakable conditions. The interiors of both Jupiter and Saturn for example have long been suspected of reaching pressures where the element hydrogen assumes the behavior of an electrically conductive liquid metal.

In fact, if you run the numbers, most of the planetary mass of the solar system is in the form of metallic hydrogen. As much as seventy-five percent of Jupiter alone may consist of this phase of hydrogen. That's pretty astonishing, and makes for some nice science fiction scenarios where visiting aliens classify us as 'mostly metallic hydrogen'.

But this idea is also based on theoretical models for these extreme states of matter - where pressures can exceed 100 million atmospheres. To test the possibility by actually squeezing hydrogen in a laboratory to mimic the interior pressure and temperature conditions of a gas giant is a huge challenge.

A new study by McWilliams et al. published in Physical Review Letters provides some intriguing insights. Using a diamond anvil with pulsed-laser heating, the team has managed to probe the behavior of hydrogen at pressures up to about 1.5 million atmospheres and temperatures as high as 6,000 Kelvin.

This experiment has accessed the conditions under which hydrogen starts to transition from a gas to a metal. What the researchers find is that the transition to a fully metallic state occurs at significantly higher pressures and temperatures than predicted. And during that transition the hydrogen is not only somewhat conducting, but also opaque to visible light, while still transparent to infrared wavelengths.

The implication is that planets like Jupiter and Saturn should actually have thick interior layers of this 'dark' hydrogen above their conductive, metallic hydrogen zones. And the infrared transparency of dark hydrogen may help explain how heat leaks out and allows these, and any other, gas-giant worlds to cool and evolve.

Perhaps the most remarkable discovery is that even the simplest element in the universe still has some tricks up its sleeve - if pushed into the right conditions.

http://www.eurekalert.org/pub_releases/2016-06/danl-cfh062716.php

ChemCam findings hint at oxygen-rich past on Mars

Curiosity rover's discovery of manganese oxide points to a more Earth-like planet

LOS ALAMOS, N.M. - The discovery of manganese oxides in Martian rocks might tell us that the Red Planet was once more Earth-like than previously believed. A new paper in Geophysical Research Letters reveals that NASA's Curiosity rover observed high levels of manganese oxides in Martian rocks, which could indicate that higher levels of atmospheric oxygen once existed on our neighboring planet. This hint of more oxygen in Mars' early atmosphere adds to other Curiosity findings--such as evidence of ancient lakes--revealing how Earth-like our neighboring planet once was.

"The only ways on Earth that we know how to make these manganese materials involve atmospheric oxygen or microbes," said Nina Lanza, a planetary scientist at Los Alamos National Laboratory and lead author on the study published in the American Geophysical Union's journal. "Now we're seeing manganese-oxides on Mars and wondering how the heck these could have formed."

Lanza uses the Los Alamos-developed ChemCam instrument that sits atop Curiosity to "zap" rocks on Mars and analyze their chemical make-up. This work stems from Los Alamos National Laboratory's experience building and operating more than 500 spacecraft instruments for national defense, giving the Laboratory the expertise needed to develop discovery-driven instruments like ChemCam. In less than four years since landing on Mars, ChemCam has analyzed roughly 1,500 rock and soil samples.

Microbes seem a far-fetched explanation for the manganese oxides at this point, said Lanza, but the idea that the Martian atmosphere contained more oxygen in the past than it does now seems possible. "These high-manganese materials can't form without lots of liquid water and strongly oxidizing conditions," said Lanza "Here on Earth, we had lots of water but no widespread deposits of manganese oxides until after the oxygen levels in our atmosphere rose due to photosynthesizing microbes."

In the Earth's geological record, the appearance of high concentrations of manganese is an important marker of a major shift in our atmosphere's composition, from relatively low oxygen abundances to the oxygen-rich atmosphere we see today. The presence of the same types of materials on Mars suggests that something similar happened there. If that's the case, how was that oxygen-rich environment formed?

"One potential way that oxygen could have gotten into the Martian atmosphere is from the breakdown of water when Mars was losing its magnetic field," said

Lanza. "It's thought that at this time in Mars' history, water was much more abundant." Yet without a protective magnetic field to shield the surface from ionizing radiation, that radiation started splitting water molecules into hydrogen and oxygen. Because of Mars' relatively low gravity, it wasn't able to hold onto the very light hydrogen atoms, but the heavier oxygen atoms remained behind. Much of this oxygen went into the rocks, leading to the rusty red dust that covers the surface today. While Mars' famous red iron oxides require only a mildly oxidizing environment to form, manganese oxides require a strongly oxidizing environment. These results suggest that past conditions were far more oxidizing (oxygen-rich) than previously thought.

"It's hard to confirm whether this scenario for Martian atmospheric oxygen actually occurred," Lanza added. "But it's important to note that this idea represents a departure in our understanding for how planetary atmospheres might become oxygenated." So far, abundant atmospheric oxygen has been treated as a so-called biosignature, or a sign of existing life.

The next step in this work is for scientists to better understand the signatures of non-biogenic versus biogenic manganese, which is directly produced by microbes. If it's possible to distinguish between manganese oxides produced by life and those produced in a non-biological setting, that knowledge can be directly applied to Martian manganese observations to better understand their origin.

The high-manganese materials were found in mineral-filled cracks in sandstones in the Kimberley region of Gale crater, which the Curiosity rover has been exploring for the last four years. But that's not the only place on Mars that abundant manganese has been found. The Opportunity rover, which has been exploring Mars since 2004, also recently discovered high-manganese deposits in its landing site thousands of miles from Curiosity, which supports the idea that the conditions needed to form these materials were present well beyond Gale crater.

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Huge helium discovery 'safeguards future supply for MRI scanners'

Researchers have developed systematic search methods to discover one of the world's biggest helium gas fields, associated with volcanoes in the Tanzanian Rift Valley.

This is the first time that helium has been found intentionally -previous finds were by accident- and opens the way for further large finds. This work is reported at the Goldschmidt conference in Yokohama, Japan.

Helium is essential for many modern technologies such as MRI scanners in medicine, nuclear energy, and is used in the Large Hadron Collider at CERN. Recent years have seen worries about the over-exploitation of this extremely limited, finite, valuable natural resource, with fears that supply could not be guaranteed into the medium to long-term future. In 2015, the British Medical Association expressed concern that helium supplies may have to be regulated.

Now a team from Oxford and Durham universities, jointly led by Professor Chris Ballentine and Professor Jon Gluyas has worked together with a helium exploration company, Helium One Ltd, to help uncover a huge helium resource in Tanzania.

The team applied methodologies used in oil exploration in their search for helium. Normally oil exploration takes into consideration a range of factors, such as the rocks sourcing the oil, and how the oil is released into underground reservoirs. Crucially, the team found that being close to a volcano may be key, as the volcanic activity acts as the releasing mechanism for helium gas.

According to researcher, Diveena Danabalan (Durham):

"***We were able to show that volcanoes in the rift play an important role in the formation of viable helium reserves. Volcanic activity likely provides the heat necessary to release the helium accumulated in ancient crustal rocks, but the location needs to be just right. If the gas traps are located too close to a given volcano, they run the risk of helium being heavily diluted by volcanic gases such as carbon dioxide".***

Professor Chris Ballentine (Oxford) added:

"By combining our understanding of helium geochemistry with seismic images of gas trapping structures, independent experts have calculated a probable resource of 54 Billion Cubic Feet (BCf)* in just one part of the rift valley. This is around the size of 600,000 Olympic sized swimming pools with helium gas. That's nearly seven times the total amount of helium consumed globally every year and enough to fill over 1.2 million medical MRI scanners when converted to liquid helium". While developing the technique in 2015, members of the same research group postulated significant helium resources in the Rocky Mountains.

"Now we understand the techniques, we anticipate more large helium finds", said Chris Ballentine, "This will help safeguard society's future helium needs".

http://www.eurekalert.org/pub_releases/2016-06/cu-cfs062716.php

Chronic fatigue syndrome is in your gut, not your head

Biological markers of chronic fatigue symptoms identified in gut bacteria

Physicians have been mystified by chronic fatigue syndrome, a condition where normal exertion leads to debilitating fatigue that isn't alleviated by rest. There are no known triggers, and diagnosis requires lengthy tests administered by an expert.

Now, for the first time, Cornell University researchers report they have identified biological markers of the disease in gut bacteria and inflammatory microbial agents in the blood.

In a study published June 23 in the journal Microbiome, the team describes how they correctly diagnosed myalgic encephalomyeletis/chronic fatigue syndrome (ME/CFS) in 83 percent of patients through stool samples and blood work, offering a noninvasive diagnosis and a step toward understanding the cause of the disease.

"Our work demonstrates that the gut bacterial microbiome in chronic fatigue syndrome patients isn't normal, perhaps leading to gastrointestinal and inflammatory symptoms in victims of the disease," said Maureen Hanson, the Liberty Hyde Bailey Professor in the Department of Molecular Biology and Genetics at Cornell and the paper's senior author.

"Furthermore, our detection of a biological abnormality provides further evidence against the ridiculous concept that the disease is psychological in origin."

"In the future, we could see this technique as a complement to other noninvasive diagnoses, but if we have a better idea of what is going on with these gut microbes and patients, maybe clinicians could consider changing diets, using prebiotics such as dietary fibers or probiotics to help treat the disease," said Ludovic Giloteaux, a postdoctoral researcher and first author of the study.

In the study, Ithaca campus researchers collaborated with Dr. Susan Levine, an ME/CFS specialist in New York City, who recruited 48 people diagnosed with ME/CFS and 39 healthy controls to provide stool and blood samples.

The researchers sequenced regions of microbial DNA from the stool samples to identify different types of bacteria.

Overall, the diversity of types of bacteria was greatly reduced and there were fewer bacterial species known to be anti-inflammatory in ME/CFS patients compared with healthy people, an observation also seen in people with Crohn's disease and ulcerative colitis.

At the same time, the researchers discovered specific markers of inflammation in the blood, likely due to a leaky gut from intestinal problems that allow bacteria to enter the blood, Giloteaux said.

Bacteria in the blood will trigger an immune response, which could worsen symptoms.

The researchers have no evidence to distinguish whether the altered gut microbiome is a cause or a whether it is a consequence of disease, Giloteaux added.

In the future, the research team will look for evidence of viruses and fungi in the gut, to see whether one of these or an association of these along with bacteria may be causing or contributing to the illness.

The study was funded by the National Institutes of Health.

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Disrupted immunity in the fetal brain is linked to neurodevelopmental disorders

Weizmann Institute findings in mice may help explain how viral infection during pregnancy raises the risk of autism and schizophrenia in the offspring

Disrupted fetal immune system development, such as that caused by viral infection in the mother, may be a key factor in the later appearance of certain neurodevelopmental disorders. This finding emerges from a Weizmann Institute study published in Science on June 23, 2016.

The study may explain, among other things, how the mother's infection with the cytomegalovirus (CMV) during pregnancy, which affects her own and her fetus's immune system, increases the risk that her offspring will develop autism or schizophrenia, sometimes years later. This increased risk of neurodevelopmental diseases had been discovered many years ago in epidemiological studies and confirmed in mouse models. The Weizmann study, led by Dr. Ido Amit and Prof. Michal Schwartz, of the Immunology and Neurobiology Departments, respectively, provides a possible explanation for this increase on the cellular and the mechanistic molecular levels.

"Previous studies had shown that the timing of the disruption in the mother's immune system during pregnancy affects the type of brain damage her child may develop. For example, a viral infection in early pregnancy raises the risk of autism, whereas an infection later in the pregnancy raises the risk of schizophrenia," said Amit. "We've set out to examine the mechanisms behind these phenomena, while focusing on the role the immune system plays in brain development."

Orit Matcovitch-Natan, a graduate student in the laboratories of both Amit and Schwartz, and other members of the two teams, studied the sole immune cells present in the brain -- the microglia, which contribute to the brain's development and maintenance. The scientists discovered that the development of these cells in the mouse fetus and in newborn mice proceeds in three distinct stages, parallel to those of the developing brain: early cells that populate the brain of the embryo shortly after its inception, pre-microglia and adult cells. By screening the genomes of these cells and testing them extensively, the scientists were able to define each stage in terms of its activated genes, their control mechanisms and the epigenetic features, that is, the activation of proteins that "package" the DNA and affect gene expression in the course of development. The scientists also characterized the functions of some of these genes in the microglia, which contributed to an in-depth understanding of the developmental processes.

The second stage -- that of the pre-microglia -- proved the most sensitive to disruptions. This stage takes place close to birth and shortly afterwards, just when the developing brain undergoes the vital process of "pruning," in which inappropriate synapses among neurons are lopped off. The pre-microglia play an important role in pruning, helping remove the superfluous neuronal networks, and shaping and strengthening the connections among the remaining neurons. When the scientists exposed the brains of pregnant mice to synthetic materials that mimic a CMV infection, they found that the development of the pre-microglia was disrupted in their offspring. Genes involved in the maturation of these cells were expressed at the wrong time, and the cells proceeded to an adult stage earlier than usual. The offspring later exhibited abnormal behavior, including disturbances in social interaction and behaviors similar to those of people with schizophrenia.

"We've discovered that it's essential for the development of immune cells in the brain to be synchronized with the development of the brain itself," says Schwartz. "Premature shift of the microglia in mice to the adult stage leads to brain malfunction later on." Though these findings have been obtained in mice, the scientists hypothesize that disrupted coordination between the development of the microglia and that of the brain contributes to an increased risk of such neurodevelopmental disorders as autism and schizophrenia in human beings. The scientists believe that the heightened immune response to viral infection in the mother's body may be responsible for disrupting the timing of microglia development.

"Our research has paved the way for studying the effects of other viruses on the mother's immune system in general, and on her offspring's brain development. It can also advance the study of neurodevelopmental disorders and their connection to the immune system," says Orit Matcovitch-Natan.

In yet another series of experiments, the Weizmann scientists established a connection between the development of the microglia in the brains of mice and intestinal microbes -- the microbiome. They found that in newborn mice that were free of any microbes, the maturation of the microglia was delayed. This finding suggests that in human babies, factors that shape the microbiome - natural ones such as breastfeeding, or therapeutic, such as antibiotics -- may affect the immune cells in the baby's brain and consequently the brain's development. It's still unknown to what extent this research, conducted in mice, is relevant to human beings, but the scientists hope that an improved understanding of this process may in the future help prevent certain neurological disorders in babies, caused by disruptions in the mother's immune system.

Taking part in the study were Dr. Deborah R. Winter, Amir Giladi, Eyal David and Dr. Hadas Keren-Shaul, as well as Dr. Eran Elinav and Christoph Thaiss of the Immunology Department, and Hila Ben-Yehuda, Merav Cohen and Dr. Kuti Baruch of the Neurobiology Department. Matcovitch-Natan and Amit Spinrad, also a graduate student, belonged to both departments. Study participants also included Prof. Michael H. Sieweke of Centre National de la Recherche Scientifique, France.

Dr. Ido Amit's research is supported by the Benoziyo Endowment Fund for the Advancement of Science; David and Fela Shapell Family Foundation INCPM Fund for Preclinical Studies; Wolfson Family Charitable Trust; Leona M. and Harry B. Helmsley Charitable Trust; and Rosenwasser Fund for Biomedical Research. Dr. Amit is the incumbent of the Alan and Laraine Fischer Career Development Chair.

Prof. Michal Schwartz's research is supported by Sonia T. Marschak, Lincolinwood, IL; Elaine Petchek, Scarsdale, NY; Nathan and Dora Oks, France; and Hilda Namm, Larkspur, CA. Prof. Schwartz is the incumbent of the Maurice and Ilse Katz Professorial Chair of Neuroimmunology.

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Researchers find protein signatures for accurate noninvasive diagnosis of prostate cancer

Protein signatures created that accurately diagnose prostate cancer and can distinguish between patients with aggressive versus non-aggressive disease

Toronto - Researchers at the Ontario Institute for Cancer Research (OICR) and University Health Network (UHN) in Toronto, along with researchers at the Eastern Virginia Medical School, have created protein signatures that accurately diagnose prostate cancer and can distinguish between patients with aggressive versus non-aggressive disease using a simple urine sample. The findings could be developed into a non-invasive "liquid biopsy" that could provide a faster, cheaper and easier method to detect prostate cancer with fewer complications for patients. The findings were published today in the journal Nature Communications.

Researchers performed an initial discovery screen on urine samples from men who were diagnosed with prostate cancer and those who were not to look for all proteins that might be different between them. They also screened for all proteins in the urine that might be different between patients with aggressive and non-aggressive disease. From these initial discoveries, they identified a subset of proteins unique to each grouping and developed two signatures: one that could be used to accurately indicate whether a patient has prostate cancer or not and a separate signature to indicate outcome.

"The amazing thing about these signatures is that their rate of accuracy is as good or better than the invasive tests that are used today, with far fewer drawbacks," said Dr. Paul Boutros, a Principal Investigator at OICR and a lead author on the

paper. "They can replace invasive, expensive, uncomfortable tests with something much easier and simpler. This type of cheap, non-invasive testing could allow patients to be screened much more frequently, allowing for more accurate monitoring of patients' non-aggressive cancer over time, sparing patients biopsies, imaging tests and even unnecessary surgeries."

Current methods to diagnose prostate cancer usually include a combination of digital rectal exams, prostate specific antigen (PSA) tests and biopsy, all of which have drawbacks, including their invasiveness for patients, potential complications and false-positive results (tests finding evidence of cancer when none is there). Finding new ways to accurately diagnose prostate cancer is considered a priority for many research institutions, including OICR, because the result of these tests' shortcomings is in many cases over-diagnosis and over-treatment.

There were three sites involved in the discovery and each brought their own unique expertise to the project. The Eastern Virginia Medical School developed clinical resources, while UHN researchers were generating large amounts of proteomic data and were developing new techniques to test proteins in blood. All of the proteomic and clinical data flowed to OICR where it was pieced together using computational biology, and where the proteins in the discovery screen were identified.

"Computational biology can help to identify the most probable protein biomarkers that show significant change of expression between two clinical or pathological conditions and could be involved in cancer development and progression," said Dr. Clare Jeon, a bioinformatician at OICR who led the computational biology portion of the study. "Initial proteomics work in this study generated expression information from 624 proteins. Computational analyses performed here at OICR reduced the number of proteins by identifying significantly differentially expressed proteins and finally characterized a set of six protein biomarkers for diagnosis and a set of seven protein biomarkers for prognosis of prostate cancer."

"Congratulations to all researchers who worked hard to make this important discovery," said Reza Moridi, Ontario's Minister of Research, Innovation and Science. "Your collaboration demonstrates the kind of world-class research taking place in Ontario that will soon pave the way for future advancements in the fight against prostate cancer."

The study has to date gone through development and initial validation and it is now ready for a large retrospective validation study, which the collaborators are now designing. After validation is successfully completed it would then move into clinical trials.

Prostate cancer is the most common cancer among Canadian men. Over 24,000 Canadian men were diagnosed with prostate cancer in 2015, representing almost a quarter of all new male cancer cases. Prostate cancer is the third leading cause of cancer death among men in Canada.

http://www.eurekalert.org/pub_releases/2016-06/mali-wed062816.php

What effect does oral aloe vera have on diabetes?

Studies show that oral aloe vera use was associated with significant decreases in both fasting blood glucose and hemoglobin A1c

New Rochelle, NY - A meta-analysis of studies in people with diabetes and pre-diabetes has shown that oral aloe vera use was associated with significant decreases in both fasting blood glucose (FBG) and hemoglobin A1c (HbA1c). The data indicate that people with a FBG >200 mg/dL may benefit the most, according to an article in The Journal of Alternative and Complementary Medicine, a peer-reviewed publication from Mary Ann Liebert, Inc., publishers. The article is available free for download on The Journal of Alternative and Complementary Medicine website until July 29, 2016.

In the article "Reduction of Fasting Blood Glucose and Hemoglobin A1c Using Oral Aloe Vera: A Meta-Analysis," William Dick, Emily Fletcher, and Sachin Shah, David Grant Medical Center, Travis Air Force Base, Fairfield, CA and Thomas J. Long School of Pharmacy and Health Sciences, University of the Pacific, Stockton, CA describe their analysis of data from nine studies to assess the effectiveness of oral aloe vera consumption in diabetes. They report significant reductions in FBG and HbA1c of 46.6 mg/dL and 1.05%, respectively, and review the proposed mechanisms that could account for these anti-diabetic effects.

http://www.eurekalert.org/pub_releases/2016-06/si-crp062816.php

Cannabinoids remove plaque-forming Alzheimer's proteins from brain cells

THC and other compounds found in marijuana can promote the cellular removal of amyloid beta

LA JOLLA -- Salk Institute scientists have found preliminary evidence that tetrahydrocannabinol (THC) and other compounds found in marijuana can promote the cellular removal of amyloid beta, a toxic protein associated with Alzheimer's disease.

While these exploratory studies were conducted in neurons grown in the laboratory, they may offer insight into the role of inflammation in Alzheimer's disease and could provide clues to developing novel therapeutics for the disorder.

"Although other studies have offered evidence that cannabinoids might be neuroprotective against the symptoms of Alzheimer's, we believe our study is the first to demonstrate that cannabinoids affect both inflammation and amyloid beta

accumulation in nerve cells," says Salk Professor David Schubert, the senior author of the paper.

Alzheimer's disease is a progressive brain disorder that leads to memory loss and can seriously impair a person's ability to carry out daily tasks. It affects more than five million Americans according to the National Institutes of Health, and is a leading cause of death. It is also the most common cause of dementia and its incidence is expected to triple during the next 50 years.

It has long been known that amyloid beta accumulates within the nerve cells of the aging brain well before the appearance of Alzheimer's disease symptoms and plaques. Amyloid beta is a major component of the plaque deposits that are a hallmark of the disease. But the precise role of amyloid beta and the plaques it forms in the disease process remains unclear.

In a manuscript published in June 2016's Aging and Mechanisms of Disease, Salk team studied nerve cells altered to produce high levels of amyloid beta to mimic aspects of Alzheimer's disease.

The researchers found that high levels of amyloid beta were associated with cellular inflammation and higher rates of neuron death. They demonstrated that exposing the cells to THC reduced amyloid beta protein levels and eliminated the inflammatory response from the nerve cells caused by the protein, thereby allowing the nerve cells to survive.

"Inflammation within the brain is a major component of the damage associated with Alzheimer's disease, but it has always been assumed that this response was coming from immune-like cells in the brain, not the nerve cells themselves," says Antonio Currais, a postdoctoral researcher in Schubert's laboratory and first author of the paper. "When we were able to identify the molecular basis of the inflammatory response to amyloid beta, it became clear that THC-like compounds that the nerve cells make themselves may be involved in protecting the cells from dying."

Brain cells have switches known as receptors that can be activated by endocannabinoids, a class of lipid molecules made by the body that are used for intercellular signaling in the brain. The psychoactive effects of marijuana are caused by THC, a molecule similar in activity to endocannabinoids that can activate the same receptors. Physical activity results in the production of endocannabinoids and some studies have shown that exercise may slow the progression of Alzheimer's disease.

Schubert emphasized that his team's findings were conducted in exploratory laboratory models, and that the use of THC-like compounds as a therapy would need to be tested in clinical trials.

In separate but related research, his lab found an Alzheimer's drug candidate called J147 that also removes amyloid beta from nerve cells and reduces the inflammatory response in both nerve cells and the brain. It was the study of J147 that led the scientists to discover that endocannabinoids are involved in the removal of amyloid beta and the reduction of inflammation.

Other authors on the paper include Oswald Quehenberger and Aaron Armando at the University of California, San Diego; and Pamela Maher and Daniel Daughtery at the Salk Institute.

The study was supported by the National Institutes of Health, The Burns Foundation and The Bundy Foundation.

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Is There a Link Between Bacteria and Breast Cancer?

There are bacteria living in women's breast tissue, and these microbes may affect women's health, a new study from Canada suggests.

By Sara G. Miller, Staff Writer | June 28, 2016 04:06pm ET

Researchers found that women with tumors in their breasts had a different mix of bacteria living in the tissue compared with woman who did not have tumors, according to the study.

Although bacteria are much more abundant in other places in women's bodies — such as the mouth, gut and vagina — low numbers of bacteria are present in breast tissue as well, said Gregor Reid, a professor of microbiology and immunology at Western University in Ontario, Canada, and the senior author of the study.

In the study, the researchers wanted to see if these bacteria differed depending on whether a woman had a tumor in her breast. They looked at breast tissue samples from 13 women with benign tumors, 45 women with cancerous tumors and 23 women who did not have breast tumors.

All of the women in the study had already planned to undergo breast surgery, either to remove a tumor, or for breast enhancement or reduction. The researchers performed a DNA analysis on a small sample of the tissue that was removed to figure out what types of bacteria were present. In the women with breast tumors, the researchers used tissue that did not contain the tumor, according to the study.

The researchers found that several types of bacteria were more common in the women with tumors in their breasts than in those without tumors. Womenwith tumors had higher levels of three types of bacteria — Enterobacteriaceae, Staphylococcus and Bacillus — compared with women who did not have tumors. For example, E. coli, which is a type of Enterobacteriaceae, was more common in the breasts of women with tumors.

It's possible that these types of bacteria may have cancer-promoting properties, the researchers said.

In the study, the researchers also did a small laboratory experiment using the bacteria found in the women with tumors: They added the bacteria to human breast cells growing in lab dishes, to see if the bacteria caused DNA damage. DNA damage can lead to the development of cancer, the researchers wrote.

The experiment showed that two of the bacterial strains (Enterobacteriaceae and Staphylococcus) from the breast tissue damaged the DNA, at least in the lab, Reid said. However, doing this experiment in animals or humans would lead to more definitive results, he said.

In women without tumors, the researchers observed higher levels of Lactococcus and Streptococcus bacteria. It's possible that these bacteria types have anti-cancer properties, although this is not proven, Reid said. Some research has shown that Lactobacillus bacteria, a related type of "good" bacteria, may be able to break down cancer-causing compounds, he said.

The breast microbiome

Research exploring the bacteria of the breast and how they may impact women's breast cancer risk is still in its infancy. However, previous studies have hinted that bacteria may play a role.

For example, breast-feeding is associated with a lower risk of breast cancer, and it's possible that breast milk helps the beneficial bacteria grow, Reid told Live Science Indeed, other studies have shown that bacteria pass from moms to their babies during breast-feeding, suggesting that breast milk and bacteria are linked.

And eating probiotics ("good" bacteria) may also affect breast bacteria, Reid said. In a recent study in Spain, researchers gave women probiotics and later found the types of bacteria contained in probiotics in the women's breast tissue, he said.

It is thought that immune cells in the gut may pick up the probiotics and transport them to the breast, Reid said. But he noted that figuring out the role bacteria may play in breast cancer is a big question and will take a lot more research.

One way to continue the research would be to ask women who are scheduled for breast surgery to take probiotics and then follow up to see if the probiotics are present in the breast tissue removed during the surgery, and also look at how likely those women are to develop cancer later on, Reid said.

Beneficial bacteria may be looked at as a potential way to prevent some cases of cancer, he said. In women who have an increased risk of breast cancer and who have higher levels of "bad" bacteria, researchers could look for possible ways to change the bacteria or monitor these bacteria, Reid said. And in the case of women who are healthy, researchers could investigate the questions, "Can we support beneficial microbes? Can we keep them healthy?" he said.

The study was published June 24 in the journal Applied and Environmental Microbiology.

http://bit.ly/297BzJy

Mummified, 99-Million-Year-Old Wings Caught in Amber

First time that feathers have been found alongside skeletal material in dinosaur-age amber

By Laura Geggel, Senior Writer | June 28, 2016 11:00am ET

About 99 million years ago, a hummingbird-size bird likely fought for its life after getting stuck in a glob of tree resin, but it couldn't tear itself away and eventually died, leaving its feathers to mummify in what became a lump of amber, a new study finds.

The soft resin even captured evidence of the bird's wriggling and writhing in an effort to free itself.

"There appear to be claw marks in the resin, which would suggest a struggle," said co-lead study researcher Ryan McKellar, a curator of invertebrate paleontology at the Royal Saskatchewan Museum in Canada.

Another preserved wing found in the clump of amber "appears to be a severed limb that may have been torn off by a predator, or may have floated free from the rest of the corpse due to resin flows," McKellar told Live Science in an email. "The broken end of the bone is fully encapsulated in amber."

The Angel Wing specimen is seen here under a compound microscope. This view shows the pigment banding the feathers and the outline of a claw.

Royal Saskatchewan Museum (RSM R.C. McKellar)

Both wing fragments are only a few centimeters in length, and are likely from the same species of ancient bird, the researchers said.

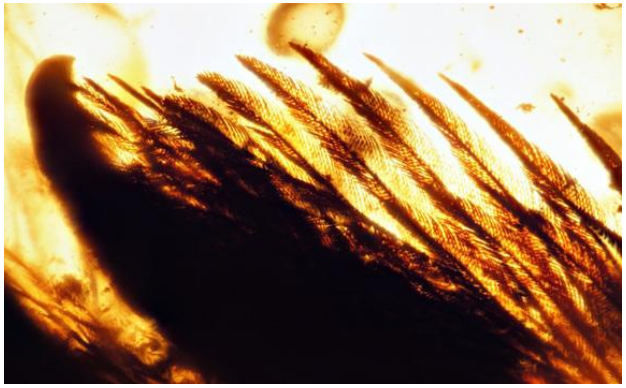
Moreover, the findings are the first concrete examples of follicles, feather tracts and bare skin from Cretaceous period birds, they said.

Lida Xing, the study's other co-leader and a lecturer at the China University of Geosciences in Beijing, discovered the specimens at an amber market in Kachin State, Myanmar, in 2015.

Delighted at the find, the researchers got right to work, studying the mummified feathers with microscopes and X-ray micro-computed tomography (CT) scanning

— a technique that's similar to a medical CT scanner but with more magnification power — to see the underlying tissue and bones, McKellar said.

"The work with microscopes under a wide range of lighting conditions allowed us to examine the feathers, claws and skin — seeing minute details of the feathers and their pigmentation," McKellar said. Ultraviolet (UV) light also helped them see flow lines within the amber, indicating how the tree resin moved before it solidified, and figure out how the wings had become trapped, he said.



An ancient, hummingbird-size bird got its wing stuck in sticky tree resin and likely struggled for its life about 99 million years ago. Researchers nicknamed this specimen "Angel Wing." **Chung-tat Cheung**

Their analyses indicate that the two birds belonged to the enantiornithines, a group of ancient birds that had teeth and whose skeletal anatomy differed within the pectoral girdle and ankle regions from modern birds.

Furthermore, the two specimens had adult-like feathers even though they were juveniles, McKellar said.

Most fossilized feathers are compressed, 2D remains preserved in sedimentary rock, making this finding all the more extraordinary, McKellar said.

"This is the first time that feathers have been found alongside skeletal material in Mesozoic [dinosaur-age] amber," McKellar said.

"We also get to see traces of pigmentation that would not be visible in the more common compression fossils, he added. For example, the researchers noticed "a pale spot and band on the upper surface of the wings, and a pale or white underside of the wings," he said.

This isn't the first time McKellar has studied mummified feathers. In 2011, McKellar and his colleagues published a study in the journal Science on 80-million-year-old feathers preserved in Canadian amber, although outside experts told Live Science that it was unclear whether the specimens were from a bird or a dinosaur.

The new study was published online today (June 28) in the journal Nature Communications.

http://www.eurekalert.org/pub_releases/2016-06/ifmp-cso062816.php

Current stimulation of the brain restores vision in patients with glaucoma and optic nerve damage

Randomized, clinical trial shows that modulating brain plasticity offers a promising avenue for vision restoration and rehabilitation

Magdeburg, Germany - Vision loss due to glaucoma or optic nerve damage is generally considered irreversible. Now a new prospective, randomized, multi-center clinical trial demonstrates significant vision improvement in partially blind patients after 10 days of noninvasive, transorbital alternating current stimulation (ACS). In addition to activation of their residual vision, patients also experienced improvement in vision-related quality of life such as acuity, reading, mobility or orientation. The results are reported in PLOS ONE.

"ACS treatment is a safe and effective means to partially restore vision after optic nerve damage probably by modulating brain plasticity, re-synchronizing brain networks, which were desynchronized by vision loss. This class 1 evidence is the first ever large-scale multi-center clinical trial in the field of non-invasive brain modulation using electric currents and suggests that visual fields can be improved in a clinically meaningful way," commented lead investigator Bernhard A. Sabel, PhD, of the Institute of Medical Psychology, Medical Faculty, Otto-von-Guericke University of Magdeburg (Germany).

In a study conducted at three German clinical centers (University of Göttingen, Charité Berlin, and University of Magdeburg), 82 patients were enrolled in a double-blind, randomized, sham-controlled clinical trial, 33 with visual deficits caused by glaucoma and 32 with anterior ischemic optic neuropathy caused by inflammation, optic nerve compression (due to tumors or intracranial hemorrhage), congenital anomalies, or Leber's hereditary optic neuropathy. Eight patients had more than one cause of optic nerve atrophy.

The groups were randomized so that 45 patients underwent 10 daily applications of ACS for up to 50 minutes per day over a two-week period and 37 patients received sham stimulation. The only difference between groups before treatment was that the stimulation group included more men than the sham group; no other differences were found, including age of the lesion or visual field characteristics. ACS was applied with electrodes on the skin near the eyes. Vision was tested before and 48 hours after completion of treatment, and then again two months later to check if any changes were long-lasting.

Patients receiving ACS showed significantly greater improvements in perceiving objects in the whole visual field than individuals in the sham-treated group. Specifically, when measuring the visual field, a 24% improvement was noted after

treatment in the ACS group compared to a 2.5% improvement in the sham group. This was due to significant improvements in the defective visual field sector of 59% in the ACS group and 34% in the sham group which received a minimal stimulation protocol. Further analyses showed improvements in the ACS group at the edges of the visual field. The benefits of stimulation were found to be stable two months later, as the ACS group showed a 25% improvement in the visual field compared to negligible changes (0.28%) in the sham group.

Patient safety measures were maintained at a high level, in line with previous studies. Current flow was assessed using sophisticated computer simulation models. No participants reported discomfort during stimulation, although temporary dizziness and mild headaches were reported in rare cases.

The study results are in line with previous small sample studies in which efficacy and safety were observed. Those studies revealed that well-synchronized dynamic brain functional networks are critical for vision restoration. Although vision loss leads to de-synchronization, these neural networks can be re-synchronized by ACS via rhythmic firing of the ganglion cells of the retina, activating or "amplifying" residual vision. Dr. Sabel added that "while additional studies are needed to further explore the mechanisms of action, our results warrant the use of ACS treatment in a clinical setting to activate residual vision by brain network re-synchronization. This can partially restore vision in patients with stable vision loss caused by optic nerve damage."

In summary, vision loss, long considered to be irreversible, can be partially reversed. There is now more light at the end of the tunnel for patients with low vision or blindness following glaucoma and optic nerve damage.

http://www.eurekalert.org/pub_releases/2016-06/acs-ptr062916.php

Portable test rapidly detects Zika in saliva for $2

New $2 test that in the lab can accurately detect low levels of the virus in saliva

Anxiety over the Zika virus is growing as the Olympic Games in Rio de Janeiro approach. To better diagnose and track the disease, scientists are now reporting in ACS' journal Analytical Chemistry a new $2 test that in the lab can accurately detect low levels of the virus in saliva.

The World Health Organization (WHO) recently announced that there was no need to postpone or move the Olympics due to Zika's presence, but concern over the virus' spread and its link to serious birth defects is far from allayed. Public health experts debate whether WHO made the right call. But while the discussion continues, scientists are working on new tools to help manage the outbreak. Current gold-standard tests to detect the virus require expensive lab equipment and trained personnel. Low-cost diagnostic methods have been reported but can't detect low levels of the disease or don't distinguish between Zika and similar viruses such as dengue. Changchun Liu and colleagues wanted to design a rapid, low-cost, and more reliable point-of-care detection test.

To ensure their system would be highly selective for Zika without confusing it with similar viruses, the researchers looked for and found a stretch of genetic code that is nearly identical for 19 different strains of the Zika virus infecting people in the Americas but not in other pathogens. Then, with materials costing $2 per test, they developed a diagnostic system, which only requires the addition of water to operate. If the Zika-specific genetic sequence is in a saliva sample, a dye within the system will turn blue within 40 minutes. The test even works if low levels of the sequence are present.

The authors acknowledge funding from the National Institutes of Health and the Penn Center for AIDS Research.

The abstract that accompanies this study is available here.

http://www.eurekalert.org/pub_releases/2016-06/tjnj-rod062716.php

Rate of decline of cardiovascular deaths slows in US

Decline in CVD started to decelerate "substantially" across the United States between 2011 and 2014

In a study published online by JAMA Cardiology, Stephen Sidney, M.D., M.P.H., of Kaiser Permanente Northern California, Oakland, and colleagues examined recent national trends in death rates due to all cardiovascular disease (CVD), heart disease (HD), stroke, and cancer, and also evaluated the gap between mortality rates from HD and cancer.

With the exception of the flu pandemic years of 1918-1920, heart disease has been the leading cause of death in the United States since 1910, with cancer and stroke among the 5 leading causes of death every year since 1924. During the first decade of the 21st century, HD mortality declined at a much greater rate than cancer mortality and it appeared that cancer would overtake HD as the leading cause of death. The decrease in HD mortality in the U.S. has been attributed to expanded use of evidence-based medical therapies as well as changes in risk factors and lifestyle modifications. For this study, researchers used the data system of the Centers for Disease Control and Prevention Wide-Ranging Online Data for Epidemiologic Research to determine national trends in age-adjusted mortality rates due to all CVD, HD, stroke, and cancer from January 2000 to December 2011 and January 2011 to December 2014, overall, by sex, and by race/ethnicity.

The researchers found that the rate of the decline in all CVD, HD, and stroke mortality decelerated substantially after 2011, and the rate of decline for cancer mortality remained relatively stable. The annual rates of decline for 2000-2011 were 3.79 percent, 3.69 percent, 4.53 percent, and 1.49 percent for all CVD, HD,

stroke, and cancer mortality, respectively; the rates for 2011-2014 were 0.65 percent, 0.76 percent, 0.37 percent, and 1.55 percent, respectively.

The authors write that if the rates of decline from 2000 to 2011 had persisted, HD mortality in the United States would have been below that of cancer mortality in 2013, but the pattern of HD and cancer being the first and second leading causes of death, respectively, has endured.

"Given the high absolute burden and associated costs of HD and stroke, continued vigilance and innovation are essential in our efforts to address the ongoing challenge of CVD prevention. However, the recent deceleration in the rate of decline in HD mortality is alarming and warrants expanded innovative efforts to improve population-level CVD prevention."

(JAMA Cardiology. Published online June 29, 2016; doi:10.1001/jamacardio.2016.1326. Available pre-embargo to the media at http://media.jamanetwork.com.)

http://www.eurekalert.org/pub_releases/2016-06/hu-sos062916.php

Science of sake: Mutation threatening high-quality brewing yeast identified

Mutation could ruin the brew of a type of yeast responsible for high-quality sake

Saijo, Hiroshima, Japan - Biologists at Hiroshima University, located in the historic sake brewing town of Saijo, have identified the genetic mutation that could ruin the brew of one particular type of yeast responsible for high-quality sake.

The research was part of an academic-government-industry collaboration involving the National Institute of Brewing (Japan), the Asahi Sake Brewing Company (Niigata), the Brewing Society of Japan, The University of Tokyo, The University of Pennsylvania, and Iwate University.

Two types of sake considered especially high-quality are called daiginjo-shu and junmai-daiginjo-shu and are often made using the yeast K1801. Different brewing yeasts, whether for beer, wine, or sake, create different tastes in the final product due to factors such as how they make the sugar-to-alcohol conversion and the by-products that they release as part of many biosynthesis pathways.

A previously identified mutation in K1801 is a desirable change that makes the yeast produce high amounts of ethyl caproate, the chemical that acts as the major flavor component of many varieties of high-quality sake and creates a fruity taste.

A different mutation, newly identified by this research team, is potentially devastating for brewers because it causes a defect in how the yeast grows and divides.

The risk of a ruined brew from this potentially dysfunctional yeast is a liability for industrial-scale sake production, where consistent production with stable quality is essential for brewers.

The research team confirmed that K1801's two mutations are not functionally related by performing genetic experiments, chemical analysis, and computer-assisted microscopic visual inspection of the yeast cells using a software program called CalMorph.

A genetically engineered version of K1801 that had normal growth but maintained high production of ethyl caproate was also built and used to brew sake in the laboratory.

Dai Hirata, PhD, from Hiroshima University is last author of the research paper and has training and experience as a sake taster, serving as an official judge at sake evaluation events.

"Our small-scale brew indicated that this version of the yeast without the growth-related mutation should maintain the high quality expected of daiginjo-shu," said Hirata.

However, the Japanese market will not accept sake made from genetically modified yeast. The next step for the research team is to begin screening potentially thousands of K1801 yeast cells until they can find a natural mutant with only the desirable mutation.

The quality of sake comes in-part from the amount of the rice husk, the outer shell responsible for giving un-processed rice its brown color, that has been polished off before the rice is used for brewing.

Daiginjo-shu is made from highly polished rice with over half of the husk removed and is usually brewed for a long fermentation period at a low temperature compared to standard sake brewing before it is filtered and bottled. K1801 does not produce a foamy layer while brewing, meaning it requires less physical labor for brewers during the cleaning process between batches. An additional valuable attribute of K1801 is the low amount of total acids it produces as it brews, which creates the smooth taste of its sake.

Original research article citation: Tetsuya Goshima, Ryo Nakamura, Kazunori Kume, Hiroki Okada, Eri Ichikawa, Hiroyasu Tamura, Hirokazu Hasuda, Masaaki Inahashi, Naoto Okazaki, Takeshi Akao, Hitoshi Shimoi, Masaki Mizunuma, Yoshikazu Ohya, Dai Hirata. 18 May 2016. Identification of a mutation causing a defective spindle assembly checkpoint in high ethyl caproate-producing sake yeast strain K1801. Bioscience, Biotechnology, and Biochemistry. DOI: 10.1080/09168451.2016.1184963

Additional information about the CalMorph software used in this research is available in the following publication: Ohtani M. et al. Development of image processing program for yeast cell morphology. J. Bioinform. Comput. Biol. 2004; 102: 19015-19021. http://dx.doi.org/10.1142/S0219720004000363

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http://www.eurekalert.org/pub_releases/2016-06/uovh-aq062916.php

Allergy-causing 'bad guy' cells unexpectedly prove life-saving in C. difficile

Finding 'as unexpected as it is important,' with 'immediate implications for therapy'

Researchers at the University of Virginia School of Medicine have identified immune cells vital for protecting us from potentially fatal C. difficile infection. Surprisingly, those cells are often vilified for their role in causing asthma and allergies. But when it comes to C. difficile, they could be the difference in life and death. With the discovery, the researchers have answered some of the greatest questions about C. diff, shed light on why antibiotics lead to severe C. diff and identified a potential way for doctors to prevent the life-threatening infection -- and possibly other infections as well.

The Role of Antibiotics

Bill Petri, MD, PhD, chief of the Division of Infectious Diseases and International Health at the UVA Health System, hailed the discovery by UVA's Erica L. Buonomo, PhD, and colleagues as "the most remarkable breakthrough I have participated in as a scientist."

"Antibiotics are really important, and very often you have to give antibiotics, but you do it knowing that you're predisposing your patient to another infection [C. difficile] that is potentially lethal. About one out of seven people with this infection dies in North America. So it's a terrible dilemma for physicians," Petri said. "This is not a common complication of antibiotics, but when it happens, it's a very serious one. This work enables a potential long-term solution to that, which is probiotics to restore the natural state of the gut."

There were almost half a million C. diff infections in the United States in 2011, and approximately 29,000 patients died within 30 days of infection, according to a study released last year by the U.S. Centers for Disease Control and Prevention. The agency has classified the bacterium as an "urgent threat," noting the rise of a new epidemic strain in recent years that has made the infection even deadlier.

Kris Chadee, PhD, a professor at the University of Calgary who was not involved in UVA's C. diff work, called the discovery "as unexpected as it is important," noting that the finding "has immediate implications for therapy: Probiotics designed to restore the healthy gut microbiome should be an effective way to prevent this life-threatening infection."

Understanding C. Difficile

C. difficile is primarily a hospital-acquired infection, and it predominantly affects the elderly, particularly elderly people on antibiotics. UVA's discovery offers answers about why that is. The researchers showed that the gut bacteria stimulates the production of a protein called IL-25, which then recruits protective cells called eosinophils. As such, IL-25, the product of "good" bacteria, protects the lining of the gut from pathogens. Antibiotics, however, disrupt our body's natural bacterial populations, leaving the gut lining vulnerable to C. diff and other infections.

Intriguingly, the researchers found an important and unexpected role for eosinophils, a type of white blood cells. These cells are often vilified for their role in causing both allergies and asthma, but in the battle against C. diff, they can be life-saving. IL-25, the UVA researchers show, protects us from C. diff by manufacturing eosinophils to guard the integrity of the gut lining.

"We found that if you deplete eosinophils, either genetically or by an antibody neutralization, you lost the integrity of the epithelial barrier in the gut," Buonomo said. "Maintaining that barrier is very important for having a healthy response to C. difficile. It also prevents bacteria from spreading to other sites in the body, so if you have a breakdown in the barrier, you can have a septic response or bacteria in your blood or in other systemic organs."

The findings suggest that researchers should be able to develop new probiotics that patients could take to ward off C. difficile. "We could end up that every person taking an antibiotic is taking a new probiotic that is specifically designed to maintain IL-25 and eosinophils," Petri said.

Petri noted that Buonomo joined his lab while a graduate student at UVA, and he credited the discovery to the new perspective she brought. "Erica was a card-carrying immunologist before she came into my lab," Petri recalled. "She came with an immunology mindset, and the lab wasn't immunology focused at all. It's changed. We've all seen the benefit of having that perspective, of looking at how the immune system is responding to the bacterial infection."

The discovery has been described in a paper published online by the scientific journal Cell Reports. It was authored by Buonomo, Carrie A. Cowardin, Madeline G. Wilson, Mahmoud M. Saleh, Patcharin Pramoonjago and Petri.

http://bit.ly/299Fqq0

Newfound Human Species Suggests Africa Was Evolutionary Melting Pot

By Charles Q. Choi, Live Science Contributor | June 29, 2016 02:46pm ET

The most recently discovered extinct human species may have lived less than 1 million years ago, researchers have discovered.

This finding suggests that a diverse range of human species might have lived at the same time in Africa, just as they might have in Asia, researchers said.

In 2015, scientists reported South African fossils of a hitherto-unknown relative of modern humans that possessed an unusual mix of features, such as feet adapted

for a life on the ground but hands suited for a life in the trees. The fossil's discoverers named the species Homo naledi, and noted that although the early human had a brain about the size of an orange, these humans may have performed ritual burials of their dead.

Frustratingly, the age of H. naledi remains unknown. "This has been one of the biggest points of consternation for other researchers," said study co-author Mark Collard, a biological anthropologist at Simon Fraser University in British Columbia, Canada.

Since scientists don't know when H. naledi lived, it's difficult to determine how exactly the species fits into the family tree of hominins, those species composed of humans and their close relatives.

Given some of H. naledi's primitive, ape-like features, some researchers argued that the species might not be a member of the human lineage Homo, but might have belonged to Australopithecus, the most likely ancestors of humans.

The skull of Homo naledi, which was discovered within the Dinaledi Chamber of the Rising Star cave system, in the Cradle of Humankind, South Africa. **John Hawks, Wits University**

Dating H. naledi fossils

To deduce the age of H. naledi and the species' relationships to other hominins, Collard and his colleagues developed a computer model analyzing skull, jaw and tooth features of both early and late hominins. For instance, the model includes Homo erectus, the most likely ancestor of modern humans, Homo sapiens.

The new model suggests "that the new species, H. naledi, is most closely related to the existing species of genus Homo and the recently discovered South African australopith species Australopithecus sediba, but the data do not allow us to determine which of the species within that group H. naledi is most closely related to," Collard said.

The new model also suggests that H. naledi fossils were about 912,000 years old. For comparison, prior work suggested that modern humans arose on Earth about 200,000 years ago.

"The date is surprising, because it's relatively young. Given the small brain size and other primitive characteristics of H. naledi, I think most researchers have assumed that it is considerably older than 900,000 years old," Collard said.

This age estimate suggests that H. naledi was a member of Homo and not Australopithecus, the scientists said. The timing also suggests H. naledi fossils were not just unusual specimens of H. erectus, but their own species, the researchers added.

Hominin diversity

Collard said he expected this new age estimate would draw a lot of skepticism from other scientists. "Their skepticism will be entirely understandable," he said. "Even now, I remain a bit skeptical about it. I think it's well-enough supported to put it out there, but I'm not about to bet my house on it. That said, I think it's worth the field pondering the implications for our understanding of human evolution if the age estimate is about right and H. naledi is around a million years old."

For instance, these findings suggest that small-brained human species such as H. naledi may have lived at the same time as larger-brained human species in Africa such as H. erectus. Similarly, recent studies have suggested that small-brained human species such as the "hobbit" Homo. floresiensis and larger-brained human species such as H. erectus and H. sapiens lived contemporaneously in Asia.

"One of the questions the possibility of such diversity raises is, 'Who made the stone tools we find in those parts of the Old World where we've got evidence for multiple species of Homo?'" Collard said. "I don't think we can assume that it was just the large-brained Homo species necessarily."

In the future, the researchers hope to extend their model to more than just the skulls of hominins, Collard said. This may help better pinpoint which hominin species H. naledi is most closely related to.

The scientists detailed their findings in the August issue of the Journal of Human Evolution.

http://bit.ly/29EeD6t

Scientists Get to the Bottom of the Bright Spots on Ceres

New results from Dawn spacecraft fuel debate on whether the dwarf planet is a habitable oasis between Mars and Jupiter

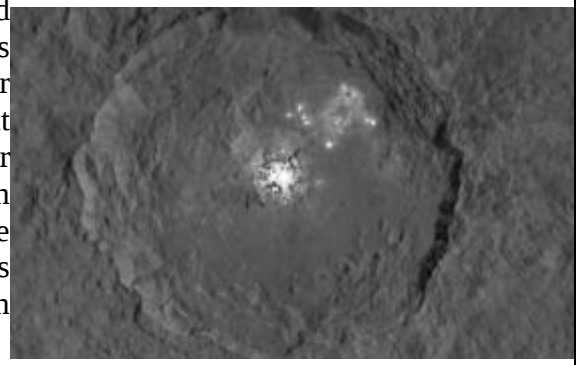
By Lee Billings on June 29, 2016

Ever since NASA’s Dawn spacecraft arrived at the dwarf planet Ceres in March 2015, scientists have been arguing over more than 130 curiously bright spots Dawn spied on the surface of the coal-dark world. Most are found in craters - including the biggest and brightest spots, which lie within Occator, a 90-kilometer-wide crater estimated to be relatively youthful at less than 80 million years old.

Are these spots the uncovered surface of a buried layer of ice or perhaps erupting geysers or cryovolcanoes or the shattered remains of space rocks striking Ceres -

or something else entirely? Researchers' best guesses remained in flux for months, changing with each new set of ever-sharper images Dawn delivered as it slowly spiraled down closer to the dwarf planet's surface.

Late last year Dawn's scientists used tentative spectroscopic measurements to finally zero in on shiny, ice-suffused deposits of magnesium sulfate salts as the most probable explanation for Occator's bright spots. Sunlight striking the deposits could boost their brightness by covering them with layers of haze produced from the vaporized ice. But these conclusions remained tentative, contingent on Dawn gathering more definitive data.



New results from NASA's Dawn mission suggest that the bright spots within Ceres's Occator Crater are composed of sodium carbonate salts, and produced through geyser-like activity **NASA/JPL-Caltech/UCLA/MPS/DLR/IDA**

And now, in a study published Wednesday, Dawn scientists have again changed their minds about the nature of Occator's spots and the implications for Ceres. Based on higher-quality spectroscopic observations taken during Dawn's descent, Maria Cristina De Sanctis of the National Institute of Astrophysics in Rome and several of her colleagues report in Nature that Occator's spots are made not of magnesium sulfate but of a very different salt—sodium carbonate.

"The abundance of [sodium] carbonate requires liquid water in the form of brine," De Sanctis says. "This is especially intriguing if you think that Ceres is in the so-called 'habitable zone' of the solar system," where liquid water could sustain life as we know it. If Ceres's subsurface has harbored liquid water in the not-too-distant past, it may still even today.

Whiffs of Salt from the Outer Solar System

According to Mikhail Zolotov of Arizona State University, who wrote an accompanying commentary for the study, the new findings have made Occator's spots—and the rest of the bright spots on Ceres—much less enigmatic. "To understand Occator is to understand the spots elsewhere. They are a bit like the Old Faithful geyser at Yellowstone."

The spots, Zolotov says, are confined to impact craters because they likely form from impacts heating the subsurface and releasing briny liquid water or vapor from scant subsurface ice or hydrated minerals. The brines flow up through fractures or porous rock and boil near the vacuum-exposed surface, jetting out as frozen, salty droplets. The water sublimates away, leaving behind shiny, salt-rich residue. In addition to creating new salt deposits by their heat, impacts could also uncover old ones, excavating substantial salt layers built up over geologic time within old craters.

The presence of sodium carbonate on Ceres also adds to an accumulating pile of circumstantial evidence suggesting the dwarf planet may have formed far from the outer edge of the inner solar system where it presently resides. One of the only other places beyond Earth that scientists have found significant signs of sodium carbonate is within plumes venting from the interior of Enceladus, an icy moon of Saturn.

Last year De Sanctis and colleagues announced their probable spectroscopic detection on Ceres of ammonia-rich clays—compounds formed from highly volatile raw materials that could not easily endure exposure to the scorching sunlight of the inner solar system, and instead are most often found on bodies in the system's frigid outer reaches.

The presence of such materials on Ceres, De Sanctis says, could also mean the world somehow formed out there before being tossed down into the inner system by a violent gravitational interaction with a passing planet or moon. Alternatively, showers of debris from the outer solar system rich in nitrogen ice and ammonia could have rained on Ceres after it was born in the inner system long, long ago.

What Lies Below?

For years, two competing theories have served as opposing bookends for scientists' studies of the dwarf planet, which is relatively light for its roughly 900-kilometer diameter.

One theory postulates that Ceres's interior was quite wet and that its low density is due to a thick shell of ice surrounding a rocky core—produced perhaps from the freezing of a buried ocean of liquid water early in the world's history. The other theory, detailed by Zolotov in 2009, suggests instead that Ceres is relatively dry, and that its lightweight status is simply due to its being an undifferentiated lump of porous rock.

Either scenario is compatible with Ceres's bright spots; minimal moisture is required to generate brines that well up from the deep to the surface. But there are still major implications to the competing possibilities in this debate.

As the most significant possible reservoir of water and other volatile compounds between Mars and Jupiter, Ceres could prove to be a vital oasis for any future human expansion into the solar system.

But the two theories hold vastly different prospects for extraterrestrial life—a dryer and more inert Ceres would stretch the definition of "habitability" even closer to a breaking point than a world with a frozen, salt-filled sea.

On a fundamental level, however, the dwarf planet is a remnant from the early history of the solar system, a sizeable scrap of protoplanetary stuff that somehow escaped incorporation into a greater world and instead became the largest known member of the Asteroid Belt, which stretches between the orbits of Mars and Jupiter. Gaining a deeper understanding of its composition, structure and history is perhaps the closest scientists will ever come to knowing the other long-vanished building blocks that went on to form Earth and the solar system's other planets.

Meanwhile a second, separate study published Wednesday in Nature Geoscience says the "dry Ceres" model is closer to the truth, based on results that suggest a paucity of water ice in the upper several kilometers of the dwarf planet's subsurface.

Using digital terrain maps constructed from Dawn images, a team led by Michael Bland of the U.S. Geological Survey Astrogeology Center at the University of Arizona determined that the morphology of Ceres's large craters rules out an ice-rich subsurface.

On Ceres, ice-dominated craters would change shape over millions and billions of years, their floors flattening and their rims softening as the underlying ice relaxes and flows. The deep, sharp concavities of Ceres's craters, Bland says, indicate that water ice makes up on average no more than 30 to 40 percent of the subsurface by volume—and perhaps much less.

"It appears to be that my prediction was right, I am sad to say," Zolotov says. "I think the data now support Ceres being a nondifferentiated body, basically a piece of porous rock—a very large but otherwise typical asteroid without anything exotic like an icy mantle ocean."

Bland does not entirely agree. Ceres is likely still the most ice-rich object in the Asteroid Belt and still holds many secrets, he says. "Many people latched on to the idea of a water-rich Ceres because it is a little more interesting, but reality is not always as exciting as our expectations," he says. "This world is probably neither as completely dry as [Zolotov] has suggested nor as wet as its rival model. It is a much more complicated place that lies somewhere in between those two extremes."

More certainty—or, at least, another change of thinking—may come soon, as the Dawn team publishes additional results from the spacecraft's ongoing observations of Ceres. Dawn is slated to continue its studies into 2017, until either its funding or its ability to maintain a stable orbit decays, although NASA is also reportedly considering whether the hardy craft could be sent to yet another asteroid (it orbited Vesta previous to its encounter with Ceres) before finally ending its mission.

http://bit.ly/29qBbsz

Ancient Shrine That May Hold Buddha's Skull Bone Found in Crypt

Archaeologists have discovered what may be a skull bone from the revered Buddha, Siddhartha Gautama.

By Owen Jarus, Live Science Contributor | June 30, 2016 08:53am ET

The bone was hidden inside a model of a stupa, or a Buddhist shrine used for meditation.

The research team found the 1,000-year-old model within a stone chest in a crypt beneath a Buddhist temple in Nanjing, China. Inside the stupa model archaeologists found the remains of Buddhist saints, including a parietal (skull) bone that inscriptions say belonged to the Buddha himself.

A skull bone of the Buddha was found inside this gold casket, which was stored in a silver casket within the stupa model, found in a crypt beneath a Buddhist temple. **Photo courtesy of Chinese Cultural Relics**

The model is made of sandalwood, silver and gold, and is covered with gemstones made of crystal, glass, agate and lapis lazuli, a team of archaeologists reported in an article published in the journal Chinese Cultural Relics.

Inscriptions engraved on the stone chest that the model was found in say that it was constructed during the reign of Emperor Zhenzong (A.D. 997-1022), during the Song Dynasty. Also inscribed on the stupa are the names of people who donated money and material to build the model, as well as some of the people who constructed the model. [See Photos of the Model Stupa Holding Buddha Remains]

While the inscriptions say that the skull bone belongs to the Buddha, it is unknown whether it really does come from him. In the journal article, archaeologists didn't speculate on how likely it is. The bone is being treated with great respect and has been interred in the modern-day Qixia Temple by Buddhist monks.

Stone chest inscription

Discovered beneath the Grand Bao'en Temple, the stupa model — which is 117 centimeters tall and 45 cm wide (nearly 4 feet by 1.5 feet) — was stored within an iron box, which, in turn, was stored within a stone chest.

An inscription found within the stone chest was written by a man named Deming about 1,000 years ago, saying that he is "the Master of Perfect Enlightenment, Abbot of Chengtian Monastery [and] the Holder of the Purple Robe" (as translated by researchers in the journal article). He tells the story of how the Buddha's parietal bone came to China.

Deming wrote that after the Buddha "entered parinirvana" (a final death that breaks the cycle of death and rebirth), that his body "was cremated near the Hirannavati River" in India. The man who ruled India at the time, King Ashoka (reign 268-232 B.C.), decided to preserve the Buddha's remains, which he "divided into a total of 84,000 shares," Deming wrote. "Our land of China received 19 of them," including the parietal bone, he added.

The parietal bone was kept in a temple that was destroyed about 1,400 years ago during a series of wars, Deming wrote. "The foundation ruins … were scattered in the weeds," Deming wrote. "In this time of turbulence, did no one care for Buddhist affairs?"

This model of a stupa, which is used for meditation, was discovered beneath Grand Bao'en Temple in Nanjing, China. The 1,000-year-old stupa is made of sandalwood, silver and gold. **Photo courtesy of Chinese Cultural Relics**

Emperor Zhenzong agreed to rebuild the temple and have the Buddha's parietal bone, and the remains of other Buddhist saints, buried in an underground crypt at the temple, according to Deming's inscriptions. They were interred on July 21, 1011 A.D., in "a most solemn and elaborate burial ceremony," Deming wrote.

Deming praised the emperor for rebuilding the temple and burying the Buddha's remains, wishing the emperor a long life, loyal ministers and numerous grandchildren: "May the Heir Apparent and the imperial princes be blessed and prosperous with 10,000 offspring; may Civil and Military Ministers of the Court be loyal and patriotic; may the three armed forces and citizens enjoy a happy and peaceful time …"

Buddha burial

The parietal bone of the Buddha was buried within an inner casket made of gold, which, in turn, was placed in an outer casket made of silver, according to the archaeologists. The silver casket was then placed inside the model of the stupa. The gold and silver caskets were decorated with images of lotus patterns, phoenix birds and gods guarding the caskets with swords. The outer casket also has images of spirits called apsaras that are shown playing musical instruments.

The parietal bone of the Buddha was placed within the gold inner casket along with three crystal bottles and a silver box, all of which contain the remains of other Buddhist saints. Engraved on the outside of the model are several images of the Buddha, along with scenes depicting stories from the Buddha's life, from his birth to the point when he reached "parinirvana," a death from which the Buddha wasn't reborn — something that freed him from a cycle of death and rebirth, according to the Buddhist religion.

Impact in China

A large team of archaeologists from the Nanjing Municipal Institute of Archaeology excavated the crypt between 2007 and 2010; they were supported by experts from other institutions in China.

Although the excavations received little coverage by Western media outlets, they were covered extensively in China. Chinese media outlets say that, after the parietal bone of the Buddha was removed, Buddhist monks interred the bone and the remains of the other Buddhist saints in Qixia Temple, a Buddhist temple used today. The Buddha's parietal bone and other artifacts from the excavation were later displayed in Hong Kong and Macao. When the bone traveled to Macao in 2012, the media outlet Xinhua reported that "tens of thousands of Buddhist devotees will pay homage to the sacred relic," and that "more than 140,000 tickets have been sold out by now, according to the [event organizer]."

An article detailing the discoveries was published in Chinese in 2015 in the journal Wenwu, before being translated and published in Chinese Cultural Relics.

http://www.eurekalert.org/pub_releases/2016-06/d-apl062916.php

Artificial pancreas likely to be available by 2018

Artificial pancreas is likely to be available by 2018

The artificial pancreas -- a device which monitors blood glucose in patients with type 1 diabetes and then automatically adjusts levels of insulin entering the body -- is likely to be available by 2018, conclude authors of a paper in Diabetologia (the journal of the European Association for the Study of Diabetes). Issues such as speed of action of the forms of insulin used, reliability, convenience and accuracy of glucose monitors plus cybersecurity to protect devices from hacking, are among the issues that are being addressed.

Currently available technology allows insulin pumps to deliver insulin to people with diabetes after taking a reading or readings from glucose meters, but these two components are separate. It is the joining together of both parts into a 'closed loop' that makes an artificial pancreas, explain authors Dr Roman Hovorka and Dr Hood Thabit of the University of Cambridge, UK. "In trials to date, users have

been positive about how use of an artificial pancreas gives them 'time off' or a 'holiday' from their diabetes management, since the system is managing their blood sugar effectively without the need for constant monitoring by the user," they say.

One part of the clinical need for the artificial pancreas is the variability of insulin requirements between and within individuals -- on one day a person could use one third of their normal requirements, and on another 3 times what they normally would. This is dependent on the individual, their diet, their physical activity and other factors. The combination of all these factors together places a burden on people with type 1 diabetes to constantly monitor their glucose levels, to ensure they don't end up with too much blood sugar (hyperglycaemic) or more commonly, too little (hypoglycaemic). Both of these complications can cause significant damage to blood vessels and nerve endings, making complications such as cardiovascular problems more likely.

There are alternatives to the artificial pancreas, with improvements in technology in both whole pancreas transplantation and also transplants of just the beta cells from the pancreas which produce insulin. However, recipients of these transplants require drugs to supress their immune systems just as in other organ transplants. In the case of whole pancreas transplantation, major surgery is required; and in beta cell islet transplantation, the body's immune system can still attack the transplanted cells and kill off a large proportion of them (80% in some cases). The artificial pancreas of course avoids the need for major surgery and immunosuppressant drugs.

Researchers globally continue to work on a number of challenges faced by artificial pancreas technology. One such challenge is that even fast-acting insulin analogues do not reach their peak levels in the bloodstream until 0.5 to 2 hours after injection, with their effects lasting 3 to 5 hours. So this may not be fast enough for effective control in, for example, conditions of vigorous exercise. Use of the even faster acting 'insulin aspart' analogue may remove part of this problem, as could use of other forms of insulin such as inhaled insulin. Work also continues to improve the software in closed loop systems to make it as accurate as possible in blood sugar management.

A number of clinical studies have been completed using the artificial pancreas in its various forms, in various settings such as diabetes camps for children, and real life home testing. Many of these trials have shown as good or better glucose control than existing technologies (with success defined by time spent in a target range of ideal blood glucose concentrations and reduced risk of hypoglycaemia). A number of other studies are ongoing. The authors say: "Prolonged 6- to 24-month multinational closed-loop clinical trials and pivotal studies are underway or in preparation including adults and children. As closed loop devices may be vulnerable to cybersecurity threats such as interference with wireless protocols and unauthorised data retrieval, implementation of secure communications protocols is a must."

The actual timeline to availability of the artificial pancreas, as with other medical devices, encompasses regulatory approvals with reassuring attitudes of regulatory agencies such as the US Food and Drug Administration (FDA), which is currently reviewing one proposed artificial pancreas with approval possibly as soon as 2017. And a recent review by the UK National Institute of Health Research (NIHR) reported that automated closed-loop systems may be expected to appear in the (European) market by the end of 2018. The authors say: "This timeline will largely be dependent upon regulatory approvals and ensuring that infrastructures and support are in place for healthcare professionals providing clinical care. Structured education will need to continue to augment efficacy and safety."

The authors say: "Cost-effectiveness of closed-loop is to be determined to support access and reimbursement. In addition to conventional endpoints such as blood sugar control, quality of life is to be included to assess burden of disease management and hypoglycaemia. Future research may include finding out which sub-populations may benefit most from using an artificial pancreas. Research is underway to evaluate these closed-loop systems in the very young, in pregnant women with type 1 diabetes, and in hospital in-patients who are suffering episodes of hyperglycaemia."

They conclude: "Significant milestones moving the artificial pancreas from laboratory to free-living unsupervised home settings have been achieved in the past decade. Through inter-disciplinary collaboration, teams worldwide have accelerated progress and real-world closed-loop applications have been demonstrated. Given the challenges of beta-cell transplantation, closed-loop technologies are, with continuing innovation potential, destined to provide a viable alternative for existing insulin pump therapy and multiple daily insulin injections."

http://bit.ly/29qqXRT

Science Finds a Way to Overcome Life's Regrets

Science Finds a Way to Overcome Life's Regrets

By Sara G. Miller, Staff Writer | June 30, 2016 05:30pm ET

If you can't seem to let go of a regret, a little self-compassion may help you move on, a recent study finds. The people in the study who practiced self-compassion, or being kind to oneself, were more likely to overcome regrets than the people who did not do so, according to the study, published in February in the journal Personality and Social Psychology Bulletin.

Although regrets are often painful, previous studies have suggested that some people can overcome them and feel stronger afterward, said Jia Wei Zhang, a graduate student in psychology at the University of California, Berkeley. But this isn't the case for everyone, he said.

The researchers wanted to better understand why some people report feeling improvement from regrets but others don't, Zhang said. They suspected that the difference lies in how people approach their regrets in hindsight, he said. "Do we run away from them, or take them head-on?" he said.

In the study, the researchers zeroed in on self-compassion as a potential factor in why some people have an easier time leaving their regrets behind them.

In an experiment, 400 students ages 18 to 49 sat down at computers for a writing exercise.

First, the students were asked to write about their biggest regret. Half were randomly assigned to write about a regret of action, or something that they did but wish they had not done; the other half were asked to write about a regret of inaction, or something they did not do but wish they had, according to the study.

Then, the participants were randomly assigned to one of three groups: self-compassion, self-esteem and a control group. The self-compassion group was asked to respond to the prompt, "Imagine that you are talking to yourself about this regret from a compassionate and understanding perspective. What would you say?"

The self-esteem group was asked to respond to the prompt, "Imagine that you are talking to yourself about this regret from a perspective of validating your positive (rather than negative) qualities," according to the study.

The control group was not asked to write about the regret; rather, these participants were asked to write about a hobby they enjoyed. Then, the researchers asked the participants a series of questions about their feelings of forgiveness, acceptance and personal improvement following the exercise.

They found that the people in the self-compassion group reported greater feelings of acceptance, forgiveness and personal improvement, compared with not only the control group but also the self-esteem group.

In other words, focusing on your best qualities is not what helps you feel better about a regret. Rather, being compassionate toward yourself is what may make a difference, the researchers found.

It's possible that people who practice self-compassion are able to confront their regrets and see what went wrong, so they can make a better choice in the future, Zhang told Live Science. Self-compassion pushes people to accept their regret instead of running away from it, he said. "This willingness to remain in contact with their regret may afford people the opportunity to discover avenues for personal improvement," the researchers wrote in the study.

The researchers added that the acceptance element is just one part of why self-compassion helps people improve after doing something they regret. The other element that they proposed is called reappraisal, in which people think of "an event in a way that shifts its emotional impact," they wrote.

They pointed to an example of this from a previous study on breast cancer patients who were asked to try thinking about their treatment in a positive light before it began. The women who did so reported greater feelings of personal growth later on, the researchers wrote.

http://bit.ly/29cp0NN

Ayurvedic Herbal Supplements Caused Man's Lead Poisoning

A 26-year-old man in Pennsylvania who took Indian Ayurvedic herbal supplements wound up developing lead poisoning from taking the pills, according to a report of his case.

By Agata Blaszczak-Boxe, Contributing Writer | June 30, 2016 06:45pm ET

Stomach pain, weight loss, nausea, vomiting and dark-colored stools had sent the man to an emergency room in Philadelphia, where doctors discovered that he had a high level of lead in his blood, according to the report.

The man's symptoms went away several months after he was treated and stopped taking the supplements, the doctors who treated him wrote in their report.

This is not the first time Ayurvedic herbal supplements have landed someone in the hospital.

There have been other cases of lead poisoning linked to the use of similar supplements, the man's doctors wrote in the report, published today (June 30) in the journal BMJ Case Reports. "This case follows similar reports in the USA of acute lead toxicity from Ayurvedic medications produced in India," they wrote.

Ayurveda is a traditional herbal medicine system that originated more than 2,000 years ago in India, according to the report. About 80 percent of people in India use this type of medicine, according to the report.

In one subdivision of Ayurveda, metals — including mercury, lead and arsenic — are used in addition to herbal remedies to treat conditions such as epilepsy, insomnia and asthma.

Researchers estimate that roughly 35 to 40 percent of the 6,000 medicines listed in the Ayurvedic collection of formulas intentionally contain at least one metal, the authors said in their report.

The man described in the report first took the herbal supplements to treat lower-back pain he experienced during a trip to India. After returning to the U.S., he

started using the supplements regularly, and soon started having abdominal symptoms, according to the study.

At the hospital, the doctors determined that the supplements he had been taking were to blame for his condition, as he had not been exposed to lead in any other way. Indeed, when the doctors later analyzed the supplements, they found that they did contain the metal.

The man's symptoms were treated, and the doctors suggested he stop taking the supplements. The man was sent home from the hospital after two days. He was then readmitted for an additional, scheduled treatment to remove the metal from his body, and within months, his symptoms resolved.

"While Ayurvedic medications are readily available without a prescription, it's important to understand that there are potential dangers associated with taking such medications that are sold over the counter, and without input from a health care provider," said Dr. Robert Glatter, an emergency physician at Lenox Hill Hospital in New York City who was not involved in the man's case.

Other than lead, "arsenic and mercury can also be contained in such remedies, and may lead to catastrophic outcomes if taken without first consulting a health care provider," Glatter said.

Other researchers reported that 20 percent of Ayurvedic herbal medicine products manufactured in South Asia and available in specialty stores in the Boston area had potentially toxic levels of these three metals, according to the report.

http://bit.ly/29eWkcq

Dog 'Kisses' Give Woman Severe Infection

A woman in the United Kingdom developed a potentially life-threatening infection that had an unusual cause: "kisses" from her dog.

By Rachael Rettner, Senior Writer | June 30, 2016 06:30pm ET

The 70-year-old woman was brought to the hospital after she began slurring her speech on the phone and was found slumped over in her chair, according to a new report of her case. She regained full consciousness at the hospital, and her symptoms appeared to be improving. Doctors initially thought she had suffered a seizure, since she had a history of epilepsy.

But on her fourth day at the hospital, her symptoms got worse: She developed a headache, high fever, chills and diarrhea, and tests showed she had sudden kidney failure, the report said.

She was admitted to the intensive care unit for severe sepsis — a potentially life-threatening complication that can develop in people who have infections.

Blood tests revealed that she was infected with a type of bacteria called Capnocytophaga canimorsus, which is found in the mouths of dogs and cats.

People who become infected with C. canimorsus get it through bites or scratches from their pets, but transmission through "licks" has been reported as well, the doctors said.

The woman didn't have any signs of scratches or bites, but she reported close contact with her dog, an Italian greyhound, including getting licked by the dog.

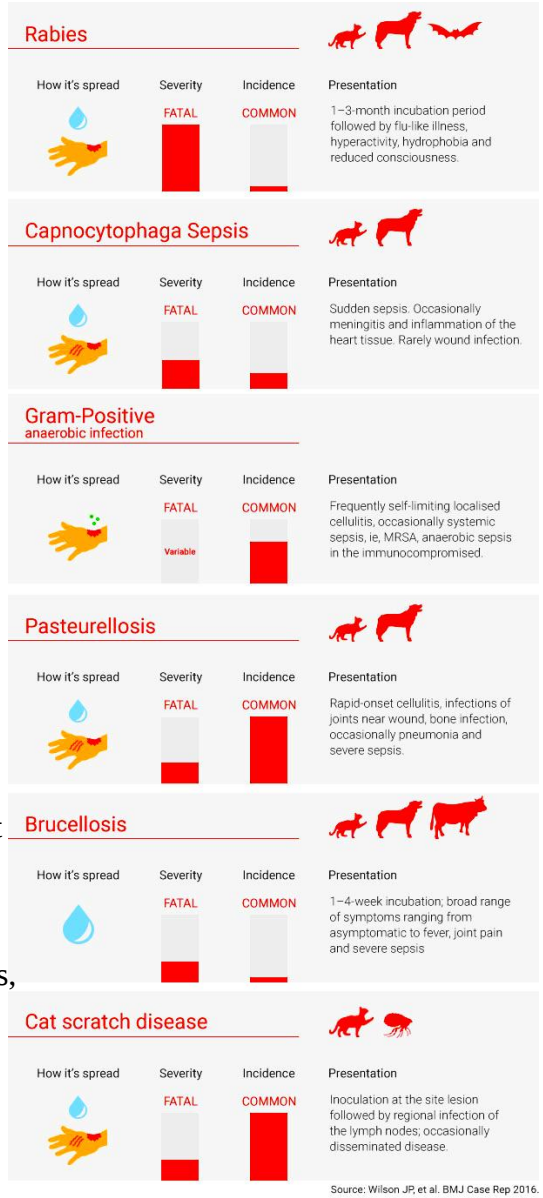
"This report highlights that infection [with C. canimorsus] can occur without overt scratch or bite injuries," the doctors wrote in their report, published today (June 30) in the journal BMJ Case Reports.

"It also reminds us that the elderly are at higher risk of infection [with this bacterium], perhaps due to age-related immune dysfunction and increasing pet ownership," they said.

It's rare for people infected with C. canimorsus to develop sepsis, but about a quarter of people who do develop sepsis from this bacterium die from the illness, the doctors said.

The woman was treated with antibiotics, and after spending a month in the hospital, she was doing well enough to return home, the report said.

In an earlier report, on 56 cases of C. canimorsus infections in California, researchers at the California Department of Public Health concluded that people may be at increased risk of developing this infection if they have had their spleen removed, or if they abuse alcohol.



Scratches, bites and licks from your pet can transmit certain diseases. **Purch Creative Ops**

http://bit.ly/29qmlEJ

Do Insects Have Consciousness?

A new theory has scientists buzzing

By Abigail Tucker

Amid the usual parade of creeping horrors—super lice, mayfly plagues and a "troll-haired insect discovered in remote Suriname"—the exterminator news site PestWeb recently shared a piece of unsettling intelligence.

"Insects Have Consciousness, Self-Awareness and Egos," the headline read.

Whether or not the consciences of professional bug slayers were burdened by this revelation, other people were alarmed. We're a far cry from "insect rights," mused the bioethicist and animal rights advocate Peter Singer, but the prospect of bugs' inner lives ups the ethical stakes.

This moral hornet's nest was first stirred at a local meeting of the worldwide science and drinking club Nerd Nite in a Sydney, Australia, pub. Honeybee scientist Andrew Barron began chatting with philosopher Colin Klein, who initially swatted away the idea of insect consciousness. After all, insect brains are tiny and have just a million or so neurons, compared with a human's average of 86 billion.

Like many of us, Klein had assumed that insects are just collections of reflexes—that they are "dark inside," he says—and this assumption jibed nicely with his habit of flushing the enormous cockroaches at his apartment down the toilet.

But then the two Macquarie University professors began to explore the research. One prominent theory holds that the core of human consciousness is not our impressive neocortex, but our much more primitive midbrain. This simple structure synthesizes sensory data into a unified, egocentric point of view that lets us navigate our world.

Insects, Barron and Klein now argue, have midbrain-like structures, including a "central complex," that seem to allow bugs to similarly model themselves as they move through space. They cite evidence ranging from a study that used microelectrodes to look at fly brain activity, to seemingly macabre research showing that when a jewel wasp injects venom into a cockroach's central complex, the zombiefied prey will allow itself to be led by the antennae into its predator's lair.

While the human midbrain and the insect brain may even be evolutionarily related, an insect's inner life is obviously more basic than our own. Accordingly, bugs feel something like hunger and pain, and "perhaps very simple analogs of anger," but no grief or jealousy. "They plan, but don't imagine," Klein says. Even so, insects' highly distilled sense of self is a potential gift to the far-out study of consciousness. Probing the insect brain could help quantify questions of what it means to think that vexed the likes of Aristotle and Descartes, and could even aid the development of sentient robots.

On the other hand, it complicates daily life. "I still flush," Klein says of his cockroaches. "But I hesitate."

http://www.eurekalert.org/pub_releases/2016-07/uow-bbb063016.php

Benign bacteria block mosquitoes from transmitting Zika, chikungunya viruses

Confirmation that Wolbachia pipientis can completely block transmission of Zika virus in Aedes aegypti

MADISON, Wis. -- Researchers at the University of Wisconsin-Madison have confirmed that a benign bacterium called Wolbachia pipientis can completely block transmission of Zika virus in Aedes aegypti, the mosquito species responsible for passing the virus to humans.

Matthew Aliota, a scientist at the UW-Madison School of Veterinary Medicine (SVM) and first author of the paper -- published today (July 1, 2016) in the journal Scientific Reports -- says the bacteria could present a "novel biological control mechanism," aiding efforts to stop the spread of Zika virus.

Thirty-nine countries and territories in the Americas have been affected by the Zika epidemic, and it is expected that at least 4 million people will be infected by the end of the year.

Scientists believe the virus is responsible for a host of brain defects in developing fetuses, including microcephaly, and has contributed to an uptick in cases of a neurological disorder called Guillain-Barre syndrome.

There are not yet any approved Zika virus vaccines or antiviral medications, and ongoing mosquito control strategies have not been adequate to contain the spread of the virus.

Researchers led by Jorge Osorio, a UW-Madison professor of pathobiological sciences, and Scott O'Neill of the the Eliminate Dengue Program (EDP) and Monash University in Melbourne, Australia, are already releasing mosquitoes harboring the Wolbachia bacterium in pilot studies in Colombia, Brazil, Australia, Vietnam and Indonesia to help control the spread of dengue virus.

Their work is supported by the Bill and Melinda Gates Foundation.

An important feature of Wolbachia is that it is self-sustainable, making it a very low-cost approach for controlling mosquito-borne viral diseases that are affecting many tropical countries around the world.

"In two of our initial study sites in Australia, approximately 90 percent of the mosquitoes continue to be infected with Wolbachia after initial release more than six years ago" says O'Neill.

EDP has now received additional endorsement from the World Health Organization's Vector Control Advisory Group to conduct further pilot studies and scale up in endemic areas.

Wolbachia can be found in up to 60 percent of insects around the world, including butterflies and bees. While not typically found in the Aedes aegypti mosquito -- the species that also transmits dengue, chikungunya and yellow fever viruses -- O'Neill discovered in the early 1990s that Wolbachia could be introduced to the mosquito in the lab and would prevent the mosquitoes from transmitting dengue virus.

Zika virus belongs to the same family as dengue virus and Aliota and Osorio -- with co-authors Stephen Penaido at SVM and Ivan Dario Velez, at the Universidad de Antioquia in Medellin, Colombia -- asked whether Wolbachia-harboring Aedes aegypti may also be effective against Zika virus. They were also interested in studying the mechanisms behind Zika virus infection and transmission in mosquitoes.

In the study, the team infected mice with Zika virus originally isolated from a human patient and allowed mosquitoes from Medellin to feed on the mice either two or three days after they were infected. The mosquitoes were either harboring the same strain of the Wolbachia bacteria (called wMel) used in field studies or were Wolbachia-free and the mice had levels of virus in their blood similar to humans infected with Zika virus.

An additional group of mosquitoes, both wild-type and Wolbachia-infected, was allowed to feed instead from a membrane containing sheep's blood spiked with a high concentration of Zika virus, per other standard laboratory studies.

Four, seven, 10 and 17 days after the mosquitoes fed on Zika-virus-infected blood the researchers tested them for Zika virus infection, assessed whether the virus had disseminated -- or spread to other tissues in the mosquito, and examined whether the virus made its way to the mosquito saliva, where it must be present to be transmitted.

"The first site of replication for arboviruses is the mosquito midgut," says Aliota. "It eventually leaves the midgut and is swept in their blood to secondary tissues and eventually to the salivary glands, where it replicates more and is eventually spit out."

They found that mosquitoes carrying Wolbachia were less likely to become infected with Zika virus after feeding on viral blood, and those that were infected were not capable of transmitting the virus in their saliva.

"We saw reduced vector competence in Aedes aegypti with Wolbachia," says Osorio, defined as the intrinsic ability of an insect to support the development or replication of a pathogen like a virus and then transmit it. "Mosquitoes with Wolbachia were less capable of harboring Zika virus, and though they do get infected with Zika, it is to a lesser extent than wild-type mosquitoes."

They also found that where mosquitoes got their blood meal -- whether from mice or the membrane -- impacted their infection and transmission status. This has implications for other laboratory-based Zika virus studies, Aliota says.

Though mice had a lower concentration of virus in their blood than the blood contained in the membrane, mosquitoes that fed on the mice were infected at higher rates than those that were membrane-fed. The levels of virus found in the mice were also more similar to those seen in human infections.

Non-Wolbachia-containing mosquitoes that acquired Zika virus from mice were also capable of transmitting the virus in a shorter number of days, and in less time than other studies have shown. Additionally, the researchers learned that a relatively low percentage of Zika-virus-transmitting mosquitoes may be sufficient to sustain an outbreak.

"A surprisingly low percentage of mosquitoes are actually capable of transmitting the virus," Aliota says, "but given the size of the outbreak, and that we think mosquitoes are the driver of the outbreak, the results were somewhat unexpected. It just goes to show you how much we still need to understand about the basic biology of this virus."

The study is one of the first to study Zika virus transmission dynamics using a living host, says Aliota.

Importantly, the team also confirmed that the strain of Wolbachia used does not impact the Aedes aegypti mosquito, which is important to the success of field studies.

Once inside a mosquito, Wolbachia is passed from mother to offspring, so newborn mosquitoes will contain the bacteria and incorporate it into the wild population. EDP hopes to see greater than 80 percent of Aedes aegypti mosquitoes in study areas harboring Wolbachia. According to Osorio, mosquitoes carrying Wolbachia in the study site in Medellin are close to reaching that number.

Other studies show Wolbachia prevents mosquito transmission of yellow fever virus -- which is causing an outbreak in Africa -- and, in another study published in late April in PLOS Neglected Tropical Diseases, Aliota, Osorio and their UW-Madison and Universidad de Antioquia colleagues showed that Wolbachia prevents Colombian Aedes aegypti from transmitting chikungunya virus.

Like Zika virus, chikungunya emerged out of Africa and spread to the Americas. It is now transmitted by mosquitoes on every inhabited continent around the globe, says Aliota. The virus can cause fever, chronic joint pain, fatigue, nausea and a rash. There is no cure or specific treatment.

Aliota and Osorio continue to study Wolbachia in mosquitoes in relation to these viruses, monitoring for changes or developments that could affect ongoing field releases. So far the findings have been encouraging, Aliota says.

"Our findings are complementary to results described earlier in the month in Cell Host & Microbe by our colleagues with EDP-Brazil, which is really exciting and really promising," he says.

The Zika virus study was funded in part by the National Institutes of Health.

http://www.eurekalert.org/pub_releases/2016-07/uoah-awg070116.php

Are we giving up on cardiac arrest patients too soon?

University of Arizona study suggests physicians need to give comatose cardiac arrest survivors adequate time before predicting outcomes

TUCSON, Ariz. - Physicians may be drawing conclusions too soon about survival outcomes of patients who suffered a cardiac arrest outside the hospital.

A study led by Bentley Bobrow, MD, professor at the University of Arizona Colleges of Medicine in Tucson and Phoenix and co-director of the Arizona Emergency Medicine Research Center - Phoenix, and his fellow UA emergency medicine researchers, showed that physicians may need to allow comatose cardiac arrest patients much more time to awaken before making a prognosis.

Gary Brauchla knows this from first-hand experience. The day after his son's twins were born in 2012, Brauchla, 68, went into cardiac arrest as he slept in his home in Pearce, Ariz. Brauchla's wife, Kathie, a former surgical technician, immediately called 911 and started cardiopulmonary resuscitation (CPR). Fifteen minutes later, paramedics took over administering CPR and shocked his heart with a defibrillator, restoring his heart rhythm.

Though Brauchla's heart was restarted, he remained in a coma as he was flown by helicopter to Tucson. There, doctors treated him with coronary stents and therapeutic hypothermia (cooling his body) to reduce his brain's need for oxygen and minimize the risk of brain injury.

"The doctors said it usually takes up to 48 hours for people to wake up, but after two days he still was not responding," said Kathie. Brauchla remained in a deep coma, until finally, 72 hours after he was rewarmed, he gradually began to awaken.

"After 48 hours, doctors used to start talking about pulling the plug," said Kathie.

More than 400,000 Americans experience out-of-hospital cardiac arrest annually. Survival statistics are bleak: although approximately 50 percent of people who arrest are revived after attempted resuscitation, only about 10 percent of these survive to leave the hospital. Furthermore, almost half of the survivors suffer some level of brain impairment from hypoxia (when the brain is not getting enough oxygen).

While out-of-hospital cardiac arrest still is a leading cause of death in the United States, outcomes have improved dramatically in places like Arizona, where the focus has been on innovative health-care advances, Dr. Bobrow said. Advances include compression-only CPR training for the public, enhanced telephone-CPR instructions and training for 911 dispatchers, implementing high-performance CPR for EMS providers and making sure patients are taken to specialized hospitals that deliver treatments like targeted therapeutic hypothermia to improve brain recovery.

Results from the multicenter UA study, recently published in the Annals of Emergency Medicine, showed for out-of-hospital cardiac arrest patients, the time it takes to regain consciousness after rewarming from therapeutic hypothermia treatment varies widely and is longer than many had thought.

"Most patients are comatose after resuscitation and accurately predicting those who will wake up can be extremely challenging," Dr. Bobrow said.

"There are many factors involved, but we know that it is common for doctors to try to decide who will and who won't wake up after 24 to 48 hours of hospitalization. However, our study found that a substantial number of cardiac arrest victims wake up longer than many people would expect. Sometimes they awaken from coma five, six or seven days after being admitted to the hospital and many of these have a good neurological outcome," he said.

Among 573 out-of-hospital cardiac arrest patients who completed targeted temperature management, 60 woke up at least 48 hours after rewarming. Eight patients became responsive more than seven days after rewarming, six of whom were discharged with good neurological scores. One of the important findings was no predictive factors reliably identified who would awaken early or late.

Dr. Bobrow said, "We were surprised by the large proportion of cardiac arrest survivors who woke up more than three days after their arrest and went home with their families.

"While targeted therapeutic hypothermia has been shown to improve outcomes, no validated system currently exists for predicting when patients receiving this treatment will awaken from coma. Physicians and family members may need to wait longer than the traditional three days before making irrevocable decisions about brain function recovery and possible withdrawal of care," he said.

"Our study quantifies the timing of awakening from a coma after cardiac arrest in the era of targeted temperature management, and this timing is much different than before we had this treatment," said Daniel Spaite, MD, UA professor and Virginia Piper Distinguished Chair of Emergency Medicine.

"We may be able to save thousands of lives each year across the country by simply giving cardiac arrest victims more time to awaken in the hospital," said

Samuel Keim, MD, professor and chair of the UA Department of Emergency Medicine.

When Brauchla first woke up, he struggled with some neurological issues, but continued to improve. Since then, he has fully recovered and so far has run twelve 5K races. He now serves as the president of the newly formed Arizona Cardiac Arrest Survivors Group. In this role, he speaks to patients and their families, teaches bystander CPR classes and works to get more AEDs (automated external defibrillators) into the community. Brauchla's message to families, physicians and emergency medical personnel: "Everyone needs to be able and willing to do bystander CPR. And then, don't give up!"

http://www.eurekalert.org/pub_releases/2016-07/oup-pet070116.php

Prenatal exposure to paracetamol may increase autism spectrum symptoms

Paracetemol has a strong association with autism spectrum symptoms in boys and for both genders in relation to attention-related and hyperactivity symptoms.

A new study has found that paracetamol (acetaminophen), which is used extensively during pregnancy, has a strong association with autism spectrum symptoms in boys and for both genders in relation to attention-related and hyperactivity symptoms.

The findings were published this week in the International Journal of Epidemiology. This is the first study of its kind to report an independent association between the use of this drug in pregnancy and autism spectrum symptoms in children. It is also the first study to report different effects on boys and girls. Comparing persistently to nonexposed children, the study has found an increase of 30 per cent in the risk of detriment to some attention functions, and an increase of two clinical symptoms of autism spectrum symptoms in boys.

Researchers in Spain recruited 2644 mother-child pairs in a birth cohort study during pregnancy. 88 per cent were evaluated when the child was one year old, and 79.9 per cent were evaluated when they were five years old. Mothers were asked about their use of paracetamol during pregnancy and the frequency of use was classified as never, sporadic, or persistent. Exact doses could not be noted due to mothers being unable to recall them exactly. 43 per cent of children evaluated at age one and 41 per cent assessed at age five were exposed to any paracetamol at some point during the first 32 weeks of pregnancy. When assessed at age five, exposed children were at higher risk of hyperactivity or impulsivity symptoms. Persistently exposed children in particular showed poorer performance on a computerised test measuring inattention, impulsivity and visual speed processing.

Boys also showed more autism spectrum symptoms when persistently exposed to paracetamol. Lead author Claudia Avella-Garcia, researcher at CREAL, an ISGlobal allied centre in Barcelona, explained that, "although we measured symptoms and not diagnoses, an increase in the number of symptoms that a child has, can affect him or her, even if they are not severe enough to warrant a clinical diagnosis of a neurodevelopmental disorder."

Co-author Dr. Jordi Júlvez, also a researcher at CREAL, commented on the possible reasoning for the effects of paracetamol on neurodevelopment: "Paracetamol could be harmful to neurodevelopment for several reasons. First of all, it relieves pain by acting on cannabinoid receptors in the brain. Since these receptors normally help determine how neurons mature and connect with one another, paracetamol could alter these important processes. It can also affect the development of the immune system, or be directly toxic to some fetuses that may not have the same capacity as an adult to metabolize this drug, or by creating oxidative stress."

There could also be an explanation for why boys are more likely to have autism spectrum symptoms: "The male brain may be more vulnerable to harmful influences during early life", said Claudia Avella-Garcia. "Our differing gender results suggest that androgenic endocrine disruption, to which male brains could be more sensitive, may explain the association."

The study concluded that the widespread exposure of infants to paracetamol in utero could increase the number of children with ADHD or autism spectrum symptoms. However, they stressed further studies should be conducted with more precise dosage measurements, and that the risks versus benefits of paracetamol use during pregnancy and early life should be assessed before treatment recommendations are made.

http://nyti.ms/29bE4Lw

Growing Pains for Field of Epigenetics as Some Call for Overhaul

Our genes are not just naked stretches of DNA.

Carl Zimmer

They’re coiled into intricate three-dimensional tangles, their lengths decorated with tiny molecular “caps.” These so-called epigenetic marks are crucial to the workings of the genome: They can silence some genes and activate others.

Epigenetic marks are crucial for our development. Among other functions, they direct a single egg to produce the many cell types, including blood and brain cells, in our bodies. But some high-profile studies have recently suggested something more: that the environment can change your epigenetic marks later in life, and that those changes can have long-lasting effects on health.

In May, Duke University researchers claimed that epigenetics could explain why people who grow up poor are at greater risk of depression as adults. Even more provocative studies suggest that when epigenetic marks change, people can pass them to their children, reprogramming their genes.

But criticism of these studies has been growing. Some researchers argue that the experiments have been weakly designed: Very often, they say, it's impossible for scientists to confirm that epigenetics is responsible for the effects they see.

Three prominent researchers recently outlined their skepticism in detail in the journal PLoS Genetics. The field, they say, needs an overhaul.

"We need to get drunk, go home, have a bit of a cry, and then do something about it tomorrow," said John M. Greally, one of the authors and an epigenetics expert at the Albert Einstein College of Medicine in New York.

Among other criticisms, he and his co-authors — Ewan Birney of the European Bioinformatics Institute and George Davey Smith of the MRC Integrative Epidemiology Unit at the University of Bristol in England — argue that in some cases, changes to epigenetic marks don't cause disease, but are merely consequences of disease.

Some studies, for example, have found that people with a high body mass index have unusual epigenetic marks on a gene called HIF3A. Some researchers have suggested that those marks change how HIF3A functions, perhaps reprogramming fat cells to store more fat.

If that were true, then drugs that reverse these changes might be able to help obese people lose weight. But Dr. Smith and his colleagues have found that overweight subjects experienced epigenetic changes to HIF3A only after they put on weight.

James M. Flanagan, a senior lecturer at Imperial College London, agreed with Dr. Smith and his co-authors that tracking epigenetic changes over time can be revealing. "It's the best way to go about it," he said.

But these experiments are especially hard to set up, he noted, because scientists have to gather blood or other genetic samples from healthy people and then wait years for some of them to get sick.

In other cases, apparent changes in epigenetic marks may actually be the result of different kinds of cells becoming more or less common in people, Dr. Greally and his colleagues also warned. "That's where things get hairy," Dr. Greally said.

Rafael A. Irizarry, an applied statistician at Dana-Farber Cancer Center and the Harvard School of Public Health, said new methods could help researchers steer clear of this confusion.

Scientists can sort cells into different types before looking at their epigenetic marks, he said. It's even becoming possible to look at the epigenetics of one cell at a time.

"But it makes the process way more expensive," Dr. Irizarry said.

Dr. Greally and his colleagues note another source of confusion: Normal genetic variation leads some people to produce different epigenetic marks than others.

If researchers were to find that alcoholics carry an unusual epigenetic mark, for instance, that wouldn't necessarily mean that it resulted from heavy drinking. These people may have a genetic variation that puts them at risk of alcoholism and, perhaps coincidentally, creates an unusual epigenetic mark on their DNA.

Dr. Greally said these possibilities have been neglected because scientists have been so captivated by the idea that epigenetic marks can reprogram cells.

"Since you don't talk about anything else, you interpret the results solely through that little sliver of possibility," he said.

He and his colleagues go so far as to claim that no published results on the links between epigenetic marks and disease "can be said to be fully interpretable."

Other experts feel that such an indictment is a bit too broad.

Dr. Flanagan pointed to several recent studies in which scientists confronted the very challenges that Dr. Greally and his colleagues wrote about.

Last year, for example, a team of European scientists investigated how smoking causes lung cancer. They took advantage of large-scale studies in Australia, Norway and Sweden that collected blood from tens of thousands of people and tracked their health for years.

The scientists found that smokers who got lung cancer tended to lose the same epigenetic marks on a pair of genes.

Dr. Greally said that genetic variations the smokers were born with might account for the results. "That's not tested in the study," he said. "It could definitely be the case."

Nevertheless, he added, these reports offer some good starting points for bigger studies in the future.

"There's nothing wrong with an exploratory study, but call it an exploratory study and acknowledge the fact that it may merely be reporting noise," Dr. Greally said. "If you say, 'Look, I'm finding something that's intriguing here,' that's legit."

http://nyti.ms/29cwUqG

Sex May Spread Zika Virus More Often Than Researchers Suspected

Intimate contact may account for more Zika infections than previously suspected

By DONALD G. McNEIL Jr.JULY 2, 2016

An outbreak of the Zika virus in the continental United States could begin any day now. But while there is plenty of discussion about mosquito bites, some researchers are beginning to worry more about the other known transmission route: sex.

Intimate contact may account for more Zika infections than previously suspected, these experts say. The evidence is still emerging, and recent findings are hotly disputed. All experts agree that mosquitoes are the epidemic's main driver.

But two reports now suggest that women in Latin America are much more likely to be infected than men, although both are presumed to be equally exposed to mosquitoes. The gender difference appears at the age at which sexual activity begins, and then fades among elderly men and women.

Dr. Anthony S. Fauci, the director of the National Institute of Allergy and Infectious Diseases, called the evidence "striking." Like other scientists, he had doubts about aspects of the data, but thought the results justified a more rigorous study, probably in Puerto Rico, of the role of sex in transmitting the Zika virus.

"I can't say it's not true that women are more at risk," he said.

The Zika virus can persist for months in semen, even in men who have had very mild infections. That's why women who are pregnant or trying to conceive are routinely warned not to have unprotected sex with men who have been in areas where the virus is spreading.

Ten countries — Argentina, Canada, Chile, France, Germany, Italy, New Zealand, Peru, Portugal and the continental United States — have reported infections that were almost undoubtedly passed via sex. No case of female-to-male transmission has been documented.

If sexual transmission is more common than believed, efforts to protect women may draw health officials in many of these countries into conflict with those who oppose greater access to birth control or more explicit discussion of sexual practices.

In most parts of the United States, including New York City, health officials have presumed that the risk of Zika infection is low, except possibly at the peak of summer, the height of the mosquito season.

But wider sexual transmission may alter that calculus. Prevention campaigns, for instance, would have to be retooled with a greater emphasis on protected sex.

Thousands of men return to the United States every week from countries in which the virus circulates. New York State alone has a quarter of the country's travel-related cases.

The most disputed piece in this medical puzzle is a relatively obscure study released in May by Brazilian and European biostatisticians. In Rio de Janeiro, a city of 6.4 million, they found "a massive increase of Zika in women compared to men."

The authors, from the Getulio Vargas Foundation and other Brazilian, French and Scottish research organizations, adjusted their figures for two confounding factors: Pregnant women are tested for Zika more frequently than anyone else, and women generally visit doctors more often than men do.

Even after removing pregnant women from the data, the researchers found women were 90 percent more likely than men their age to be infected. To adjust for doctor-visit differences, the team compared the current Zika outbreak to two outbreaks of dengue, which is not sexually transmitted.

Even after that adjustment, said Flavio C. Coelho, a Vargas Foundation biostatistician and the lead author, women were still 60 percent more likely than men to be infected with the Zika virus. Sexual transmission, he said, "was the most probable cause."

The paper's "very intriguing" conclusions "merit further study," said Dr. John T. Brooks, an expert on the sexual transmission of disease at the Centers for Disease Control and Prevention.

But other experts, including Donald A. Berry, a leading biostatistician at the University of Texas M.D. Anderson Cancer Center, dismissed the study. Women's fear of Zika is so great, and confusion over dengue, which has similar symptoms, so common that these variables alone could have accounted for the difference in observed infections between men and women, Dr. Berry said.

"Women seek to find out whether they have Zika, while men blow it off," he said. "This bias is so large that it could easily explain differences much greater than 60 percent."

The biostatistics experts at the National Institute of Allergy and Infectious Diseases were also skeptical of the conclusions, Dr. Fauci said. But another study, published on June 15 in The New England Journal of Medicine, produced similar data. That study, by researchers at the Colombian health ministry and the C.D.C., was set up to look at birth defects linked to the virus. But the authors also found age and gender disparities among those infected.

Young boys and girls in Colombia were infected with the Zika virus at roughly the same rates. Then, after age 15, once sexual activity began, the rates in females shot up.

By age 25 to 29, women in Colombia were three times as likely as men of the same age to be diagnosed with Zika. As they aged, the margin tapered off; after age 65, the infection rates were close to the same again.

The "most intriguing difference," said Margaret A. Honein, chief of the C.D.C.'s birth defects branch and one of the study's authors, was that in Colombia women 45 to 64 years old were still almost twice as likely as men of that age group to be infected.

If large numbers of those women were still sexually active, but very few were worried about pregnancy or fetal damage, then male-to-female sexual transmission "might be one explanation" for the higher infection rates, she said.

On the other hand, she said, "men may just be more stubborn about seeing a doctor, while women are more sensible."

The C.D.C. knows of just 13 sexually transmitted cases of Zika in the continental United States thus far. It does not try to count them in Puerto Rico because it cannot distinguish them from mosquito-borne cases. Because 80 percent of all infections are asymptomatic, the real number is probably higher.

To find out for sure how often sex spreads the virus, researchers would need to choose hundreds of men and women at random and quiz them about how often they were bitten by mosquitoes, how often and with whom they had sex, and how readily they sought medical care, among other factors. Then their blood would have to be tested for the infection.

It might not be possible to do that survey, Dr. Fauci said.

Not only has Congress been reluctant to authorize more spending on Zika prevention, but the most practical tests for such surveys — antibody tests — are the least accurate for Zika infections, because earlier infections with dengue or yellow fever create false positives.

Scientists have documented similar age disparities in H.I.V. infections in Africa, where the gap clearly indicates sexual transmission. In some African cities, teenage girls are five times as likely as boys their age to be infected with H.I.V., according to Unicef.

In that epidemic, the difference is driven by infected older men having sex with younger women through rape, incest or "sugar daddy" relationships.

There is no evidence that sexual transmission played an important role in the first modern Zika outbreaks, in 2007 on Yap Island in Micronesia and in 2013 in French Polynesia.

C.D.C. tests on Yap blood samples found infections slightly higher over all in males. But they were not broken down by age.

In Polynesia, "we did not find any evidence of a sex difference in our first seroprevalence surveys," said Dr. Henri-Pierre Mallet, an epidemiologist in that French territory's health department.

However, both those outbreaks spread extremely rapidly and died out within months, so swarms of mosquitoes may have simply overwhelmed signs that sex also served as a driver of those epidemics.

http://www.eurekalert.org/pub_releases/2016-07/rumc-cdl070116.php

Cerebrovascular disease linked to Alzheimer's

Study finds association between diseases in brain blood vessels and dementia

While strokes are known to increase risk for dementia, much less is known about diseases of large and small blood vessels in the brain, separate from stroke, and how they relate to dementia.

Diseased blood vessels in the brain itself, which commonly is found in elderly people, may contribute more significantly to Alzheimer's disease dementia than was previously believed, according to new study results published in June in The Lancet Neurology, a British medical journal.

"Cerebral vessel pathology might be an under-recognized risk factor for Alzheimer's disease dementia," the researchers wrote.

The study by researchers from the Rush Alzheimer's Disease Center analyzed medical and pathologic data on 1,143 older individuals who had donated their brains for research upon their deaths, including 478 (42 percent) with Alzheimer's disease dementia.

Analyses of the brains showed that 445 (39 percent) of study participants had moderate to severe atherosclerosis -- plaques in the larger arteries at the base of the brain obstructing blood flow -- and 401 (35 percent) had brain arteriolosclerosis -- in which there is stiffening or hardening of the smaller artery walls.

The study found that the worse the brain vessel diseases, the higher the chance of having dementia, which is usually attributed to Alzheimer's disease. The increase was 20 to 30 percent for each level of worsening severity.

The study also found that atherosclerosis and arteriolosclerosis are associated with lower levels of thinking abilities, including in memory and other thinking skills, and these associations were present in persons with and without dementia.

"Both large and small vessel diseases have effects on dementia and thinking abilities, independently of one another, and independently of the common causes of dementia such as Alzheimer's pathology and strokes," said Dr. Zoe Arvanitakis. A neurologist and researcher at the Rush Alzheimer's Disease Center, Arvanitakis led the study, which was funded by the National Institutes of Health.

Part of Rush University Medical Center, the Rush Alzheimer's Disease Center is dedicated to the study of Alzheimer's, a neurological condition that is the most common cause of dementia. It is one of 29 designated centers in the United States funded by the National Institute on Aging.

The study was not designed to determine causation of Alzheimer's dementia, or even whether vascular disease or Alzheimer's developed first. "But it does suggest that vessel disease plays a role in dementia," Arvanitakis said. "We found that blood vessel diseases are very common in the brain, and are associated with dementia that is typically attributed to Alzheimer's disease during life."

Does preventing cerebrovascular disease also prevent Alzheimer's?

The study examined which cognitive difficulties are caused by vessel diseases and whether vessel disease and Alzheimer's are more destructive in tandem than they would be alone.

An editorial in The Lancet Neurology that accompanied the study findings noted that while other studies have indicated that proactive measures like eating a selective diet and getting regular exercise might protect people against getting Alzheimer's, those interventions might actually be acting on non-Alzheimer's disease processes, such as cerebrovascular disease.

Arvanitakis says they don't know yet. "They may decrease actual Alzheimer's, and possibly even work by yet other pathways," Arvanitakis said. "We hope to better distinguish how the clinical expression of vessel diseases in the brain differ from those of Alzheimer's, so that we may eventually use earlier and more targeted treatments for dementia."

Nearly 47 million people now live with dementia worldwide, according Alzheimer's Disease International, the international federation of Alzheimer associations around the world. By 2050, that number is projected to be 132 million. Therefore, finding ways to treat or prevent the disease "is a major goal," Arvanitakis said.

The participants in the study published in Lancet Neurology came from two (RADC) cohort studies, the Religious Orders Study and the Rush Memory and Aging Project, which have followed people older than 65, in their communities, for more than two decades. Participants receive annual health assessments and agree to donate their brains for research upon their deaths.

The Lancet Neurology study used clinical data gathered from participants from 1994 to 2015, and pathologic data obtained from examination of the brains donated for autopsy, and used regression analyses to determine the odds of Alzheimer's dementia and levels of cognitive function, for increasing levels of brain vessel diseases.

http://www.eurekalert.org/pub_releases/2016-07/esoh-esa062916.php

Endometrial scratch appears beneficial in couples trying to conceive

Results from a Cochrane review

Helsinki, 4 July 2016: There is a much disputed claim that "injury" to the lining of the uterus - whether inadvertent or deliberate - increases the chance of embryo implantation and thus the chance of pregnancy in certain groups of women having IVF. The "injury" has usually been performed as a biopsy from the womb lining (endometrium), whose action is believed to cause a favourable inflammation ("scratch") within the endometrium thereby making it more receptive to an implanting embryo. Indeed, the success of more complex uterine surgery in some studies has even been attributed to the scratch and not to the surgery itself.

Now, a review of randomised controlled trials evaluating endometrial scratching in women planning to have intrauterine insemination (IUI) or attempting to conceive spontaneously (with or without ovulation induction) suggests that endometrial scratching may well be beneficial in couples trying to conceive naturally or with IUI, although "the quality of the available evidence is low".

The review was performed by collaborators from Cochrane, an independent network of rearchers whose aim is to gather and summarise the best evidence in different medical disciplines. This Cochrane review of endometrial scratching is presented as a poster at this year's Annual Meeting of ESHRE by Sarah Lensen from the Department of Obstetrics and Gynaecology, University of Auckland, New Zealand.

Eight eligible trials with a total of 1180 women were included in the review, in which endometrial scratching was compared to no intervention or a mock intervention. The primary outcomes were live birth/ongoing pregnancy and pain from the intervention.

Following analysis, endometrial scratching appeared to increase the chance of clinical pregnancy and live birth compared to no procedure or a placebo procedure; the difference in outcome was statistically significant and appeared to roughly double the chance of live birth compared to no intervention (relative risk 2.22). Ms Lensen explained that endometrial scratching would increase the normal chance of a live birth or ongoing pregnancy from 9% over a set period of time to somewhere betweem 14 and 28%.

However, the quality of the studies from which the result was derived was descibed as "very low-quality". "The results must be treated with caution," said Ms Lensen, as most of the included trials were associated with a serious risk of bias. There was no evidence that endometrial scratching has any effect on

miscarriage, ectopic pregnancy, or multiple pregnancy. Pain during the scratch procedure was reported by one study as an average of 6/10.

Ms Lensen described endometrial scratching as "a cheap and simple procedure" which can be conducted without analgesia during a short clinic visit; it does, however, require an internal examination which is associated with pain and discomfort.

Abstract P-287, Monday 4 July 2016 Endometrial scratching for pregnancy following sexual intercourse or intrauterine insemination (IUI): a Cochrane systematic review and meta-analysis

1. Successful implantation (whether in natural or assisted conception) depends on embryo quality and a receptive endometrium. The "window" of favourable implantation is maintained by hormones and other molecules, and it has been proposed that cytokines released after endometrial injury and during the repair process induce endometrial changes favourable to implantation.

2. A Cochrane review of endometrial injury prior to IVF found insufficient evidence for any effect, but did advise " not to perform endometrial injury on the day of oocyte retrieval because it appears to significantly reduce clinical and ongoing pregnancy rates". Nastri CO, Gibreel A, Raine-Fenning N, et al. Endometrial injury in women undergoing assisted reproductive techniques. Cochrane Database Syst Rev. 2012; 7: CD009517.

A podcast of Ms Lensen speaking about this study is available at *https://www.eshre2016.eu/Media/Press-releases/Lensen/Podcast.aspx*

http://nyti.ms/29stSjZ

NASA Announces Extension of 9 Spacecraft Missions

Just before the spacecraft Juno finishes a five-year trip to Jupiter on Monday, NASA has decided to extend the missions of nine older robotic explorers that have lived beyond original expectations.

By KENNETH CHANG JULY 2, 2016

The agency announced the decision on Friday, saying the nine are still producing bounties of observations for scientists. Most of the extensions were expected. The New Horizons spacecraft, which flew past Pluto last year, had already been steered toward a new target, known as 2014 MU69, one of the small icy objects in the ring of debris beyond Neptune.

But one of NASA's decisions, about the Dawn spacecraft orbiting Ceres, the dwarf planet in the asteroid belt, was somewhat of a surprise — as well as a disappointment to some working on the mission.

It was a bit unexpected because Dawn is low on fuel. "Less than a year ago, I would have thought it was ridiculous that the spacecraft would even be operating at this point," said Marc D. Rayman, the chief engineer for the Dawn mission.

The Dawn spacecraft was designed to use four spinning wheels to pivot in different directions. But at its previous destination, the asteroid Vesta, two of the four wheels overheated and failed. At Ceres, the wheels stayed off, and the spacecraft used its thrusters instead to pivot.

In December, Dawn reached its lowest orbit, just 240 miles above Ceres. Dr. Rayman said he and his team had expected Dawn to exhaust its remaining propellant by March. But they spun up the wheels again. That succeeded, cutting the use of the thrusters. "It all worked out beautifully," Dr. Rayman said. That left enough fuel to contemplate doing something more.

On Thursday, Dr. Rayman's blog made a stunning announcement: Dawn would leave Ceres and head toward a flyby of a third asteroid, Adeona, in 2019.

The posting was yanked. A member of Dawn's social media team had mistakenly published an unfinished draft that Dr. Rayman had started writing in case NASA selected that course.

On Friday, around noon, Dr. Rayman received word from officials at NASA headquarters that they had decided on the other option proffered by the Dawn team: Dawn will stay where it is, continuing observations of Ceres.

Dr. Rayman said Dawn could continue until next spring, as long as the spinning wheels kept working.

"The long-term monitoring of Ceres, particularly as it gets closer to perihelion — the part of its orbit with the shortest distance to the sun — has the potential to provide more significant science discoveries than a flyby of Adeona," James L. Green, NASA's director of planetary science, said in a statement.

Dr. Rayman said he did not have a preference. But the mission's principal investigator, Christopher T. Russell, said he was disappointed.

"Almost every time when you are doing exploration, a new path is going to provide more return on your investment (time or money) than continuing to repeat the old well-worn path," Dr. Russell, a professor of geophysics and space physics at the University of California, Los Angeles, wrote in an email. "Nevertheless, given that we were told to stay at Ceres, we will continue our exploration of Ceres and do our best possible work in the time we have remaining," he said. "There is still science that can be done here."

The other missions receiving extensions are the Lunar Reconnaissance Orbiter and a flotilla of spacecraft at Mars: the Mars Reconnaissance Orbiter, the Mars Atmosphere and Volatile Evolution mission, the Mars Opportunity and Curiosity rovers, the Mars Odyssey orbiter, and NASA's support for the European Space Agency's Mars Express mission. NASA officials periodically ask managers of the long-lived missions to justify the cost of their continued operations. Final decisions depend on whether NASA has enough money in its budget for all of them. On Monday, Juno will be on NASA's center stage as it begins 20 months of orbiting Jupiter, the solar system's largest planet.