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Before animals, evolution waited eons to inhale

Animal evolution may have sputtered in sparse, uneven oceanic oxygen; new model offers insights for gauging probability of complex life on exoplanets

A couple of times in four billion years, evolution has slowed to a crawl. And an eon or so has passed before more complex life forms, such as simple animals, could arise.

Earliest animals evolved in the mid to late Proterozoic Eon and lie deep in the fossil record. **Douglas Erwin / National Museum of Natural History**

Evolution may have been waiting for a decent breath of oxygen, said researcher Chris Reinhard. And that was hard to come by. His research team is tracking down O_2 concentrations in oceans, where earliest animals evolved.

By doing so, they have jumped into the middle of a heated scientific debate on what rising oxygen did, if anything, to charge up evolutionary eras. Now, Reinhard, a geochemist from the Georgia Institute of Technology, is shaking up conventional thinking with the help of computer modeling.

Smash the beaker

That thinking goes like this: "Atmospheric oxygen had a value of 'x' back then, and so we just assume that the whole ocean is a beaker that equilibrates with that value," Reinhard said. Then all evolving animals everywhere had the selfsame concentration of oxygen to live on.

But oceans are expansive and asymmetrical; deep here, shallower there, frosty at the poles, soupy at the girth. Turbulences, streams and temperatures distribute sediment, algae, salt -- and gases like oxygen -- into lopsided stores.

Oceans leave some areas teeming and others vacuous. Then they reshuffle their loads. Even today, concentrations of dissolved oxygen vary widely from ocean region to ocean region. Equating the global ocean to a placid lab beaker? "This is an okay thought experiment to start with, but I think everybody would acknowledge over a beer that it's simplistic," said Reinhard, an assistant professor at Georgia Tech's School of Earth and Atmospheric Sciences.

Create a stir

So, he and his team modeled how oxygen entered oceans from the atmosphere and from aquatic sources, and how oceans might have shuffled it around during the mid to late Proterozoic Eon. That was 0.6 to 1.8 billion years ago, when the Earth's atmosphere had only fraction of the breathable oxygen it does today.

In the model, the ocean didn't share and share alike, but instead pushed dissolved O_2 into areas of concentration that shifted starkly as corresponding concentrations in the atmosphere rose. That has implications for the way scientists think about the timeframe for animal evolution on Earth and for future estimates for the probability of complex life on exoplanets.

The results and detailed modeling parameters appear on Monday, July 25, 2016, in the *Proceedings of the National Academy of Sciences*. The research was funded by the National Science Foundation and the NASA Astrobiology Institute.

Be unreliable

Humans and today's large animals would quickly suffocate in a Proterozoic-like world. And according to Reinhard's research, its oceans may not have been as conducive to evolution as previously thought.

"What really matters for the early evolution of animals is ocean oxygen. To a certain degree, it's really shallow sea floor oxygen that matters," Reinhard said.

Those ocean shallows are called benthic regions, and in the Proterozoic Eon, they received plenty of sunlight and nutrients key to evolution. Even today, they're teeming with life, which makes them popular places for snorkeling and fishing.

But the new model shows oxygen levels there may have been unreliable during the mid to late Proterozoic Eon.

Rob the rich

Earliest metazoans, the term for multicellular beings that are animals, may have done alright with scarce amounts and survived O_2 droughts -- periods of anoxia. But they also evolved into a world of rising breathable oxygen.

Reinhard's computational model accounted for scenarios from atmospheric oxygen concentrations of 0.5 to 10 percent of today's levels.

At low concentrations, the simulation showed oceanic oxygen building up around the equator, where hot spots in the water produced higher amounts of it. Then -- as the atmosphere began filling with oxygen -- in the oceans, it shifted toward the poles, where cold water was able to hold on to more of it.

Formerly oxygen-rich regions were robbed of conditions friendly to animal evolution. In the beaker way of thinking, higher atmospheric oxygen should have meant evenly rising levels of oceanic oxygen for animals evolving everywhere, even in those depleted regions. "In reality, the ecology they would have been facing would have been pretty severe," Reinhart said.

Follow dead animals

Reinhard's team could have framed the study around other organisms but chose metazoans. "We focused on animals principally because that's where we have the best empirical constraints for the oxygen levels that the organisms need," he said.

Their evolution also left behind a calendar convenient to scientific study - a progressive fossil record that became more complex as oxygen levels rose.

In Earth's roughly 3.7-billion-year history of life, animals turned up in about the most recent third. Furry, feathery and even scaly animals have only appeared in the last few hundred million years.

As oxygen became plentiful, critters got bigger, smarter, faster, and became predators and prey. Pursuit and flight accelerated as gasping lungs and gills pulled in more of the powerful oxidant to exponentially boost metabolism.

Evolution went into overdrive, diversifying the fossil record over time. But dive back down into it a billion or so years, to the mid to late Proterozoic, and animal fossils get smaller and simpler. You find little, squishy sponges and jellyfish.

Think (eco)logically

Their stony imprints mark the beginnings of that very complex evolution, and they may point to oxygen concentrations at the time.

"We were focusing on changes in atmospheric oxygen during the time period in which animals appear in the fossil record and trying to link that quantitatively to the oxygen levels early animals would have needed," Reinhard said. His computational oxygen distribution model was based on the current constellation of Earth's continents - vastly different from that of the Proterozoic Eon.

But Reinhard said that difference would not change the conclusions. And the concepts they support should also apply to predictions about life on exoplanets with differing continental structures. "The basic take-home -- that we need to be thinking ecologically rather than just in terms of a single oxygen level -- is going to prove to be pretty robust," he said.

That beaker? May have just flown out the window.

Noah Planavsky from Yale University, Stephanie Olson and Timothy Lyons from the University of California Riverside and Douglas Erwin from the National Museum of Natural History coauthored the paper. Research was funded by a National Science Foundation Sedimentary Geology and Paleobiology grant (1338290) and NASA Astrobiology Institute (grant NNA15BB03A).

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Evidence suggests migratory birds are not a reservoir for highly pathogenic flu viruses

Evidence suggests highly pathogenic flu viruses do not persist in wild birds

The H5 avian influenza A virus that devastated North American poultry farms in 2014-15 was initially spread by migratory waterfowl, but evidence suggests such highly pathogenic flu viruses do not persist in wild birds. St. Jude Children's Research Hospital led the research, which appears online this week in the Proceedings of the National Academy of Sciences.

While wild ducks and other aquatic birds are known to be natural hosts for low pathogenic flu viruses associated with milder symptoms, the results of this study indicate that is not the case with the highly pathogenic flu viruses that are associated with more severe illness. The research suggests that wild ducks and other aquatic birds are not an ongoing source of highly pathogenic flu infection in domestic poultry.

"The findings provide a scientific basis for the decision by officials to use culling and quarantines to stop the 2014-15 outbreak in domestic poultry," said corresponding author Robert Webster, Ph.D., an emeritus member of the St. Jude Department of Infectious Diseases. "Now, research is needed to identify the mechanism that has evolved in these wild birds to disrupt the perpetuation of highly pathogenic influenza."

In this study, researchers analyzed throat swabs and other biological samples taken from 22,892 wild ducks and other aquatic birds collected before, during and after a 2014-15 H5 flu outbreak in poultry. The outbreak has been linked to a highly pathogenic H5N8 influenza A virus spread from Asia to North America by migratory waterfowl. The H5N8 virus reasserted, or mixed genes, with other influenza viruses in North American waterfowl and went on to trigger 248 flu outbreaks in commercial and backyard turkey and chicken farms in the U.S. and Canada at a cost of nearly $5 billion.

Officials worked to end the outbreaks by quarantining and eliminating infected poultry. The last confirmed case occurred in June 2015. Officials worried that the highly pathogenic virus would be re-introduced into poultry farms by migratory aquatic birds carrying the virus. But none of the migratory birds included in this analysis were infected with a highly pathogenic flu virus. The sampling was conducted in Canada, the Mississippi flyway and along the U.S. Atlantic coast by David Stallknecht and Rebecca Poulson of The University of Georgia and Richard Slemons, Andrew Bowman and Jacqueline Nolting from the The Ohio State University in conjunction with Scott Krauss and James Knowles of St. Jude. The sampling was done as part of the federally funded Centers of Excellence for Influenza Research and Surveillance.

Such viruses have not been identified in any of the more than 100,000 wild birds tested since the flu surveillance sampling began 43 years ago, Webster said. "Existing immunity in wild birds is one of the possible explanations that may explain why highly pathogenic influenza A viruses do not become established in wild bird populations," he said. "But a more complete understanding of the mechanisms at work would aid efforts to prevent, control and eradicate these dangerous viruses in poultry in other areas of the world."

Webster added that while there were no reported human cases of influenza caused by the highly pathogenic flu viruses involved in this outbreak, other related H5 viruses have spread to humans with deadly results.

Krauss is the first author. The other authors are Stallknecht and Poulson, both of The University of Georgia, Athens; Slemons, Bowman and Nolting, all of The Ohio State University, Columbus; and Knowles of St. Jude.

The research was funded in part by a contract (HHSN272201400006C) from the National Institute of Allergy and Infectious Diseases, part of the National Institutes of Health; and ALSAC.

http://www.eurekalert.org/pub_releases/2016-07/uok-dad072216.php

Does a dementia diagnosis have a silver lining? Study suggests it can

Results challenge the stereotype of depression, denial and despair post-diagnosis

LEXINGTON, KY. - Results from a study of patients with a diagnosis of mild cognitive impairment or early dementia indicates that their outlook isn't as dark as expected.

A group of scientists from the University of Kentucky's Sanders-Brown Center on Aging asked 48 men and women with early dementia or mild cognitive impairment (MCI) a series of questions about their quality of life and personal outlook post-diagnosis.

Called the Silver Lining Questionnaire (SLQ), the instrument measures the extent to which people believe their illness has had a positive benefit in areas such as: improved personal relationships, greater appreciation for life, positive influence on others, personal inner strength and changes in life philosophy.

The SLQ has been administered previously to patients with cancer diagnoses, but hasn't been given to MCI/dementia patients, according to Gregory Jicha, MD, PhD, a professor at the Sanders-Brown Center on Aging and the study's lead author.

"The overall assumption is that this diagnosis would have a uniformly negative impact on a patient's outlook on life, but we were surprised to find that almost half of respondents reported positive scores," Jicha said.

Positive responses were even higher on certain scores, such as:

appreciation and acceptance of life
less concern about failure
self-reflection, tolerance of others, and courage to face problems in life
strengthened relationships and new opportunities to meet people.

"The common stereotype for this type of diagnosis is depression, denial, and despair," Jicha said. "However, this study -while small - suggests that positive changes in attitude are as common as negative ones."

The next step, according to Jicha, is to explore the variables that affect outlook in these patients with an eye towards interventions that might help the other half find their "silver lining."

Jicha presented the study data at the Alzheimer's Association International Conference in Toronto on Monday.

The study was funded by a grant from the National Institutes of Health (NIH P-30 AG028383).

http://www.eurekalert.org/pub_releases/2016-07/lsu-ddi072516.php

Digging deeper into Mars

New findings on the chemical composition of hydrated soil at regional scales

Water is the key to life on Earth. Scientists continue to unravel the mystery of life on Mars by investigating evidence of water in the planet's soil.

Previous observations of soil observed along crater slopes on Mars showed a significant amount of perchlorate salts, which tend to be associated with brines with a moderate pH level. However, researchers have stepped back to look at the bigger picture through data collected from the 2001: Mars Odyssey, named in reference to the science fiction novel by Arthur C. Clarke, "2001: A Space Odyssey," and found a different chemical on Mars may be key.

The researchers found that the bulk soil on Mars, across regional scales the size of the U.S. or larger, likely contains iron sulfates bearing chemically bound water, which typically result in acidic brines. This new observation suggests that iron sulfates may play a major role in hydrating martian soil.

This finding was made from data collected by the 2001: Mars Odyssey Gamma Ray Spectrometer, or GRS, which is sensitive enough to detect the composition of Mars soil up to one-half meter deep. This is generally deeper than other missions either on the ground or in orbit, and it informs the nature of bulk soil on Mars. This research was published recently in the Journal of Geophysical Research: Planets.

"This is exciting because it's contributing to the story of water on Mars, which we've used as a path for our search for life on Mars," said Nicole Button, LSU Department of Geology and Geophysics doctoral candidate and co-author in this study.

The authors expanded on previous work, which explored the chemical association of water with sulfur on Mars globally. They also characterized how, based on the association between hydrogen and sulfur, the soil hydration changes at finer regional scales.

The study revealed that the older ancient southern hemisphere is more likely to contain chemically bound water while the sulfates and any chemically bound water are unlikely to be associated in the northerly regions of Mars.

The signature of strong association is strengthened in the southern hemisphere relative to previous work, even though sulfates become less hydrated heading southwards. In addition, the water concentration may affect the degree of sulfate hydration more than the sulfur concentration.

Limited water availability in soil-atmosphere exchange and in any fluid movement from deeper soil layers could explain how salt hydration is water-limited on Mars. Differences in soil thickness, depth to any ground ice table, atmospheric circulation and sunshine may contribute to hemispheric differences in the progression of hydration along latitudes.

The researchers considered several existing hypotheses in the context of their overall observations, which suggest a meaningful presence of iron-sulfate rich soils, which are wet compared to Mars' typically desiccated soil. This type of wet soil was uncovered serendipitously by the Spirit Rover while dragging a broken wheel across the soil in the Paso Robles area of Columbia Hills at Gusev Crater.

Key hypotheses of the origin of this soil include hydrothermal activity generating sulfate-rich, hydrated deposits on early Mars similar to what is found along the flanks of active Hawaiian volcanoes on Earth.

Alternatively, efflorescence, which creates the odd salt deposits on basement walls on Earth, may have contributed trace amounts of iron-sulfates over geologic time.

A third key hypothesis involves acidic aerosols released at volcanic sites, such as acid fog, dispersed throughout the atmosphere, and interacting subsequently with the finer components of soil as a source of widespread hydrated iron-sulfate salts.

Among these hypotheses, the researchers identify acid fog and hydrothermal processes as more consistent with their observations than efflorescence, even though the sensitivity of GRS to elements, but not minerals, prevents a decisive inference.

Hydrothermal sites, in particular, are increasingly recognized as important places where the exchange between the surface and deep parts of Earth's biosphere are possible. This hypothesis is significant to the question of martian habitability.

"Our story narrows it to two hypotheses, but emphasizes the significance of all of them," said LSU Department of Geology and Geophysics Assistant Professor Suniti Karunatillake, who is a fellow lead author. "The depth and breadth of these observation methods tell us about global significance, which can inform the big question of what happened to the hydrologic cycle on Mars."

http://www.eurekalert.org/pub_releases/2016-07/uos-ss1072216.php

Study suggests 1.6 million childbearing women could be at risk of Zika virus infection

Research by scientists in the US and UK has estimated that up to 1.65 million childbearing women in Central and South America could become infected by the Zika virus by the end of the first wave of the epidemic.

Researchers from the WorldPop Project and Flowminder Foundation at the University of Southampton and colleagues from the University of Notre Dame and University of Oxford have also found that across Latin America and the Caribbean over 90 million infections could result from the initial stages of the spread of Zika.

The team's projections, detailed in the paper Model-based projections of Zika virus infections in childbearing women in the Americas and published in Nature Microbiology, also show that Brazil is expected to have the largest total number of infections (by more than three-fold), due to its size and suitability for transmission.

The estimates reflect the sum of thousands of localised projections of how many people could become infected within every five x five km grid cell across Central and South America. Because the virus may not reach each corner of this region, or may do so slowly, the total figure of 1.65 million represents an upper limit estimate for the first wave of the epidemic.

Geographer at the University of Southampton and WorldPop and Flowminder Director Professor Andrew Tatem comments: "It is difficult to accurately predict how many child-bearing women may be at risk from Zika because a large proportion of cases show no symptoms. This largely invalidates methods based on case data and presents a formidable challenge for scientists trying to understand the likely impact of the disease on populations."

In fact, an estimated 80 per cent of Zika infections don't show symptoms and of those which do, some may be due to other viruses. Coupled with inconsistent case reporting and variable access to health care for different populations, these factors make case based data unreliable.

However, this latest research has built a picture of the projected spread of the disease by examining its likely impact at very local levels -at a scale of five kilometres squared. The researchers have brought this local data together to model infection rates across the region.

The team took into account disease patterns displayed in similar epidemics, along with other factors such as how the virus is transmitted (in this instance by mosquito), climate conditions and virus incubation periods. They also examined

transmission behaviour in dengue and chikungunya viruses. Their projections for Zika are largely consistent with annual, region-wide estimates of 53 million infections by the dengue virus (2010), which has many similarities to Zika.

Coupled with existing data on population, fertility, pregnancies, births and socio-economic conditions for the region, the team has been able to model the possible scale of the projected spread of the Zika virus and provide a detailed understanding of the places likely to be most affected - helping to inform which areas will need the most support in combatting the disease and helping sufferers.

Professor Tatem adds: "These projections are an important early contribution to global efforts to understand the scale of the Zika epidemic, and provide information about its possible magnitude to help allow for better planning for surveillance and outbreak response, both internationally and locally."

Scientists are still investigating the potential link between microcephaly in babies and Zika.

http://www.eurekalert.org/pub_releases/2016-07/qumc-fdc072516.php

First diagnosed case of Alzheimer's disease in HIV-positive individual presented at AAIC

First case of Alzheimer's disease diagnosed in an HIV-positive individual

TORONTO - The first case of Alzheimer's disease diagnosed in an HIV-positive individual will be presented in a poster session at the Alzheimer's Association International Conference 2016 in Toronto July 27. The finding in a 71-year-old man triggers a realization about HIV survivors now reaching the age when Alzheimer's risk begins to escalate.

The case was first published online April 15 in the open access journal Alzheimer's & Dementia: Diagnosis, Assessment & Disease Monitoring. Georgetown neurologist R. Scott Turner, MD, PhD, diagnosed the patient after a PET scan showed deposition of amyloid in the brain. Until this point, Turner said, clinicians thought that individuals with HIV may not develop AD because HIV-related inflammation in the brain may prevent amyloid clumps from forming.

"This patient may be a sentinel case that disputes what we thought we knew about dementia in HIV-positive individuals," says Turner, who leads the Memory Disorders Program at Georgetown University Medical Center.

In addition, Turner says the finding suggests that some older HIV-positive patients with dementia may be misdiagnosed with HIV-associated neurocognitive disorders (HAND) when they may be developing AD. It also may be possible that some patients experience HAND and AD -- a new type of mixed dementia, Turner says. "Chronic HIV infection and amyloid deposition with aging may represent a "double-hit" to the brain that results in progressive dementia."

"While it may be challenging to diagnose the cause of dementia in an HIV-positive patient, the diagnosis matters because HAND and AD are treated differently," he says.

"For Alzheimer's disease, we now have four FDA-approved drugs and more effective treatments are on the way. For HAND, we prescribe anti-retroviral drugs that have a better chance of penetrating the brain. So getting a correct diagnosis is important, and a critical first step in advancing the field."

HAND will develop in 30-50 percent of individuals with long-term HIV infections. But HAND symptoms are identical to those with AD, Turner says. He adds, "The medical community assumes that dementia with HIV is caused by HAND. Physicians haven't considered Alzheimer's, so it's possible that a number of older HIV-positive individuals may be misdiagnosed."

Published studies to date point to only five individuals with HAND who have undergone amyloid PET imaging, and all were negative; however, the oldest of these patients was 67, Turner says.

Diagnosis of dementia in older HIV-infected individuals is on the rise. HIV-infected adults over 55 comprise the fastest growing age group in the HIV-positive population.

According to the most recent CDC HIV Surveillance Report with data through 2013, 53,000 people in the U.S. living with HIV are 65 and older, the age when Alzheimer's disease risk begins to escalate. That number is expected to double in less than 10 years and doesn't include those who have not been diagnosed. Worldwide, more than 37 million people are living with HIV.

"This case report reveals important new insights into the specific issue of HIV-related neurological impairment," says Jeffrey Crowley, MPH, program director of the National HIV/AIDS Initiative at the O'Neill Institute for National and Global Health Law at Georgetown Law.

Crowley is former director of the White House Office of National AIDS Policy and senior advisor on disability policy. "This finding must lead to additional population-based studies, as well as timely clinical and programmatic interventions to better support individuals with HIV who are facing neurological decline."

This work was supported, in part, by a grant from the Alzheimer's Drug Discovery Foundation. Piramal, Inc., manufacturer of florbetaben (NeuraCeq) used to identify amyloid, covered the cost of the amyloid PET scan. (Amyloid PET scans, which cost about $4,000, are not covered by Medicare).

Co-authors on the report include Georgetown researchers Melanie Chadwick, NP; Wesley A. Horton; Gary Simon, MD, PhD; Xiong Jiang, PhD; and Giuseppe Esposito, MD.

http://bit.ly/2ahA6qJ

Universal ancestor of all life on Earth was only half alive

Want to find some ancient fossils? Scratch yourself.

By Michael Le Page

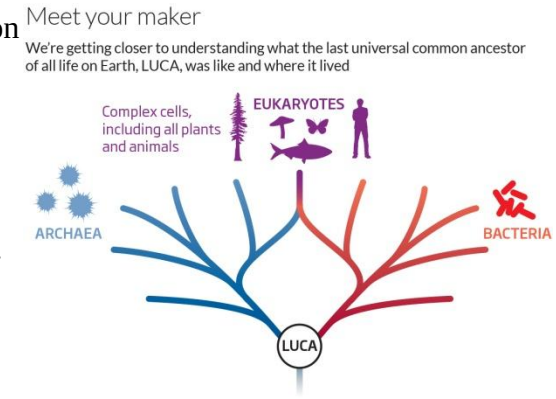
Many of the genes in our cells evolved billions of years ago and a few of them can be traced back to the last common ancestor of all life.

Now we have the best picture yet of what that ancestor was like and where it lived, thanks to a study that identified 355 genes that it probably possessed.

"It was flabbergasting to us that we found as many as we did," says William Martin of the University of Dusseldorf in Germany, who led the study. The findings support the idea that the last universal common ancestor (LUCA) lurked in hydrothermal vents where hot water rich in hydrogen, carbon dioxide and minerals emerged from the sea floor.

"It's spot on with regard to the hydrothermal vent theory," Martin says. He describes LUCA as half-living, because it may have depended on abiotic reactions in the vents to produce many of the chemicals it needed.

LUCA emerged around 3.8 billion years ago and gave rise to two kinds of simple cells: bacteria and archaea (see diagram, below). By looking for genes common to almost all cells living today, previous studies have identified around 100 genes almost certainly present in LUCA.



This tells us what LUCA had in common with modern cells, but what we really want to know is how it was different, Martin says. So his group analysed the genomes of 1800 bacteria and 130 archaea to find the genes that were the most ancient but not necessarily shared. The 355 they found include some universal genes, such as a few involved in reading the genetic code. But others point to a very distinctive lifestyle.

One characteristic of almost all living cells is that they pump ions across a membrane to generate an electrochemical gradient, then use that gradient to make the energy-rich molecule ATP. Martin's results suggest LUCA could not generate such a gradient, but could harness an existing one to make ATP.

That fits in beautifully with the idea that the first life got its energy from the natural gradient between vent water and seawater, and so was bound to these vents. Only later did the ability to generate gradients evolve, allowing life to break away from the vents on at least two occasions – one giving rise to the first archaea, the other to bacteria.

Revolving door

LUCA also appears to have had a gene for a "revolving door" protein that could swap sodium and hydrogen ions across this gradient. Earlier studies by Martin and Nick Lane of University College London suggest that such a protein would have been absolutely crucial for exploiting the natural gradient at vents.

One thing Martin didn't find is genes involved in making amino acids, the building blocks of proteins. LUCA may have depended on amino acids produced spontaneously at vents, he says.

Peter Gogarten of the University of Connecticut in Storrs, who studies the evolution of early life, thinks Martin's approach is sound. "Most of the identified genes are good candidates for having been present in LUCA," he says.

But it's hard to tell apart genes that are truly ancient and those that merely appear ancient because bacteria and archaea have swapped them. Martin's team disregarded these swapped genes, and could in the process have omitted some genes that LUCA did possess, perhaps including those for amino-acid synthesis.

There are many competing ideas for how life first arose, but the hydrothermal vent theory was the leading contender even before the new findings, because it provides a detailed scenario that explains many of life's key features.

But however plausible it appears, it will never be possible to prove that it is right, Martin says.

Journal reference: Nature Microbiology, DOI: 10.1038/nmicrobiol.2016.116

http://bit.ly/2aBI9yh

Mystery ancient human ancestor found in Australasian family tree

Who's your daddy? An unknown hominin species that bred with early human ancestors when they migrated from Africa to Australasia has been identified through genome mapping of living humans.

By Alice Klein

The genome analysis also questions previous findings that modern humans populated Asia in two waves from their origin in Africa, finding instead a common origin for all populations in the Asia-Pacific region, dating back to a single out-of-Africa migration event.

Modern humans first left Africa about 60,000 years ago, with some heading west towards Europe, and others flowing east into the Asia-Pacific region.

Previous research looking at the genomes of people living today has revealed that the Asia-Pacific arrivals mated with two hominin species they found there – the Neanderthals and the Denisovans.

Mysterious ancestor

But when Jaume Bertranpetit at Pompeu Fabra University in Spain and his colleagues analysed the genomes of living Indigenous Australians, Papuans, people from the Andaman Islands near India, and from mainland India, they found sections of DNA that did not match any previously identified hominin species.

These DNA sequences are not present in the genomes of living Europeans or east Asians, suggesting that the ancestors of these people met and bred with a mystery hominin in south Asia or the Pacific region, who left their genetic legacy in the area's present-day populations. The unidentified hominin may be Homo erectus or "upright man", says Bertranpetit. H. erectus is believed to be the first hominin with a similar stature to today's humans, and the first to leave Africa.

Ancient DNA needed

Fossil records indicate that H. erectus was present in Asia between about 1.8 million and 33,000 years ago, so there could have been an overlap with humans towards the end of its existence.

"But we do not have any direct evidence," says Bertranpetit. Confirmation would require a match between ancient DNA from H. erectus remains and DNA from current Australasian populations.

Unfortunately, none of the H. erectus fossils unearthed to date contain sufficient genomic data for this kind of comparison to be made, says Alan Cooper of the University of Adelaide, Australia. "Until we find a skeleton that is preserved well enough, we won't be able to generate a whole genome like we've done with the Denisovans," he says.

Many groups

The Denisovan genome was derived from a well-preserved finger bone found in a cave in Siberia, but such findings are rare, especially in the hot climate of Asia. "We may never find another preserved hominin in Asia," Cooper says.

Making the story even more complicated is the possibility that multiple unknown hominin species contributed to the mystery DNA snippets, says Cooper. "I wouldn't be surprised – Asia is a bit of a nightmare in terms of the number of different groups that were running around at the same time," he says.

Asia has turned out to have many more hominin forms than Europe, Cooper says. "There is a tidal wave of studies coming out now on Australian and Asian genomes and they're all concluding the same thing – there was a single out–of-Africa movement of modern humans," says Cooper. "Europeans headed west, and everybody else headed east. And then within Asia, it became horribly complicated in terms of the movement, because there were several hominins floating around in that space – Denisovans, Neanderthals and now this third group."

Journal reference: Nature Genetics, DOI: 10.1038/ng.3621

http://bit.ly/2a9HbEf

Revealed: the teenage brain upgrades that occur before adulthood

What goes on in teenagers' heads?

By Andy Coghlan

The final brain edit before adulthood has been observed for the first time. MRI scans of 300 adolescents and young adults have shown how the teenage brain upgrades itself to become quicker – but that errors in this process may lead to schizophrenia in later life.

The editing process that takes place in teen years seems to select the brain's best connections and networks, says Kirstie Whitaker at the University of Cambridge. "The result is a brain that's sleeker and more efficient."

When Whitaker and her team scanned brains from people between the ages of 14 and 24, they found that two major changes take place in the outer layer of the brain – the cortex – at this time. As adolescence progresses, this layer of grey matter gets thinner – probably because unwanted or unused connections between neurons – called synapses – are pruned back.

At the same time, important neurons are upgraded. The parts of these cells that carry signals down towards synapses are given a sheath that helps them transmit signals more quickly – a process called myelination.

Schizophrenia link

"It may be that pruning and myelination are part of the maturation of the brain," says Steven McCarroll at Harvard Medical School. "Pruning involves removing the connections that are not used, and myelination takes the ones that are left and makes them faster," he says.

McCarroll describes this as a trade-off – by pruning connections, we lose some flexibility in the brain, but the proficiency of signal transmission improves.

The most profound editing appears to occur in the busiest hubs of the brain, in areas that link various regions together. When Whitaker's team compared the most edited areas with maps of brain gene activity, they found that the most active genes in these hubs are linked to improving signal speed.

But they also found that genes that have been linked with schizophrenia are also particularly active in these areas. This adds to evidence that errors in the way brain connections are edited during the adolescent years could lead to this disorder.

"If you are distressed as a child, you myelinate more quickly, in a kind of panic, instead of taking longer to figure out the optimal processing network," says Whitaker.

The team is planning to continue re-scanning the brains of the 300 participants in the study, to see if any go on to develop conditions that can be traced back to their

teenage brain development. “Not many will develop schizophrenia, but we’re also interest in mood disorders and depression,” says Whitaker.

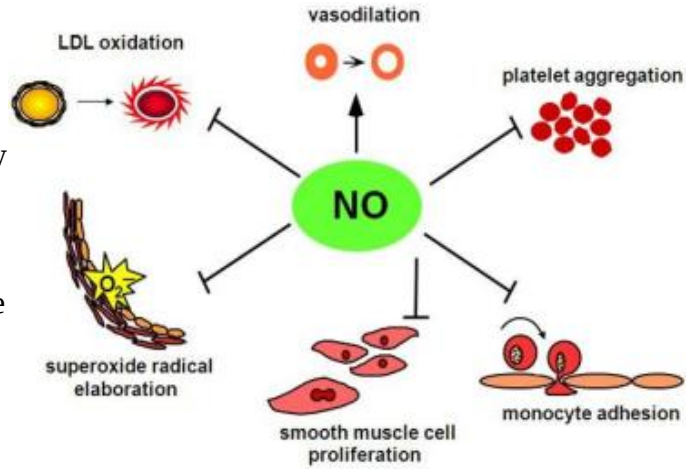
Journal reference: PNAS, DOI: 10.1073/pnas.1601745113

http://www.eurekalert.org/pub_releases/2016-07/lmsu-tmf072616.php

The mysterious farting

Scientists have figured out how gaseous substances in the human body affects psyche and behavior

Professor Alexander Oleskin from the Faculty of Biology of the Lomonosov Moscow State University and his colleague Professor Boris Shenderov from the Gabrichevsky Moscow Research Institute of Epidemiology and Microbiology published an article devoted to the review of gaseous neurotransmitters of microbial origin and their role in the human body. The results of the research were published in Microbial Ecology in Health and Disease.



Functions of nitric oxide (NO) in the human organism. **Lomonosov Moscow State University**

'Our brain cannot work without neurotransmitters, i.e., substances that transmit impulses from one nerve cell to another. One of the classes of neurotransmitters are gaseous substances (gasotransmitters). Our brain uses gases such as hydrogen sulfide, ammonia, and even carbon monoxide to transfer information between cells,' Alexander Oleskin tells.'Bacteria that inhabit our body (and especially the intestine), also form gasotransmitters that affect our brain, mind and behavior.'

Gasotransmitters are gaseous substances produced in various organs and tissues. The name "gasotransmitters" is related to the term "neurotransmitters". These are substances that serve for the transmission of impulses between nerve cells, including the brain, where such gas transmitters as NO, CO and H2S are generated by means of special enzymes.

The review article provides an extensive analysis of the data related to the mechanisms of action of gaseous substances of microbial origin (among them: nitric oxide (NO), carbon monoxide (CO), hydrogen sulfide (H2S), methane (CH4), hydrogen (H2), ammonia (NH3), etc.). They are considered asregulators ofthe human behavior, neurophysiological and mental disorders. The above mentioned gases are among the smallest biologically active molecules which perform vital functions of both multi-cellular organisms and bacteria.They act as mediators and regulators in intercellular interactions in the bodies of mammals.

Importantly, substances that act as gasotransmitters are synthesized in the gastrointestinal tract both by the cells of the host organism and a variety of gastrointestinal microorganisms that inhabit it, including Archaea, Bacteroides, Bifidobacterium, Butyrivibrio, Clostridium, Collinsella, Coprococcus, Desulfovibrio, Eubacterium, Lactobacillus, Prevotella, Propionibacterium, Roseburia, and others.

The gastrointestinal (GI) tract of an adult contains about 20 ml of various gaseous products, producing from 400 to 1200 ml per day. Nitrogen, oxygen, hydrogen, methane, carbon dioxide and hydrogen sulfide constitute 20-90%, 3.9-10%, 20.9-50% 7.2-10%, 9-30% and 0.00028% respectively of the total volume. Their numbers vary depending on the human's diet. The gaseous products are formed as the result of various eukaryotic (human) and prokaryotic (bacterial) cells' activity by enzymatic or non-enzymatic processes, and can also be gripped together with air and food. The majority of the gas molecules is removed from the intestines: they are absorbed and transferred to the bloodstream, and eventually removed from the body through the respiratory system.

Gasotransmitters play a dual role in the body. They may serve as energy sources, also for the inhabiting microbes. For instance, a typical symbiont isthe intestinal bacterium Escherichia coli (E. coli), which lives in the digestive tract, using nitric oxide (NO) generated by the host cells as an energy source for their own metabolism. As nitric oxide is also produced actively by the immune cells during inflammation, it turns out that E. coli is 'interested' in thedevelopment of an inflammation in the intestines.

Gasotransmitters are involved both in the communication between microbial cells and the "dialogue" between the microbial "life partners" and the host cells. The nitric oxide (NO)producedby the host organism or microbes regulates the functioning of the immune and cardiovascular systems and acts as a brain neurotransmitter involved inthe regulation of learning and cognitive activities. Under experimental conditions, mice deficient in one of the nitric oxide forming enzymes (neuronal NO-synthase) exhibit increased motor and sexual activity and long-term depression.

Hydrogen sulphide (H2S) at low concentrations regulates a number of processes in various human organs, especially the cardiovascular and nervous systems. Hydrogen sulfide acts as a neuroprotector: the effect of its insufficient concentration on the nervous system was demonstrated in studies with patients

with epileptic seizures, psychiatric disorders, or pathological changes in the electroencephalogram. Many of these patients are deficient in enzymes which produce hydrogen sulfide in the body. Patients with the Down syndrome, by contrast, have an increased activity of the enzymes that form hydrogen sulfide.

An excess of ammonia (NH3) in the body (hyperammonemia), may be due to disorders in the gastrointestinal tract microbiota (dysbiosis). It results in accumulation of significant concentrations of NH3 in the brain. This situation is characteristic of liver cirrhosis and poses the threat of hepatic encephalopathy.

Gasotransmitters affect the cell that formed them (autocrine action), adjacent cells (paracrine action), and distant tissues and organs and the whole body systemically (endocrine action). The production of the gas transmitters and the distribution to various areas of the body depends on the activity of the cells forming the material of both of the body and the microbial symbionts. The concentrations and activities of gas transmitters are under a combined influence of the brain and the entire nervous system (including intestinal nerve cells that constitute the enteric nervous system), the immune system.They are also influenced by the gastrointestinal microbiota and that of other body areas (the skin, the respiratory tract, the uro-genital tract etc.).

'Prospectively the research findings will be implemented in medical and psychiatric practice. They will serve for the treatment and prevention of neuropsychiatric disorders (including depression, increased aggressiveness, and others) using microbial gas transmitters. It seems feasiblefor instance, to attempt to normalize the amount of ammonia with the help of bacteria that will be introduced into the body in a goal-directed fashion', hypothesizes Alexander Oleskin.

There are some developments in this direction. They are based on useful microorganisms, i.e., probiotics that can be consumed with milk products (yoghurt, cheese etc.), or in pharmaceutical formulations. The novelty lies in the approach to the use of such probiotics: they help administering potentially poisonous gases in minute amounts to improve human health and promote adequate behavior. Probiotic strains of lactobacilli, bifidobacteria, and E. coli actively synthesize one of the most important multifunctional gas transmitters - nitric oxide; moreover, probiotics additionally stimulate the nitric oxide production by the cells of the host organism.

The term 'psychobiotics' has recently been introduced to designate the probiotic bacterial strains that are used as dietary supplements to optimize functioning of the brain and the whole body activities by making good use of h the beneficial effects of microbial products, including gas transmitters, on the brain and behavior.

http://nyti.ms/2au6WmB

Building a Better Human With Science? The Public Says, No Thanks

Americans aren't very enthusiastic about using science to enhance the human species. Instead, many find it rather creepy.

Gina Kolata @ginakolata JULY 26, 2016

A new survey by the Pew Research Center shows a profound distrust of scientists, a suspicion about claims of progress and a real discomfort with the idea of meddling with human abilities. The survey also opens a window into the public's views on what it means to be a human being and what values are important.

Pew asked about three techniques that might emerge in the future but that are not even close to ready now: using gene editing to protect babies from disease, implanting chips in the brain to improve people's ability to think, and transfusing synthetic blood that would enhance performance by increasing speed, strength and endurance.

The public was unenthusiastic on all counts, even about protecting babies from disease. Most, at least seven out of 10, thought scientists would rush to offer each of the technologies before they had adequately tested or even understood them.

Two-thirds say they would not want the enhancement technologies for themselves. And even though genetic manipulations appear more frightening than a chip or artificial blood, which might be removed, the public finds it slightly more acceptable to change a baby's genes than to enhance human abilities.

Religion affected attitudes on these issues. The more religious people said they were, the less likely they were to want genetic alterations of babies or technologies to enhance adults. The differences were especially pronounced between evangelical Protestants and people who said they were atheists or agnostics.

For example, 63 percent of evangelical Protestants said gene editing to protect babies from serious diseases was meddling with nature. In contrast, 81 percent of atheists and 80 percent of agnostics said it was not fundamentally different from other ways humans have tried to better themselves.

Cary Funk, an associate director at Pew and the lead researcher for the survey, said she was surprised by the extent of the public's worries. "These are appealing ideas: being healthier, improved minds, improved bodies," she said.

And she was surprised that the public seemed nearly equally worried about all three of the technologies. After all, she said, "these are three different kinds of technologies, for different purposes."

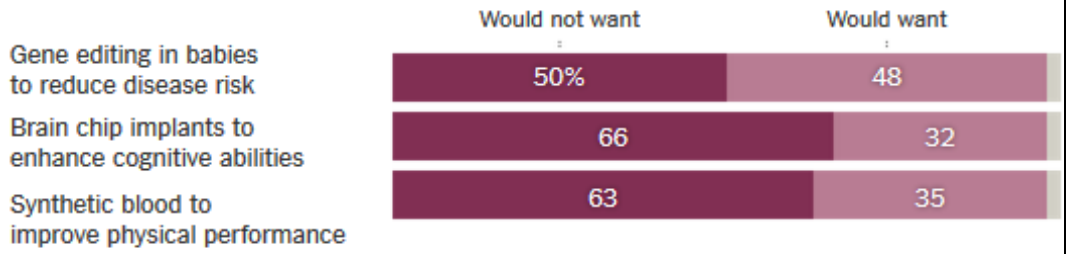
The survey queried a nationally representative sample of 4,700 adults, supplemented by discussions with six focus groups.

Much of the concern about enhancement reflects worries about doing something that seems unnatural, a worry that shows up in many contexts. For example, it is legal for athletes to sleep in low-oxygen altitude tents to develop more red blood cells, which enhance performance.

But it is not legal for them to use the hormone EPO to achieve the same effect. And it ties in to distrust of scientists and corporations trying to sell a product. It is

A Wariness of Enhanced Humans

Pollsters asked Americans whether they would want these enhancements for their babies or for themselves.



Source: Pew Research Center

the sort of distrust that is reflected in the controversy over genetically modified organisms. For years scientists and companies have insisted that foods containing G.M.O.s are safe, but many people do not believe them. In another recent Pew survey, 88 percent of scientists said it was safe to eat these foods, but only 37 percent of the general public thought it was.

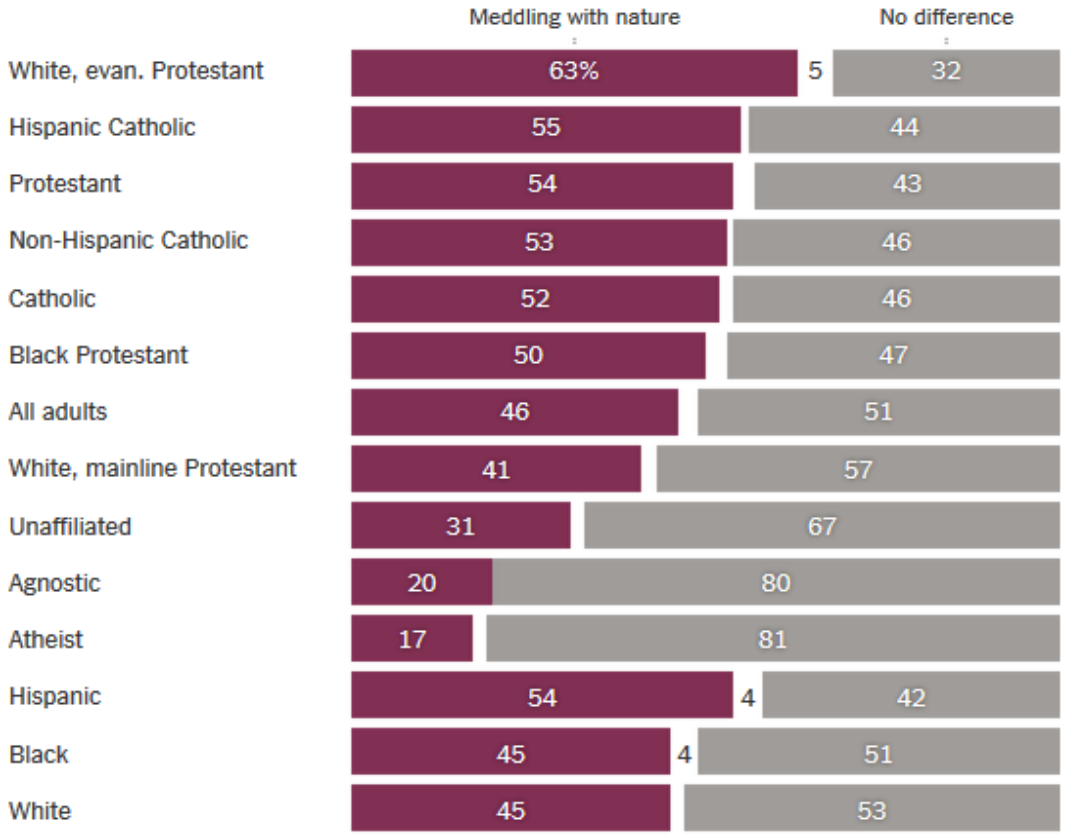
In a way, the public's wariness about science and its uses is part of a long history of worries about new technologies. The cautionary tales go back beyond Frankenstein's monster and continue into the present. When in vitro fertilization was developed, many were vehemently opposed to it, fearing it would result in damaged babies. There was a flurry of concern about genetic engineering, with fears about using it to alter humans — and there were even greater concerns when cloning was developed.

The three specific technologies noted in the Pew survey are recent advances. Gene editing has been taken up by thousands of laboratories around the world with the recent discovery of a method that allows researchers to home in on a gene of interest and delete, replace or alter it. The method, known as Crispr, is still under development — it can lead to the unintended alteration of other genes — and no one is ready to start altering genes of babies.

Even if Crispr were perfected, there are other problems with gene editing to prevent disease. For example, how and when would you alter these genes? And what diseases are you thinking of eliminating? Most involve many genes acting together in ways that are not understood, so even the idea of altering a gene to protect a baby from disease seems, for now, to be limited to a very few disorders, like sickle cell, which involves a single mutation that can be corrected in blood cells that are easily accessible.

Are We Meddling With Nature?

Pollsters asked whether gene editing a baby crossed a line or whether it was no different than other ways humans better themselves. Religious beliefs affected the answer.



Source: Pew Research Center

The idea for synthetic blood came from a report out of Britain last year that scientists were planning to start giving synthetic blood as a substitute for donated human blood. There was no thought of making people stronger or faster. But if

synthetic blood could, for example, carry more oxygen, the possibility of enhancement exists. Once again, though, it is a futuristic notion.

This year, researchers reported that they had put a chip in the brain of a quadriplegic man that transmitted signals to a sleeve around his arm, allowing him to use it. Of course, that is a far cry from implanting brain chips to make people smarter or better able to concentrate, something that scientists do not know how to do.

Conversations in focus groups reflected the trends in the survey, with people saying they worried about what is natural and about the risks of altering humans. Nearly half said it would be acceptable to use synthetic blood, for example, if it simply restored a person's peak abilities. But more than three-quarters were opposed to using it to make people faster or stronger than would otherwise have been possible.

For example, a 35-year-old man in an Atlanta focus group said, "You would have this culture of people just obsessed with being bigger, stronger, faster and just outperforming everybody."

A 27-year-old woman in the Boston area said of brain chips: "The thing just keeps going over in my brain is that you're altering the brain. It's such a high risk. "When you think about DNA, O.K., but it's your brain. It's so complex, and I just feel this is very, very high risk."

The public was also concerned about equity, worried about creating a society of enhanced versus unenhanced humans. A 50-year-old woman in Phoenix said: "Who gets the promotion at work? Because you could afford to have an implant, so you get it? I mean, what about everybody else?"

There may be lessons here for scientists and corporations as they develop technologies that could make people healthier or enhance their abilities. But, as the struggles over G.M.O.s illustrate, knowing the public is leery does not necessarily help scientists know how or even whether to assuage its fears.

http://www.eurekalert.org/pub_releases/2016-07/mbae-ego072116.php

Every grain of rice: Ancient rice DNA data provides new view of domestication history

Despite its importance, the domestication and origins of rice have remained a mystery.

Rice, or Oryza sativa as its scientifically known, feeds more than a third of the globe. Yet the majority of rice crops that supply 90 percent of the world come from just two domesticated varieties, japonica and indica.

Despite its importance on global palates and economies, the domestication and origins of rice have remained a mystery. The popular consensus is that japonica, the shorter stickier grain perfect for sushi, has been exclusively cultivated exclusively in northern part of East Asia. In northern parts of East Asia, consisting of Japan, Korea, and northern part of China, current rice production and consumption are japonica with very little exceptional use of indica.

Now, using new data collected samples of ancient, carbonized rice, a team of Japanese and Chinese scientists have successfully determined DNA sequences to make the first comparisons between modern and ancient rice. To do so, they used new techniques to carefully cull chloroplast DNA from ancient rice 900-2,800-years-old, which had been excavated from seven archaeological sites in Japan and Korea.

In the process, they've become among the first research groups to successfully glean DNA information from ancient cereal crop analysis--not an easy feat. Literally, from a single grain of rice, less than 10mg in weight, they were able to glean DNA from typically just a few out of the precious hundreds they were able to sample. These ancient rice samples were compared to a database collected from 216 modern cultivated and wild rice DNA samples from around the world.

They have new findings suggesting that indica rice was historically cultivated in East Asia or imported to East Asia, which go against generally held assumptions. Almost 2,000 years ago, ancient East Asians lived on a wide variety of rice cultivars including indica. The research team has now found, for the first time, the presence of both japonica- and indica-type varieties in the Yayoi period and the middle ages of Japan and the middle part of Korea Peninsula 2000 years ago. Together with the finding of rice variety in Korean Peninsula, the indica variety also contributed to the dietary of people living in archaic East Asia of more than two thousand years ago.

The authors suggest the possibility of cultivation of the indica variety as the ordinary rice variety in the west side of middle of Korean Peninsula more than 2,000 years ago. Another possibility is that indica rice was brought from China, because the area around Lelang in that era was governed by Chinese Han Empire.

"We have shown a decrease in number of the rice cultivar in East Asia from 2,000 years ago to the present," said the authors. "Reduction of genetic diversity by factitious bottleneck is one of the key aspects in domestication process. In addition, development of civilization and technologies has accelerated further reduction of genetic diversity in the modern era. Advanced agricultural technologies including water management, fertilizer and agrochemical enabled farmers cultivating rice fields under different environmental condition to produce varieties having higher value in market. Modernization has promoted sharing of the sense of values, causing homogenization of crop varieties produced."

The study successfully demonstrates the ability of ancient DNA studies to provide new insights into archaic rice diversity and domestication, which otherwise have not been made from DNA evidence solely from modern rice.

http://www.eurekalert.org/pub_releases/2016-07/afps-wci072616.php

Witnesses confuse innocent and guilty suspects with 'unfair' lineups

Lineups in which distinctive features are not altered can impair witnesses' ability to distinguish between innocent and guilty suspects

Police lineups in which distinctive individual marks or features are not altered can impair witnesses' ability to distinguish between innocent and guilty suspects, according to new research in Psychological Science, a journal of the Association for Psychological Science.

The research, conducted by a team of psychology researchers from the University of Warwick in the UK, builds on existing eyewitness identification studies suggesting that so-called "unfair lineups," in which the police suspect stands out, make witnesses more willing to identify that suspect.

"Worse still, it could impair their ability to distinguish between guilty and innocent suspects and distort their ability to judge the trustworthiness of their identification decision," says Melissa Colloff, lead author on the study.

In contrast to film and TV depictions in which a witness views a police lineup via a one-way mirror, lineups today typically involve the witness looking at and evaluating digital photos. Using digital images gives the police the ability to disguise distinguishing features.

Colloff and colleagues examined the three methods currently used by English police forces to manipulate digital images in order to counteract the effect of any distinguishing marks such as black eyes, eyeglasses, and beards. In an online experiment with almost 9,000 participants, the researchers compared the three techniques - pixelating part of the face, hiding part of the face, or manipulating the photos so they contain the same feature (e.g., adding a beard) - with digital lineups that were not manipulated.

Participants watched a brief video of a crime and were told to pay attention as they would be asked questions about it later. Afterward, they completed several distractor tasks that were unrelated to the study. They were then presented with a lineup composed of two rows of three photos and were told that the culprit may or may not be present in the lineup.

The participants were asked to select one of the photos in the lineup as the culprit or choose the option labelled "not present." Finally, they rated how confident they were in making their identification (1 = completely uncertain, 100 = completely certain). The results showed that participants were more willing to identify the suspect when they viewed a lineup in which the suspect alone had a distinguishing feature compared with the altered lineups.

More importantly, they were less able to distinguish between actual guilty suspects and innocent suspects (i.e., those who shared the culprit's distinctive feature) when they viewed lineups that had not been altered compared with altered lineups.

"When the suspect was the only person with the distinctive feature, this actually made people more likely to confuse who was guilty and who was innocent," Colloff explains. "That's because they weren't really using their memory of the culprit's face, they were just picking the only plausible option - the only one with the scar that they remembered from the crime video - and this made it difficult for people to tell the difference between the real culprit and an innocent suspect who had a similar feature."

The results indicated that the three fair lineup techniques currently used by police were equally effective. "This research has crucial implications for the police--it suggests there are multiple ways in which police officers can fairly accommodate distinctive suspects in lineups," concludes study co-author Kimberley Wade.

All data have been made publicly available via the Open Science Framework (the complete Open Practices Disclosure is included in the Supplemental Data). This article has received the badge for Open Data. More information about the Open Practices badges can be found at OSF and Psychological Science. The article abstract can be found online: *http://pss.sagepub.com/content/early/2016/07/21/0956797616655789.abstract*

http://bit.ly/2ap9qaN

Missing craters on Ceres may have been smoothed by a mud facial

Hiding 800-kilometre scars isn't as tricky as you might think – if you're a dwarf planet, all you need is a mud facial scrub.

By Harry Pettit

The absence of such large impact craters on the dwarf planet Ceres, which is located in the asteroid belt between Mars and Jupiter, has puzzled planetary scientists since NASA's Dawn probe arrived there in March 2015.

The latest mapping images from Dawn, still in orbit around the dwarf, may just provide the answer.

Objects in the asteroid belt are the fragmented leftovers of clashing planetesimals, the building blocks of planets. Studying their impact history can therefore yield important clues to the formation and evolution of our solar system.

Ceres is by far the largest object found in the asteroid belt with a diameter of 939 km, and has witnessed most of the evolution of our solar system, so should have a

rich history of collisions. Models developed by Simone Marchi and his colleagues at the Southwest Research Institute in Colorado indicate that Ceres should have around 10 to 15 impact craters at least 400 km wide alongside its many smaller craters, but early pictures from Dawn did not show any craters larger than 280 km wide.

Now Marchi's team have used the latest data from Dawn in an attempt to unravel the mystery. The team combined multiple hi-res images to create a three-dimensional model of Ceres's outer layer, allowing them to focus in on the nuances of the surface. They discovered that many of Ceres's larger craters have been obliterated beyond recognition.

"Our detailed simulations were telling us that these craters should be there when they simply weren't, which was very puzzling," says Marchi. "Using the topography models from Dawn we confirmed that there were no defined large craters. What we can see, however, is large-scale depressions – some almost 800 km across and 4 to 5 km deep – which may be the remains of impact craters that have been wiped off of the surface over billions of years."

Marchi and his team suggest that Ceres's unusual internal composition and evolution is to blame for the missing craters. It's thought that beneath its surface lies a slushy cocktail of low viscosity substances such as ice and clay that form a kind of mud, which permits the outer layer to shift and relax, potentially smoothing out any large craters.

The results confirm Ceres is a long-term resident of the asteroid belt, says Thomas Davison at Imperial College London. "Some had theorised that Ceres actually slotted into the asteroid belt late from the outer solar system, and hence had not sustained the impacts necessary for large craters to form" he says. "This new research discredits that idea, so it's an important step towards bettering our understanding of this unusual dwarf planet."

Journal reference: Nature Communications, DOI: 10.1038/ncomms12257

http://nyti.ms/2a7bqIP

Mass Killings May Have Created Contagion, Feeding on Itself

Highly publicized attacks may be providing troubled people already contemplating violence a spur to act

The horrifying rash of massacres during this violent summer suggests that public, widely covered rampage killings have led to a kind of contagion, prompting a small number of people with strong personal grievances and scant political ideology to mine previous attacks for both methods and potential targets to express their lethal anger and despair.

The Iranian-German who killed nine people at a Munich mall was reportedly obsessed with mass killings, particularly the attack by a Norwegian that killed 77 people in 2011. The Tunisian who killed 84 people at a Bastille Day celebration in Nice, France, also researched previous attacks, including the mass killing in Orlando, Fla. The Orlando gunman had reportedly researched the San Bernardino, Calif., attack.

Some of the attacks are ideological, some are not and some fall into a gray area. But the highly publicized attacks in a nightclub and restaurants in Paris, at airports in Brussels and Istanbul, and in public spaces in Mumbai may be providing troubled people already contemplating violence a spur to act, experts said, in the same way that many school shootings and other violent rampages follow close on the heels of similar incidents in the news.

"Those of us in this field, it's the first thing we think about when we read accounts of these recent mass murders: The detailed coverage of terrorist attacks may be giving people who are vulnerable or thinking along these line ideas about what to do and how to do it," said Madelyn Gould, a professor of epidemiology and psychiatry at Columbia.

The historical evidence that terrorist attacks become blueprints for random massacres is slim, Dr. Gould and others said. No one knows precisely what factors prompt people to commit such extreme acts, when the primary motivation is radical ideology. In rare cases where perpetrators survive, even they often do not have a clear sense of what moved them from despair and anger to large-scale murder.

"In interviews, they come across as what we call pseudo-terrorists," said J. Kevin Cameron, the director of the Canadian Center for Threat Assessment and Trauma Response, who has consulted on school shootings and other mass killing for almost 20 years. "They're people with some ax to grind who are fluid — that is, they're truly at their core struggling with suicide and homicide, and they swing between the two. Today the person is more suicidal; a week later he's more homicidal."

But there is reason to suspect that contagion is a factor, from previous research on violence. Researchers have long known that highly publicized suicides can precede "clusters" of suicides in the weeks or months afterward, in people already thinking about suicide. The likelihood of such contagion depends on the prominence of the coverage, the detail in the reports about methods, the richness of the portrayals of people affected. In similar fashion, terrorist attacks and mass killings have been exhaustively covered, Dr. Gould said.

The vast majority of people who take their lives kill only themselves, leaving no evidence that they wanted to kill others. But experts suspect that murder-suicides are subject to contagion effects from high-profile cases, though the numbers are too small to establish that statistically. Only about 1 to 2 percent of murder-

suicides target random people outside immediate family or friends, said Matthew Nock, a psychologist at Harvard.

“These events seem more homicide related, with suicide as part of the process, including suicide by police,” Dr. Nock said. “But you can see, with a confluence of factors, including readily available high-capacity firearms, continuous media reporting of mass killings and terror attacks, that there’s certainly fuel for contagion.”

One study in Germany of rampage killers — those who murder as many people as they can, without apparent motive — found that these events do not occur randomly over time. Most such attacks, between 1993 and 2000, followed a similar event by weeks. A 2015 study of school shootings in the United States had a similar finding: Attacks tended to follow similar ones within about two weeks.

Many school killers have researched the 1999 massacre at Columbine High School in Colorado, including the young man who slaughtered children and teachers at an elementary school in Sandy Hook, Conn. — an attack that, in turn, informed still another school gunman, at an Oregon community college.

In the weeks following a mass shooting in Canada this year, “we got three to four threats a day to duplicate that crime for more than two weeks afterward,” Dr. Cameron said. “If you’re a suicidal individual who never seriously thought of killing someone else, these mass attacks, whether terrorism or school shootings, or something like Nice, they give you ideas on site selection, on human target selection — and how to go out with a bang.”

Terrorist attacks, besides providing how-to ideas, may also provide political cover to angry, mentally unstable people drawn to violence — an ideological cause to justify acts of vengeance or grievance, some experts said.

Brian Jenkins, a terrorism specialist at the RAND Corporation, referred to the Islamic State, also known as ISIS, in an email about the perpetrators of recent attacks in Orlando, Nice and Germany: “ISIS’ ideology may resonate with their own anger and promises them applause and recognition. The ideology becomes a vehicle for individual discontents.”

http://www.bbc.com/news/uk-england-tyne-36895395

Orangutan 'copies human speech'

An orangutan copying sounds made by researchers offers new clues to how human speech evolved, scientists say.

Rocky mimicked more than 500 vowel-like noises, suggesting an ability to control his voice and make new sounds.

It had been thought these great apes were unable to do this and, since human speech is a learned behaviour, it could not have originated from them. Study lead Dr Adriano Lameira said this "notion" could now be thrown "into the trash can".

Dr Lameira, who conducted the research at Amsterdam University prior to joining Durham University, said Rocky's responses had been "extremely accurate".

The team wanted to make sure the ape produced a new call, rather than adapting a "normal orangutan call with a personal twist" or matching sounds randomly or by coincidence, he said.

The new evidence sets the "start line for scientific inquiry at a higher level", he said. "Ultimately, we should be now in a better position to think of how the different pieces of the puzzle of speech evolution fit together."

The calls Rocky made were different from those collected in a large database of recordings, showing he was able to learn and produce new sounds rather than just match those already in his "vocabulary".

In a previous study Dr Lameira found a female orangutan at Cologne Zoo in Germany was able to make sounds with a similar pace and rhythm to human speech. Researchers were "astounded" by Tilda's vocal skills but could not prove they had been learned, he said.

However, the fact that "other orangutans seem to be exhibiting equivalent vocal skills shows that Rocky is not a bizarre or abnormal individual", Dr Lameira said.

The research, which also involved universities in the Netherlands, Germany, the USA and Liverpool John Moores University, has been published in the journal Scientific Reports.

http://www.livescience.com/55557-death-spiral-is-fourth-phase-of-life.html

Death Spiral: 4th Phase of Life May Signal the End Is Near

There may be common signs in organisms that signal a spiral toward death.

By Taylor Kubota, Live Science Contributor

Biologists separate life into three phases: development, aging and late life. But a growing body of research now suggests that there is a fourth phase immediately preceding death that scientists have dubbed the "death spiral."

Although most of the "death spiral" research has focused on fruit flies, scientists think these studies can offer valuable insight into the last stage of human life as well. "We believe this is part of the process of, basically, genetically programmed death," Laurence Mueller, chair of the Department of Ecology and Evolutionary Biology at the University of California, Irvine, said in an interview with Live Science.

Expiring fruit flies

Over the past decade, several studies of fruit flies have suggested this spiral toward death can be seen in the drop in reproductive rate (fecundity), according to a review of this research by Mueller and his colleagues, published earlier this year in the journal Biogerontology. For instance, researchers reporting in 2015 in The Journals of Gerontology found that the first day a female fly laid zero eggs was a

significant predictor of death: Indicators of fecundity started to decline about 10 days before young female fruit flies laid zero eggs. The researchers think that whatever leads to the flies' deaths also affects their ability to reproduce in their final days.

In the new review, Mueller said that the timing of this decline matches another previous estimate of the death spiral's duration. Relative to the average life span of a fruit fly, 10 days could be as much as a third of a fly's life, Mueller said. Research from 2002 on Mediterranean fruit flies, called medflies, found that 97 percent of males began lying upside down about 16 days prior to death. In relative terms, this potential indicator of a death spiral is also approximately equal to the timing of the fecundity decline in the fruit flies.

In another study, scientists observed fruit flies, nematodes and zebrafish, to see if their intestines exhibited increased leakiness before death. The researchers tested this leakiness, called permeability, by feeding food dye to each animal. If permeability increased, that dye would leak out into the animal's body, and its body would change color — blue in the flies and fish, and fluorescent green in the nematodes. The research, published online March 22 in the journal Scientific Reports, concluded that this intestinal leakiness was a marker of death in all three species.

A human death spiral?

The hope is that death-spiral research in fruit flies and other organisms could someday tell scientists more about the decline of humans prior to death.

In their review paper, Mueller and his colleagues cited a study from 2008 published in the journal Proceedings of the National Academy of Sciencesas evidence that people may experience the death spiral as well. In that study, researchers analyzed data collected on the physical and cognitive abilities of 2,262 Danish people, ages 92 to 100, from 1998 to 2005. They found that the physical and cognitive scores of individuals who died within the first two years of the study were significantly lower than the scores of those who were still alive in 2005. The assessments included measures of grip strength, ability to complete daily activities (such as using the toilet and eating) and exams that helped evaluate cognitive impairment.

Basically, Mueller said, a death spiral in people could be the reason we often see a distinct increase in disability just before a person dies. Humans are challenging study subjects for both ethical and biological reasons, but looking at the death spiral in other organisms could give scientists a window into how this works in humans, the researchers said.

According to Mueller, the next step in this research might be to selectively breed the flies to create groups that experience death spirals of different durations.

"Once you create populations that are genetically different in that way, you can ask, 'What genes were changed in order to reduce the length of the death spiral?'" Mueller said. Using that knowledge, researchers could look at the human genome for similar genetic markers; humans are genetically similar to fruit flies, Mueller noted. According to yourgenome.com, a website of the Wellcome Genome Campus, 75 percent of disease-causing genes in humans are also present in fruit flies.

Mueller said the research isn't about stopping or even delaying death. Rather, he sees it as a way to improve people's quality of life when they are reaching the end and potentially save immense amounts of money in end-of-life health care.

"Even if we don't affect when you die, we'd like to make you fully functional up to the day you die," he said.

http://www.eurekalert.org/pub_releases/2016-07/aaon-acn072116.php

AAN: Closure not recommended for people with heart defect and stroke

Catheter-based closure should not be routinely recommended for people who have had a stroke and also have a patent foramen ovale

MINNEAPOLIS - An updated recommendation from the American Academy of Neurology (AAN) states that catheter-based closure should not be routinely recommended for people who have had a stroke and also have a heart defect called a patent foramen ovale (PFO), a channel between the top two chambers in the heart. The practice advisory, which updates a previous AAN guideline, is published in the July 27, 2016, online issue of Neurology®, the medical journal of the American Academy of Neurology.

To develop the advisory, researchers reviewed all available scientific studies on people with PFO who also had an ischemic stroke, which is a stroke caused by a blood clot, or a transient ischemic attack, which is an episode of temporary stroke symptoms.

"Compared with other ways to prevent a second stroke, such as medications to reduce blood clots, the devices used to close a patent foramen ovale have limited evidence to support their use," said practice advisory author Steven R. Messé, MD, with the Perelman School of Medicine at the University of Pennsylvania in Philadelphia and a Fellow of the American Academy of Neurology. "It's still uncertain how effective these devices are in reducing stroke risk, and the procedure is associated with uncommon but potentially serious complications."

In addition, Messé noted that the devices used for PFO closure are not available for routine use in the United States, so the procedure must be done off-label with a device approved for treating a similar heart defect or with another device that does

not have strong evidence regarding its use. At the time of publication, the US Food and Drug Administration is currently reviewing the one device that has the best evidence regarding closure.

"People should know that having a PFO is common -- one in four people have one--and the risk of having a second stroke is low," Messé said.

When the AAN developed the earlier guideline on this topic in 2004, not enough evidence was available to make a recommendation on whether closing a PFO was effective in reducing stroke risk.

The advisory also recommends that aspirin or other antiplatelet drugs be used to prevent blood clots instead of anticoagulant drugs such as warfarin and heparin, also known as blood thinners, unless there is another reason to use blood thinners, such as a person with a history of blood clots in the legs or lungs.

The practice advisory was supported by the American Academy of Neurology.

http://www.eurekalert.org/pub_releases/2016-07/gumc-rrb072216.php

Resveratrol appears to restore blood-brain barrier integrity in Alzheimer's disease

Resveratrol appears to restore the integrity of the blood-brain barrier, reducing ability of harmful immune molecules to infiltrate into brain tissues

WASHINGTON -- Resveratrol, given to Alzheimer's patients, appears to restore the integrity of the blood-brain barrier, reducing the ability of harmful immune molecules secreted by immune cells to infiltrate from the body into brain tissues, say researchers at Georgetown University Medical Center. The reduction in neuronal inflammation slowed the cognitive decline of patients, compared to a matching group of placebo-treated patients with the disorder.

The laboratory data provide a more complete picture of results from a clinical trial studying resveratrol in Alzheimer's disease that was first reported in 2015. The new findings will be presented at the Alzheimer's Association International Conference 2016 in Toronto on July 27th.

The Alzheimer's disease brain is damaged by inflammation, thought to be due to a reaction to the buildup of abnormal proteins, including Abeta40 and Abeta42, linked to destruction of neurons. Researchers believe that heightened inflammation -- which was historically thought to come only from "resident" brain immune cells -- worsens the disease. According to the researchers, this study suggests that some of the immune molecules that can cause inflammation in the blood can enter the brain through a leaky blood-brain barrier.

"These findings suggest that resveratrol imposes a kind of crowd control at the border of the brain. The agent seems to shut out unwanted immune molecules that can exacerbate brain inflammation and kill neurons," says neurologist Charbel Moussa, MD, PhD, scientific and clinical research director of the GUMC Translational Neurotherapeutics Program. "These are very exciting findings because it shows that resveratrol engages the brain in a measurable way, and that the immune response to Alzheimer's disease comes, in part, from outside the brain."

Resveratrol is a naturally occurring compound found in foods such as red grapes, red wine, raspberries and dark chocolate. GUMC researchers, led by R. Scott Turner, MD, PhD, tested the substance in 119 patients, the largest nationwide phase II clinical trial to study high-dose pure synthetic (pharmaceutical-grade) resveratrol in individuals with mild to moderate Alzheimer's. The study was published Sept. 11, 2015 in Neurology.

The new part of the resveratrol study examines specific molecules in the cerebrospinal fluid (CSF) taken from participants with biomarker-confirmed Alzheimer's disease -- 19 were given a placebo, and 19 treated daily for a year with resveratrol, equivalent to the amount found in about 1,000 bottles of red wine.

Previous studies with animals found that age-related diseases--including Alzheimer's -- can be prevented or delayed by long-term caloric restriction (consuming two-thirds the normal caloric intake). The researchers studied resveratrol because it mimics the effects of caloric restriction by also activating proteins called sirtuins.

In this new study, Moussa and Turner found that treated patients had a 50 percent reduction in matrix metalloproteinase-9 (MMP-9) levels in the cerebrospinal fluid. MMP-9 is decreased when sirtuin1 (SIRT1) is activated. High levels of MMP-9 cause a breakdown in the blood-brain barrier, allowing proteins and molecules from the body to enter the brain. Normally low MMP-9 levels maintain the barrier, say the researchers.

"These new findings are exciting because they increase our understanding of how resveratrol may be clinically beneficial to individuals with Alzheimer's disease. In particular, they point to the important role of inflammation in the disease, and the potent anti-inflammatory effects of resveratrol," says Turner, director of GUMC's Memory Disorders Program and co-director of the Translational Neurotherapeutics Program.

They also found that resveratrol increased the level of molecules linked to a long-term beneficial or "adaptive" immune reaction, suggesting involvement of inflammatory cells that are resident in the brain, says Moussa. "This is the kind of immune response you want -- it is there to remove and degrade neurotoxic proteins."

"A puzzling finding from the resveratrol study (as well as immunotherapy strategies for Alzheimer's under investigation) is the greater shrinkage of the brain found with treatment. These new findings support the notion that resveratrol

decreases swelling that results from inflammation in Alzheimer's brain," says Turner. "This seemingly paradoxical effect is also found with many of the drugs that are beneficial for patients with multiple sclerosis -- another brain disease characterized by excessive inflammation."

Moussa says that resveratrol should be further tested in a phase III study, but the agent, by itself, is unlikely to be a complete treatment for Alzheimer's. It does not inhibit destruction of brain neurons by tau, another protein aggregate involved in the disease, so a likely beneficial treatment would combine resveratrol with an agent that targets tau, he says.

The research was supported by a grant from the National Institute on Aging (U01 AG010483). Turner and Moussa report no personal financial interests related to the study.

http://www.eurekalert.org/pub_releases/2016-07/uoc--hfw072516.php

Hot flash: Women who start menstruation and menopause later more likely to live to 90

Women with more than 40 reproductive years enjoyed increased odds of living to advanced age

The number of women living to age 90 in the United States has increased significantly in the past century. Currently estimated at 1.3 million, this demographic is expected to quadruple by 2050. A new study by researchers at University of California San Diego School of Medicine found that women who start menstruation and experience menopause later in life may have increased chances of surviving nine decades.

The study, published online July 27, 2016 in Menopause, is the first to evaluate the association of reproductive factors with survival to a specific advanced age, such as 90 years old.

"Achieving longevity is an overarching public health goal with so many of us asking 'how do I live longer?' Our study found that women who started menstruation at age 12 or older, experienced menopause, either naturally or surgically, at age 50 or older and had more than 40 reproductive years had increased odds of living to 90-years-old," said Aladdin Shadyab, PhD, with the Department of Family Medicine and Public Health at UC San Diego School of Medicine.

Of the approximately 16,000 participants in the racially and ethnically diverse group, 55 percent survived to age 90. The participants were from the Women's Health Initiative (WHI), a national longitudinal investigation of postmenopausal women, and were followed for 21 years.

"Our team found that women who started menstruation at a later age were less likely to have certain health issues, like coronary heart disease, and those who experienced menopause later in life were more likely to be in excellent health overall, which may be a possible explanation for our findings," said Shadyab.

Women who started menstruation and experienced menopause at a later age were also less likely to be smokers or have a history of diabetes.

"Factors, such as smoking, can damage the cardiovascular system and ovaries, which can result in earlier menopause. Women with later menopause and a longer reproductive lifespan may have decreased risk of cardiovascular diseases," said Shadyab.

Shadyab, whose grandfather lived to age 102-years-old and sparked his passion for studying aging, said more studies are needed to examine how lifestyle, genetics and environmental factors may explain the link between reproductive lifespan and longevity.

"This study is just the beginning of looking at factors that can predict a woman's likelihood of surviving to advanced age," said Shadyab. "Using my grandfather as inspiration, I am excited to take these results and continue to contribute to the science behind longevity."

Study co-authors include: Sonia Jain, Andrea LaCroix, UC San Diego; Caroline Macera, Richard Shaffer, Linda Gallo, San Diego State University; Margery Gass, The North American Menopause Society; Molly Waring, University of Massachusetts Medical School; Marcia Stefanick, Stanford University School of Medicine.

http://www.eurekalert.org/pub_releases/2016-07/uobc-faa072616.php

Faces aren't always to be believed when it comes to honesty

UBC researchers have determined that certain facial features, not the expression, influence whether people think someone is trustworthy.

UBC psychology professor Stephen Porter, who teaches psychology at UBC's Okanagan campus, and PhD student Alysha Baker, recently completed two studies determining that people often make judgments of trustworthiness based solely on the face.

"Our findings in this and our past studies suggest that your physical appearance can have major implications for your assumed credibility and other character traits, even more powerful than the manner in which you behave and the words you speak," says Porter. "The implications in social, workplace, corporate and criminal justice settings are enormous."

In their studies, the researchers asked participants to watch a video, listen to audio-only pleas or examine a photo of people publicly asking for the return of a missing relative. They then asked for their personal perceptions of general trustworthiness and honesty.

"A lot of information that feeds into our impressions about one's trustworthiness is deduced from the face," says Baker, who conducted much of the research. "More

specifically, there are certain facial features considered that make an individual look more trustworthy--higher eyebrows, more pronounced cheekbones, rounder face--and other features that are perceived to be untrustworthy-looking--downturned eyebrows, or a thinner face."

The studies cited two real criminal cases, one with an 81-year-old woman and one with a father of a missing nine-year-old girl. People believed the elderly woman's public appeal for justice, even though it was later determined she had killed her husband. Many judged the father to be lying, based on his facial features, even though he later proved to be innocent.

"When encountering a person in any given situation, we automatically and instantaneously form an impression of whether a target is worthy of our trust because, evolutionarily, this kind of assessment has helped our survival. For example, assessing 'friend or foe'," says Baker. "We're typically not aware of this quick decision and it may be experienced as 'intuition', but this can be particularly problematic in the legal system because these first impressions are often unfounded and can lead to biased decision-making."

Baker cautions that in some legal settings those who are untrustworthy-looking may be judged more harshly and receive different outcomes than those deemed to be trustworthy-looking. This has occurred in the United States where untrustworthy-looking men are more likely to receive the death penalty than trustworthy-looking men convicted of similar crimes.

This study, recently published in Psychology, Crime & Law, was supported by the Social Sciences and Humanities Research Council of Canada.

http://www.eurekalert.org/pub_releases/2016-07/acs-dcb072716.php

Dandelions could be a sustainable source of rubber

special variety of dandelion may be the answer to sustainable and U.S.-based rubber-making

While most farmers are actively trying to kill weeds, researchers in Ohio are trying to grow them - fast. Taraxacum kok-saghyz, a special variety of dandelion from Kazakhstan -- nicknamed "Buckeye Gold" by the researchers studying it -- may be the answer to sustainable and U.S.-based rubber-making. An article in Chemical & Engineering News (C&EN), the weekly newsmagazine of the American Chemical Society, examines the plants' potential for revolutionizing the rubber industry.

Melody Bomgardner, a senior editor at C&EN, takes a look at the work of Katrina Cornish, a researcher currently studying Buckeye Gold at the Ohio State University. While it might look like a regular dandelion, this variety's roots contain 10-15 percent natural rubber. The goal is to cultivate these dandelions to the point where they can become an industrial rubber crop. Currently, rubber trees that grow on plantations in Thailand, Indonesia and Malaysia take years to grow, making it hard for producers to adapt to changes in the market. Also, transporting the material is costly to both the industry and the environment. With Buckeye Gold, crops can be grown locally, and they mature much faster than rubber trees.

However, scaling up dandelion cultivation so it is competitive with the well-established rubber industry will take time. Researchers are looking to modify these dandelions so they can withstand disease and pest-control measures, which would otherwise kill them. Also, because the plant's root has only small amounts of rubber in it, researchers will have to find ways to use the rest of the crop in order for it to be truly sustainable.

http://www.eurekalert.org/pub_releases/2016-07/rb-ncf072716.php

New catalyst for hydrogen production

It doesn't always have to be precious metals: a promising new catalyst material IS discovered

With the aid of platinum catalysts, it is possible to efficiently produce hydrogen. However, this metal is rare and expensive. Researchers have discovered an alternative that is just as good, but less costly.

The mineral pentlandite ($(Fe,Ni)_9S_8$) is a potential new catalyst for hydrogen production. As described in the journal Nature Communications, it works just as efficient as the platinum electrodes commonly used today. In contrast to platinum, pentlandite is affordable and found frequently on Earth.

A team headed by Dr. Ulf-Peter Apfel and Prof. Dr. Wolfgang Schuhmann of the Ruhr-Universität Bochum describes the results together with colleagues from the Max-Planck-Institute for Coal Research in Mülheim an der Ruhr and the Technical University of Bratislava.

Producing hydrogen without precious metals

In addition to platinum, there are numerous other substances that can catalyse the reaction of water to hydrogen and oxygen and do not contain any precious metals. Among such compounds are the so-called metal chalcogenides. Usually, however, these non-metallic materials are distinctly poorer conductors of electrons and are thus inefficient catalysts.

Pentlandite consists of iron, nickel, and sulfur. Its structure is similar to the active center of hydrogenases, which are hydrogen-producing enzymes, as found, for example, in green algae. In the current study, the researchers compared the hydrogen production rate of naturally obtained and artificially produced pentlandite with platinum and other non-metallic catalysts.

Mineral pentlandite just as good as platinum

Artificial pentlandite and platinum prove to be equally good catalysts, with a performance that surpasses that of all the other materials tested. The mineral

synthesized in the lab produced hydrogen much more efficiently than the naturally found variant. The reason: Inclusions of magnesium and silicon in natural pentlandite reduce its conductivity. The scientists called the output of artificial pentlandite "surprisingly high", and the rate of synthesis also remained stable for a long time.

The mineral has another advantage compared to other non-precious-metal materials. It has a greater active surface area to which the reacting substances can dock. In other non-precious-metal materials, this surface has to be created using complex methods by applying the catalyst to an electrode in the form of nanoparticles.

The German Research Foundation subsidized the work as part of the Resolv Cluster of Excellence (EXC1069) and the Emmy-Noether-Project AP242/2-1. Further financial support came from the Chemical Industry Fund in the form of a Liebig Stipend.

Bharathi Konkena, Kai junge Puring, Ilya Sinev, Stefan Piontek, Oleksiy Khavryuchenko, Johannes P. Dürholt, Rochus Schmid, Harun Tüysüz, Martin Muhler, Wolfgang Schuhmann, Ulf-Peter Apfel: Pentlandite rocks as highly efficient, sustainable and stable electrocatalysts for H2 generation, in: Nature Communications, 2016, DOI: 10.1038/NCOMMS12269

http://www.bbc.com/news/health-36895789

Hour's activity 'offsets sedentary day'

An hour's "brisk exercise" each day offsets the risks of early death linked to a desk-bound working life, scientists suggest.

By Caroline Parkinson Health editor, BBC News website

The analysis of data from more than a million people is part of a study of physical activity published in the Lancet to coincide with the Olympics. Watching TV was found to be worse than sitting at a desk, probably because of associated habits like snacking.

Current NHS guidelines recommend 150 minutes of moderate exercise a week. Being inactive is known to increase the risk of conditions such as heart disease, diabetes and some cancers. It has been linked to 5.3 million deaths globally a year - compared with 5.1 million linked to smoking. The Lancet research says the global cost, for healthcare and lost productivity, is estimated at $67.5bn per year.

A cheat's guide to staying active

To look at the the impact of activity and inactivity, researchers went back to the authors of 13 existing papers and asked all of them to reanalyse their data.

People were classed depending on how active they were - from the least active who did less than five minutes a day, up to 60-75 minutes a day for the most active. Researchers then looked at how many people died during the follow-up period - between two and 14 years. Those who sat for eight hours a day, but were physically active, had a much lower risk of premature death compared with people who sat for fewer hours a day, but were not active. Sitting for a long time as well as being inactive carried the greatest risk.

Prof Ulf Ekelund, of the Norwegian School of Sports Sciences and the University of Cambridge, led the study. He said: "For many people who commute to work and have office-based jobs, there is no way to escape sitting for prolonged periods of time. "For these people in particular, we cannot stress enough the importance of getting exercise, whether it's getting out for a walk at lunchtime, going for a run in the morning or cycling to work. "An hour of physical activity per day is the ideal, but if this is unmanageable, then at least doing some exercise each day can help reduce the risk."

But he admitted: "One hour's moderate activity is substantially higher than current recommendations."

TV time

Watching TV for more than three hours was associated with an increased risk of premature death for all but the most active. The researchers suggest this is likely to be because people might snack while they watch, or because they are more likely to watch TV after eating their evening meal which might affect their metabolism. It could, they say, also be a sign of a more unhealthy lifestyle in general.

Dr Pedro Hallal of Brazil's Federal University of Pelotas looked at the effect of the Olympics on the general public's activity levels. He said that, despite a blip around the Games where people temporarily take up a sport, there is no long-term legacy. "There's been no health legacy of the Olympics reported ever, but it's the perfect time to talk about human movement."

The scientists said governments should ensure their policies encouraged physical activity - citing the example of a bus scheme where stops are placed further apart to encourage walking - and employers should make it easier for staff to be active during their working day - such as flexible lunch breaks and the provision of showering facilities.

Lisa Young, a physical activity specialist at the British Heart Foundation said: "Although we recognise the link between sedentary behaviour and poor health, we do advocate further research in this area to establish categorical statistics in relation to cardiovascular morbidity and mortality."

Dr Mike Loosemore, from the English Institute of Sport, said: "An hour of brisk walking is hard work this is essentially moderate exercise, I suspect not many people would be able to manage that amount of moderate activity a day. "So if you change the guidelines then it puts them even further out of reach of the people who would benefit most from increasing their physical activity, which are those that do very little.

"For the vast majority of people while the best way to stay healthy would be to do an hour of moderate activity a day, realistically the best place to start is reducing your sedentary behaviour at work by sitting less and try to increase whatever physical activity you are doing."

http://www.eurekalert.org/pub_releases/2016-07/w-asd072716.php

A sage discovery: Plant-derived compounds have potent anti-inflammatory effects

New research reveals that two specific plant-derived compounds may be effective for fighting inflammation and pain.

The findings are published in the British Journal of Pharmacology.

Diterpenoids are found in certain plants, fungi, and marine organisms, and two in particular--carnosol (CS) and carnosic acid (CA)--are known to interfere with multiple pathways in the human body associated with inflammation and pain.

A team led by Giuseppe Bifulco, PhD of the University of Salerno in Italy, and Andreas Koeberle, PhD of the Friedrich Schiller University Jena in Germany, have investigated the effects of these natural products in their pure form in inflammatory pain through research involving human cells and mice. The researchers found that the diterpenoids inhibited two enzymes involved in inflammation, fever, and pain. Overexpression of one of these enzymes has been observed in several inflammatory disorders as well as in many human tumors; the second enzyme is also a major player in inflammation and other immune-related processes in the body.

"We have demonstrated that 5-LO and mPGES-1, two key enzymes of inflammation, are primary targets of CS and CA, which are major bioactive ingredients of herbs that are used as spices--namely sage and rosemary--and in traditional medicine," said Dr Bifulco. "Our study provides comprehensive insights into their anti-inflammatory mechanism. Understanding both the molecular basis and pharmacological relevance of natural products is essential to fully exploit the power of nature for human health."

The investigators noted that dual inhibitors of 5-LO and mPGES-1 are considered potential alternatives to classical anti-inflammatory and analgesic drugs that have well-documented side effects. Recently, the mPGES-1 inhibitor GRC 27864 (Glenmark Pharmaceuticals Ltd.) entered the first phase of clinical development.

"The discovery of new dual 5-LO/mPGES-1 inhibitors, like CS and CA, represents a valid strategy for the treatment of inflammatory and cancer diseases and further justifies the use of sage and rosemary in traditional medicine," said Dr Koeberle. "It is important that these natural products are tested in different experimental inflammation and cancer animal models as well as in imaging studies to obtain a complete comprehension of the molecular basis behind their observed biological activity."

Full citation: "In vivo and in vitro biological evaluation of the anti-inflammatory and analgesic response of carnosol and carnosic acid and in silico analysis of their target interactions." Francesco Maione, Vincenza Cantone, Simona Pace, Maria Giovanna Chini, Angela Bisio, Giovanni Romussi, Stefano Pieretti, Oliver Werz, Andreas Koeberle, Nicola Mascolo, and Giuseppe Bifulco. British Journal of Pharmacology; Published Online: July 28, 2016 (DOI: 10.1111/bph.13545) URL Upon Publication: http://doi.wiley.com/10.1111/bph.13545

http://www.bbc.com/news/health-36910766

Antibiotic resistance: 'Snot wars' study yields new class of drugs

A new class of antibiotics has been discovered by analysing the bacterial warfare taking place up people's noses, scientists report.

By James Gallagher Health and science reporter, BBC News

Tests reported in the journal Nature found the resulting drug, lugdunin, could treat superbug infections. The researchers, at the University of Tubingen in Germany, say the human body is an untapped source of new drugs. The last new class of the drugs to reach patients was discovered in the 1980s. Nearly all antibiotics were discovered in soil bacteria, but the University of Tubingen research team turned to the human body.

Dreaded superbug

Our bodies might not look like a battlefield, but on a microscopic level a struggle for space and food is taking place between rival species of bacteria. One of the weapons they have long been suspected of using is antibiotics. Among the bugs that like to invade the nose is Staphylococcus aureus, including the dreaded superbug strain MRSA. It is found in the noses of 30% of people.

But why not everyone?

The scientists discovered that people with the rival bug Staphylococcus lugdunensis in their nostrils were less likely to have S. aureus.

The German team used various strains of genetically-modified S. lugdunensis to work out the crucial piece of genetic code that allowed it to win the fight to live among your nose hairs. They eventually pinpointed a single crucial gene that contained the instructions for building a new antibiotic, which they named lugdunin. Tests on mice showed lugdunin could treat superbug infections on the skin including MRSA, as well as Enterococcus infections.

One of the researchers, Dr Bernhard Krismer, said: "Some of the animals were completely clear, no single cell of the bacterium was detectable. "Others were reduced, but still contained some bacteria and we also saw that the compound penetrated the tissue and acted on the deeper layer of the skin."

It will take years of testing before lugdunin could reach patients and it may not prove to be successful. But new antibiotics are desperately needed as doctors face the growing challenge of infections that resist current drugs and could become untreatable.

'Pressure to eliminate'

Fellow researcher Prof Andreas Peschel said the body could be mined for new antibiotics. "Lugdunin may be the first example of such an antibiotic, we have started a screening programme," he said.

And he even believes that people could one day be infected with genetically-modified bacteria to fight their infections. He argued: "By introducing the lugdunin genes into a completely innocuous bacterial species we hope to develop a new preventive concept of antibiotics that can eradicate pathogens."

Prof Kim Lewis and Dr Philip Strandwitz, from the antimicrobial discovery centre at Northeastern University in the US, commented: "It may seem surprising that a member of the human microbiota - the community of bacteria that inhabits the body - produces an antibiotic. "However, the microbiota is composed of more than a thousand species, many of which compete for space and nutrients, and the selective pressure to eliminate bacterial neighbours is high."

Prof Colin Garner, the head of Antibiotic Research UK, told the BBC: "Altering the balance of bacteria in our bodies through the production of natural antibiotics could eventually be exploited to fight off bacterial infections. "It is possible that this report will be the first of many demonstrating that bacteria in our bodies can produce novel antibiotics with new chemical structures. "Alongside a report that men with beards have fewer pathogens including MRSA on their faces than clean-shaven men, it seems the paper identifying lugdunin should be viewed alongside facial hair as a preventer of infection."

http://www.eurekalert.org/pub_releases/2016-07/fsu-aae072516.php

Apollo astronauts experiencing higher rates of cardiovascular-related deaths

Study suggests exposure to deep space radiation likely the cause

TALLAHASSEE, Fla. -- Members of the successful Apollo space program are experiencing higher rates of cardiovascular problems that are thought to be caused by their exposure to deep space radiation, according to a Florida State University researcher.

In a new paper in Scientific Reports, FSU Dean of the College of Human Sciences and Professor Michael Delp explains that the men who traveled into deep space as part of the lunar missions were exposed to levels of galactic cosmic radiation that have not been experienced by any other astronauts or cosmonauts. That exposure is now manifesting itself as cardiovascular problems.

"We know very little about the effects of deep space radiation on human health, particularly on the cardiovascular system," Delp said. "This gives us the first glimpse into its adverse effects on humans."

This is the first study looking at the mortality of Apollo astronauts. The Apollo program ran from 1961 to 1972, with 11 manned flights into space between 1968 and 1972. Nine of those flew beyond Earth's orbit into deep space. The program is most notable for landing men on the moon as well as the failed mission of Apollo 13 that inspired the popular 1995 Ron Howard film.

Delp's research is of special interest now as the United States and other nations, plus private organizations, make plans for deep space travel. NASA has unveiled plans for U.S. orbital missions around the moon from 2020 to 2030 in preparation for a manned flight to Mars. Russia, China and the European Space Agency are all looking at lunar missions. And SpaceX, owned by Elon Musk, has proposed landing humans on Mars by 2026.

As a group, astronauts are highly educated and have access to top medical care, meaning their healthcare outcomes are generally better than the general population. But the group of men in the Apollo program experienced different environmental conditions than anyone else in the world when they traveled into deep space.

Delp found that 43 percent of deceased Apollo astronauts died from a cardiovascular problem. That is four to five times higher than non-flight astronauts and astronauts who have traveled in low Earth orbit.

Of the 24 men who flew into deep space on the Apollo lunar missions, eight have died and seven were included in the study. The eighth -- Edgar Mitchell -- died after the data analysis had been completed.

Delp and his colleagues also exposed mice to the type of radiation that Apollo astronauts would have experienced. After six months -- the equivalent of 20 human years -- the mice demonstrated an impairment of arteries that is known to lead to the development of atherosclerotic cardiovascular disease in humans.

"What the mouse data show is that deep space radiation is harmful to vascular health," Delp said.

Delp is working with NASA to conduct additional studies on the Apollo astronauts regarding their cardiovascular health.

This research was funded by National Space and Biomedical Research Institute and the NASA Space Biology Program. Other authors on the paper include Jacqueline Charvat from Johnson Space Center, Charles Limoli from University of California Irvine, Ruth Globus from the NASA Ames Research Center and FSU postdoctoral researcher Payal Ghosh.

http://www.eurekalert.org/pub_releases/2016-07/uotw-coa072716.php

Cancer on a Paleo-diet? Ask someone who lived 1.7 million years ago

Evidence of earliest cancer in homonin record found on South African fossils

Johannesburg, South Africa - an international team of researchers led by scientists from the University of the Witwatersrand's Evolutionary Studies Institute and the South African Centre for Excellence in PalaeoSciences today announced in two papers, published in the South African Journal of Science, the discovery of the most ancient evidence for cancer and bony tumours yet described in the human fossil record.

Volume rendered image of the external morphology of the foot bone shows the extent of expansion of the primary bone cancer beyond the surface of the bone. **Patrick Randolph-Quinney (UCLAN)**

The discovery of a foot bone dated to approximately 1.7 million years ago from the site of Swartkrans with definitive evidence of malignant cancer, pushes the oldest date for this disease back from recent times into deep prehistory. Although the exact species to which the foot bone belongs is unknown, it is clearly that of a hominin, or bipedal human relative.

In an accompanying paper appearing in the same journal, a collaborating team of scientists identify the oldest tumour ever found in the human fossil record, a benign neoplasm found in the vertebrae of the well-known Australopithecus sediba child, Karabo from the site of Malapa, and dated to almost two million years in age. The oldest previously demonstrated possible hominin tumour was found in the rib of a Neanderthal and dated to around 120,000 years old.

Edward Odes, a Wits doctoral candidate and lead author of the cancer paper, and co-author on the tumour paper, notes "Modern medicine tends to assume that cancers and tumours in humans are diseases caused by modern lifestyles and environments. Our studies show the origins of these diseases occurred in our ancient relatives millions of years before modern industrial societies existed".

The cancer in a foot bone, a metatarsal, was identified as an osteosarcoma, an aggressive form of cancer which usually affects younger individuals in modern humans, and, if untreated typically results in early death. "Due to its preservation, we don't know whether the single cancerous foot bone belongs to an adult or child, nor whether the cancer caused the death of this individual, but we can tell this would have affected the individuals' ability to walk or run," says Dr Bernhard Zipfel, a Wits scientist and an expert on the foot and locomotion of early human relatives. "In short, it would have been painful."

Lead author of the tumour paper and co-author of the cancer paper, Dr Patrick Randolph-Quinney of Wits University and the University of Central Lancashire in the UK, suggests "The presence of a benign tumour in Australopithecus sediba is fascinating not only because it is found in the back, an extremely rare place for such a disease to manifest in modern humans, but also because it is found in a child. This, in fact, is the first evidence of such a disease in a young individual in the whole of the fossil human record".

Prof. Lee Berger, an author on both papers and leader of the Malapa project where the fossil vertebra was found adds "not only has there been an assumption that these sorts of cancers and tumours are diseases of modernity, which these fossils clearly demonstrate they are not, but that we as modern humans exhibit them as a consequence of living longer, yet this rare tumour is found in a young child. The history of these types of tumours and cancers is clearly more complex than previously thought".

Both incidences of disease were diagnosed using state of the art imaging technologies including those at the European Synchrotron Research Facility in Grenoble, France, medical CT at the Charlotte Maxeke Hospital in Johannesburg, and the micro-CT facility at the Nuclear Energy Corporation of South Africa at Pelindaba.

"Researchers in South Africa are at the forefront of using various X-Ray modalities to discover new and interesting facts about ancient human relatives," notes Dr Jacqueline Smilg, a radiologist based at Charlotte Maxeke Hospital, who is an author on both papers and was involved in the clinical diagnoses. "This is another good example of how the modern clinical sciences and the science of palaeoanthropology are working together in South Africa and with international collaborators to advance our understanding of diseases in both the past and the present."

http://www.eurekalert.org/pub_releases/2016-07/uoia-bsc072216.php

Breakthrough solar cell captures CO2 and sunlight, produces burnable fuel

1,000-fold improved chemistry leads to 'artificial leaf' that makes syngas

Researchers at the University of Illinois at Chicago have engineered a potentially game-changing solar cell that cheaply and efficiently converts atmospheric carbon dioxide directly into usable hydrocarbon fuel, using only sunlight for energy.

The finding is reported in the July 29 issue of Science and was funded by the National Science Foundation and the U.S. Department of Energy. A provisional patent application has been filed.

Unlike conventional solar cells, which convert sunlight into electricity that must be stored in heavy batteries, the new device essentially does the work of plants, converting atmospheric carbon dioxide into fuel, solving two crucial problems at once. A solar farm of such "artificial leaves" could remove significant amounts of carbon from the atmosphere and produce energy-dense fuel efficiently.

"The new solar cell is not photovoltaic -- it's photosynthetic," says Amin Salehi-Khojin, assistant professor of mechanical and industrial engineering at UIC and senior author on the study.

"Instead of producing energy in an unsustainable one-way route from fossil fuels to greenhouse gas, we can now reverse the process and recycle atmospheric carbon into fuel using sunlight," he said.

While plants produce fuel in the form of sugar, the artificial leaf delivers syngas, or synthesis gas, a mixture of hydrogen gas and carbon monoxide. Syngas can be burned directly, or converted into diesel or other hydrocarbon fuels.

The ability to turn CO2 into fuel at a cost comparable to a gallon of gasoline would render fossil fuels obsolete.

Chemical reactions that convert CO2 into burnable forms of carbon are called reduction reactions, the opposite of oxidation or combustion. Engineers have been exploring different catalysts to drive CO2 reduction, but so far such reactions have been inefficient and rely on expensive precious metals such as silver, Salehi-Khojin said. "What we needed was a new family of chemicals with extraordinary properties," he said.

Salehi-Khojin and his coworkers focused on a family of nano-structured compounds called transition metal dichalcogenides -- or TMDCs -- as catalysts, pairing them with an unconventional ionic liquid as the electrolyte inside a two-compartment, three-electrode electrochemical cell. The best of several catalysts they studied turned out to be nanoflake tungsten diselenide.

"The new catalyst is more active; more able to break carbon dioxide's chemical bonds," said UIC postdoctoral researcher Mohammad Asadi, first author on the Science paper. In fact, he said, the new catalyst is 1,000 times faster than noble-metal catalysts -- and about 20 times cheaper.

Other researchers have used TMDC catalysts to produce hydrogen by other means, but not by reduction of CO2. The catalyst couldn't survive the reaction.

"The active sites of the catalyst get poisoned and oxidized," Salehi-Khojin said. The breakthrough, he said, was to use an ionic fluid called ethyl-methyl-imidazolium tetrafluoroborate, mixed 50-50 with water.

"The combination of water and the ionic liquid makes a co-catalyst that preserves the catalyst's active sites under the harsh reduction reaction conditions," Salehi-Khojin said.

The UIC artificial leaf consists of two silicon triple-junction photovoltaic cells of 18 square centimeters to harvest light; the tungsten diselenide and ionic liquid co-catalyst system on the cathode side; and cobalt oxide in potassium phosphate electrolyte on the anode side.

When light of 100 watts per square meter - about the average intensity reaching the Earth's surface - energizes the cell, hydrogen and carbon monoxide gas bubble up from the cathode, while free oxygen and hydrogen ions are produced at the anode.

"The hydrogen ions diffuse through a membrane to the cathode side, to participate in the carbon dioxide reduction reaction," said Asadi.

The technology should be adaptable not only to large-scale use, like solar farms, but also to small-scale applications, Salehi-Khojin said. In the future, he said, it may prove useful on Mars, whose atmosphere is mostly carbon dioxide, if the planet is also found to have water.

"This work has benefitted from the significant history of NSF support for basic research that feeds directly into valuable technologies and engineering achievements," said NSF program director Robert McCabe.

"The results nicely meld experimental and computational studies to obtain new insight into the unique electronic properties of transition metal dichalcogenides," McCabe said. "The research team has combined this mechanistic insight with some clever electrochemical engineering to make significant progress in one of the grand-challenge areas of catalysis as related to energy conversion and the environment."

"Nanostructured transition metal dichalcogenide electrocatalysts for CO2 reduction in ionic liquid" is online at http://www.eurekalert.org/jrnls/sci/ or by contacting scipak@aaas.org.

Co-authors with Asadi and Salehi-Khojin are Kibum Kim, Aditya Venkata Addepalli, Pedram Abbasi, Poya Yasaei, Amirhossein Behranginia, Bijandra Kumar and Jeremiah Abiade of UIC's mechanical and industrial engineering department, who performed the electrochemical experiments and prepared the catalyst under NSF contract CBET-1512647; Robert F. Klie and Patrick Phillips of UIC's physics department, who performed electron microscopy and spectroscopy experiments; Larry A. Curtiss, Cong Liu and Peter Zapol of Argonne National Laboratory, who did Density Functional Theory calculations under DOE contract DE-ACO206CH11357; Richard Haasch of the University of Illinois at Urbana-Champaign, who did ultraviolet photoelectron spectroscopy; and José M. Cerrato of the University of New Mexico, who did elemental analysis.

http://www.eurekalert.org/pub_releases/2016-07/uonc-nde072516.php

No dream: Electric brain stimulation during sleep can boost memory

By targeting 1 facet of the brain's electrical activity, UNC neuroscientist Flavio Frohlich showed it's possible to enhance memory, laying the groundwork for a new treatment paradigm for neurological and psychiatric disorders

CHAPEL HILL, NC - When you sleep, your brain is busy storing and consolidating things you learned that day, stuff you'll need in your memory toolkit tomorrow, next week, or next year. For many people, especially those with neurological conditions, memory impairment can be a debilitating symptom that affects every-day life in profound ways. For the first time, UNC School of Medicine scientists report using transcranial alternating current stimulation, or tACS, to target a specific kind of brain activity during sleep and strengthen memory in healthy people. The findings, published in the journal Current Biology, offer a non-invasive method to potentially help millions of people with conditions such as autism, Alzheimer's disease, schizophrenia, and major depressive disorder.

For years, researchers have recorded electrical brain activity that oscillates or alternates during sleep; they present as waves on an electroencephalogram (EEG). These waves are called sleep spindles, and scientists have suspected their involvement in cataloging and storing memories as we sleep.

"But we didn't know if sleep spindles enable or even cause memories to be stored and consolidated," said senior author Flavio Frohlich, PhD, assistant professor of psychiatry and member of the UNC Neuroscience Center. "They could've been merely byproducts of other brain processes that enabled what we learn to be stored as a memory. But our study shows that, indeed, the spindles are crucial for the process of creating memories we need for every-day life. And we can target them to enhance memory."

This marks the first time a research group has reported selectively targeting sleep spindles without also increasing other natural electrical brain activity during sleep. This has never been accomplished with tDCS - transcranial direct current stimulation - the much more popular cousin of tACS in which a constant stream of weak electrical current is applied to the scalp.

During Frohlich's study, 16 male participants underwent a screening night of sleep before completing two nights of sleep for the study.

Before going to sleep each night, all participants performed two common memory exercises - associative word-pairing tests and motor sequence tapping tasks, which involved repeatedly finger-tapping a specific sequence. During both study nights, each participant had electrodes placed at specific spots on their scalps. During sleep one of the nights, each person received tACS - an alternating current of weak electricity synchronized with the brain's natural sleep spindles. During sleep the other night, each person received sham stimulation as placebo.

Each morning, researchers had participants perform the same standard memory tests. Frohlich's team found no improvement in test scores for associative word-pairing but a significant improvement in the motor tasks when comparing the results between the stimulation and placebo night.

"This demonstrated a direct causal link between the electric activity pattern of sleep spindles and the process of motor memory consolidation." Frohlich said.

Caroline Lustenberger, PhD, first author and postdoctoral fellow in the Frohlich lab, said, "We're excited about this because we know sleep spindles, along with memory formation, are impaired in a number of disorders, such as schizophrenia and Alzheimer's. We hope that targeting these sleep spindles could be a new type of treatment for memory impairment and cognitive deficits." Frohlich said, "The next step is to try the same intervention, the same type of non-invasive brain stimulation, in patients that have known deficits in these spindle activity patterns."

Frohlich's team previously used tACS to target the brain's natural alpha oscillations to boost creativity. This was a proof of concept. It showed it was possible to target these particular brain waves, which are prominent as we create ideas, daydream, or meditate. These waves are impaired in people with neurological and psychiatric illnesses, including depression.

Other authors of the Current Biology paper include Bradley Vaughn, MD, professor of neurology at UNC, Sankar Alagapan, PhD, a postdoctoral researcher in the Frohlich lab, Juliann Mellin, the research study coordinator for the Frohlich lab, and Michael Boyle, a graduate student in the UNC/NC State biomedical engineering department.

http://www.eurekalert.org/pub_releases/2016-07/uowh-odd072716.php

Open-source drug discovery a success

Researchers from around the world collaborate

In what is being called the first-ever test of open-source drug-discovery, researchers from around the world have successfully identified compounds to pursue in treating and preventing parasite-borne illnesses such as malaria as well as cancer.

Starting in late 2011, the Medicines for Malaria Venture, based in Geneva, Switzerland, distributed 400 diverse compounds with antimalarial activity free of charge to 200 labs in 30 countries. One-third of the labs reported their results in a paper published today in PLOS Pathogens, "Open source drug discovery with the Malaria Box compound collection for neglected diseases and beyond."

The results have ignited more a dozen drug-development projects for a variety of diseases.

"The trial was successful not only in identifying compounds to pursue for anti-malarials, but it also identified compounds to treat other parasites and cancer," said lead author Wesley Van Voorhis. To help lead the project, Van Voorhis took a sabbatical from his roles as a University of Washington professor of medicine (allergy and infectious diseases) and director of the Center for Emerging and Re-emerging Infectious Diseases.

The box of 400 active drug-like molecules was distributed at no cost to researchers around the world. **Medicines for Malaria Venture**

The National Cancer Institute is now working on a colon cancer drug that emerged from the testing, Van Voorhis said. Several European labs are working on anti-worm compounds, and numerous U.S. labs are investigating drugs to combat other parasites. Medicines for Malaria Venture is also working with pharmaceutical companies GSK and Novartis on related anti-malarials, he added.

In their paper, researchers cited the lack of interaction between academia and industry as a major curb to innovation in drug discovery.

"Much of the global resource in biology is present in universities, whereas the focus of medicinal chemistry is still largely within industry. Open-source drug discovery, with sharing of information, is clearly a first step towards overcoming that gap," they wrote. The Malaria Box distributed 400 diverse druglike molecules that were most often found in industry collections, helping to bridge the gap between industry and academia.

This open-access effort was so successful that Medicines for Malaria Venture has begun to distribute another set of compounds with broader potential applicability, called the Pathogen Box. The box is available now to scientific labs globally.

http://www.eurekalert.org/pub_releases/2016-07/f-mmb072816.php

Music makes beer taste better

The music played in a bar can impact how much you enjoy your drink

Music can influence how much you like the taste of beer, according to a study published in Frontiers in Psychology. Their findings suggest that a range of multisensory information, such as sound, sensation, shape and color, can influence the way we perceive taste. The Brussels Beer Project collaborated with UK band The Editors to produce a porter-style beer that took inspiration from the musical and visual identity of the band.

The ale had a medium body and used an Earl Grey infusion that produced citrus notes, contrasting with the malty, chocolate flavors from the mix of grains used in production. This taste profile was designed to broadly correspond to The Editors latest album, 'In Dreams'.

Then, a team of researchers led by Dr. Felipe Reinoso Cavalho, from the Vrije Universiteit Brussel and KU Leuven, designed an experiment to see if the influence of music and packaging design would result in a more positive tasting experience.

They invited 231 drinkers to experience the beer in three different conditions.

The first served as a control group and drank the beer along with a bottle without a label. In this case, they didn't listen to any specific song. The second group, testing the influence of packaging, tasted the beer after seeing the bottle with the label. The third group drank the beer presented with the label while listening to 'Oceans of Light', one of the songs on the band's latest album which the beer was created to reflect.

Before the test the participants rated how tasty they thought the beer might be. Then after tasting they rated how much they had actually enjoyed the drink.

The results showed that those presented with the label and track reported both greater enjoyment than those presented with the beer and label alone.

Filipe said: "We have been able to see that people tend to feel more pleasure when experiencing beverages along with sounds that are part of the beverage's identity.

"In this case, we have shown that people that previously knew the song that was used in the experiment, not only liked the multisensory experience of drinking beer more while listening to it, but they also liked the beer itself more. "It seems that the added pleasure that the song brought into the experience was transferred into the beer's flavor."

Speaking about the next steps for this research Felipe said: "We want to keep assessing how sounds can modulate perceived flavor attributes of food and beverages, such as bitterness, sweetness, sourness and creaminess. "We also want to understand how sounds can influence our decision making process, in order to see if different sounds could, for example, lead people towards healthier food choices."

Research into the interaction of different sensory information on taste has opened up the way for food and beverage retailers to create a range of novel eating and drinking experiences. "We believe that this is just the beginning;" said Felipe, "We will also be able to work with other food and beverage types and progressively include other senses in this pairing process, such as vision, smells, touch."

http://www.eurekalert.org/pub_releases/2016-07/uoaa-wbn072816.php

Why brain neurons in Parkinson's disease stop benefiting from levodopa

UAB researchers have uncovered an essential mechanism of long-term memory for L-DOPA-induced-dyskinesia: widespread reorganization of DNA methylation. This may be a therapeutic target to prevent or reverse dyskinesia.

BIRMINGHAM, Ala. - Though the drug levodopa can dramatically improve Parkinson's disease symptoms, within five years one-half of the patients using L-DOPA develop an irreversible condition -- involuntary repetitive, rapid and jerky movements. This abnormal motor behavior appears only while taking L-DOPA, and it stops if the drug is stopped. However, if L-DOPA is taken again, even many months later, it quickly re-emerges.

In research to prevent this side effect and extend the usefulness of L-DOPA -- which is the most effective drug treatment for Parkinson's disease -- University of Alabama at Birmingham researchers have uncovered an essential mechanism of this long-term memory for L-DOPA-induced-dyskinesia, or LID.

They report a widespread reorganization of DNA methylation -- a process in which the function of DNA is modified -- in brain cells caused by L-DOPA. They also found that treatments that increase or decrease DNA methylation can alter dyskinesia symptoms in an animal model. Thus, modification of DNA methylation may be a novel therapeutic target to prevent or reverse LID behavior.

"L-DOPA is a very valuable treatment for Parkinson's, but in many patients its use is limited by dyskinesia," said David Standaert, M.D., Ph.D., the John N. Whitaker Professor and chair of the Department of Neurology at UAB. "Better means of preventing or reversing LID could greatly extend the use of L-DOPA without inducing intolerable side effects. The treatments we have used here, methionine supplementation or RG-108, are not practical for human use; but they point to the opportunity to develop methylation-based epigenetic therapeutics in Parkinson's disease."

The research by David Figge, Karen Eskow Jaunarajs, Ph.D., and corresponding author David Standaert, Center for Neurodegeneration and Experimental Therapeutics, UAB Department of Neurology, was recently published in The Journal of Neuroscience.

Research Details

Although studies of LID in animal models have shown changes in gene expression and cell signaling, a key unanswered question still remained: Why is the neural sensitization seen in LID persistent when delivery of L-DOPA is transient?

The UAB researchers suspected DNA methylation changes -- the attachment of a methyl group onto nucleotides in DNA -- because methylation is known to stably alter gene expression in cells as they grow and differentiate. Furthermore, methylation changes in neurons have been shown to be involved during the formation of place memory and the development of addictive behavior after cocaine use.

In general, increased DNA methylation has a silencing effect on nearby gene expression, while removal of the methyl groups enhances gene expression.

Figge and colleagues found that:

L-DOPA treatment of parkinsonian rodents enhanced the expression of two DNA demethylases.

Cells in the dorsal striatum in the LID model showed extensive, location-specific changes in DNA methylation, mostly seen as demethylation.

The changes in DNA methylation were near many genes with established functional importance in LID.

Modulating global DNA methylation -- either by injecting methionine to increase methylation or applying RG-108, an inhibitor of methylation, to the striatum -- modified the dyskinetic behavior of LID, down or up, respectively.

"Together," the researchers wrote, "these findings demonstrate that L-DOPA induces widespread changes to striatal DNA methylation and that these modifications are required for the development and maintenance of LID."

http://bit.ly/2ab5t5b

Autoimmune diseases may be side effect of a strong immune system

Evidence that people are more susceptible to autoimmune diseases because their immune system is better equipped to combat dangerous infections

By Viviane Callier

Evolution could be to blame for our autoimmune diseases, such as lupus, multiple sclerosis and rheumatoid arthritis. For the first time, we have evidence that people who are more susceptible to disorders of this kind are that way because their immune system is better equipped to combat dangerous infections, enabling them to live longer.

“There are so many autoimmune diseases affecting all sorts of tissues,” said Andrea Graham, an evolutionary biologist at Princeton University, at the annual meeting of the International Society for Evolution, Medicine and Public Health in Durham, North Carolina, last month. So what could explain the existence of these conditions? “One potential answer is that vulnerability to immune-mediated disease is simply the price we must pay for potent and rapid defence against infection.”

Graham and her colleagues have found evidence for this idea using a long-running study of elderly people in Taiwan. It has tracked more than 1000 people born between 1892 and 1953 for the past 27 years.

The team analysed blood samples collected from 639 of these people in 2000 and 2006, measuring the levels of "self-reactive" antibodies – those capable of attacking the body's own tissues. They found that individuals with higher levels of these antibodies were likely to live longer.

For any particular age, the participants with high levels of self-reactive antibodies had on average a 33 per cent lower risk of dying that year. These people also seemed less likely to have a type of chronic viral infection.

The downside is that these antibodies are precisely those implicated in autoimmune diseases. The kidney is one of the first organs to be affected by the autoimmune disorder lupus, so the team also looked at urine samples, which can indicate kidney health. They found that people who had higher levels of self-reactive antibodies may also be more likely to develop lupus.

What makes this study remarkable is that it explains in evolutionary terms why human evolution has failed to weed out autoimmune diseases, says Gabriele Sorci, an evolutionary biologist at the University of Bourgogne in France.

The work was inspired by Graham's findings from a similar study in the UK that involves not humans but sheep. For the last 30 years, researchers have been painstakingly recording the health and life details of more than 7000 Soay sheep on the Scottish island of St Kilda.

By analysing the antibodies in sheep blood samples, Graham's team had found that there was a correlation between levels of self-reactive antibodies and those of antibodies against parasites, and that a high level of self-reactive antibodies runs in sheep families. Together, the findings suggest that genetics influences levels of self-reactive antibodies, and that this is linked to mounting a stronger defence against parasites. This seems to provide an evolutionary advantage – sheep with higher levels of self-reactive antibodies live longer.

"Autoimmunity has previously been considered to be a bad thing, and a consequence of the immune system misfiring instead of attacking what it's supposed to," says Aaron Blackwell, an evolutionary anthropologist at the University of California, Santa Barbara. "These studies show that there may be a function for autoimmunity," says Blackwell.

Statistical analysis of the sheep data revealed that the correlation between survival and high levels of self-reactive antibodies isn't completely explained by being better at beating parasites. This may mean that self-reactive antibodies are not just a side effect of a strong immune system – perhaps they are doing something useful too. Other studies suggest that self-reactive antibodies can help clear dying cells and other debris from the body, and it is possible that they may play a role in watching for cancer cells.

The emerging picture is that physiological responses are a product of long evolutionary processes, and often serve a function that makes an animal more likely to survive under the right circumstances, says Blackwell. "I would expect these results to be applicable across many species and across different human populations," he says.

http://www.eurekalert.org/pub_releases/2016-07/sfpa-cav072916.php

Cognitive ability varies, but prejudice is universal

When it comes to prejudice, it does not matter if you are smart or not, or conservative or liberal, each group has their own specific biases.

In a recent study, psychologists show that low cognitive ability (i.e., intelligence, verbal ability) was not a consistent predictor of prejudice. Cognitive ability, whether high or low, only predicts prejudice towards specific groups. The results are published in the journal Social Psychological and Personality Science.

"Very few people are immune to expressing prejudice, especially prejudice towards people they disagree with," says lead author Mark Brandt (Tilburg University, Netherlands). Brandt and Jarrett Crawford (The College of New Jersey) analyzed data from 5914 people in the United States that includes a measure of verbal ability and prejudice towards 24 different groups.

Analyzing the results, the researchers found that people with both relatively higher and lower levels of cognitive ability show approximately equal levels of intergroup bias, but towards different sets of groups. People with low cognitive ability tended to express prejudice towards groups perceived as liberal and unconventional (e.g., atheists, gays and lesbians), as well as groups of people perceived as having low choice over group membership (e.g., ethnic minorities). People with high cognitive ability showed the reverse pattern. They tended to express prejudice towards groups perceived as conservative and conventional (e.g., Christians, the military, big business).

"There are a variety of belief systems and personality traits that people often think protect them from expressing prejudice," says Brandt. "In our prior work we found that people high and low in the personality trait of openness to experience show very consistent links between seeing a group as 'different from us' and expressing prejudice towards that group. The same appears to be true for cognitive ability. "

"Whereas prior work by others found that people with low cognitive ability express more prejudice, we found that this is limited to only some target groups," says Brandt. "For other target groups the relationship was in the opposite direction. For these groups, people with high levels of cognitive ability expressed more

prejudice. So, cognitive ability also does not seem to make people immune to expressing prejudice."

The authors would like to see if their findings will replicate in new samples, with new target groups, and additional measures of cognitive ability.

"We used a measure of verbal ability, which is essentially a vocabulary test," says Brandt. "Although this measure correlates pretty well with other measures of cognitive ability it is not a perfect nor a complete measure."

http://www.eurekalert.org/pub_releases/2016-07/vu-nfe072916.php

New fossil evidence supports theory that first mass extinction engineered by early animals

Newly discovered fossil evidence from Namibia strengthens the proposition that the world's first mass extinction was caused by "ecosystem engineers" - newly evolved biological organisms that altered the environment so radically it drove older species to extinction.

The event, known as the end-Ediacaran extinction, took place 540 million years ago. The earliest life on Earth consisted of microbes - various types of single-celled organisms. These held sway for more than 3 billion years, when the first multicellular organisms evolved. The most successful of these were the Ediacarans, which spread around the globe about 600 million years ago. They were a largely immobile form of marine life shaped like discs and tubes, fronds and quilted mattresses.

After 60 million years, evolution gave birth to another major innovation: metazoans, the first animals. Metazoans could move spontaneously and independently at least during some point in their life cycle and sustain themselves by eating other organisms or what other organisms produce. Animals burst onto the scene in a frenzy of diversification that paleontologists have labeled the Cambrian explosion, a 25 million-year period when most of the modern animal families - vertebrates, mollusks, arthropods, annelids, sponges and jellyfish - came into being.

"These new species were 'ecological engineers' who changed the environment in ways that made it more and more difficult for the Ediacarans to survive," said Simon Darroch, assistant professor of earth and environmental sciences at Vanderbilt University, who directed the new study described in the paper titled "A mixed Ediacaran-metazoan assemblage from the Zaris Sub-basin, Namibia," published in the journal Palaeogeography, Palaeoclimatology, Palaeoecology.

Darroch and his colleagues report that they have found one of the best-preserved examples of a mixed community of Ediacarans and animals, which provides the best evidence of a close ecological association between the two groups.

"Until this, the evidence for an overlapping ecological association between metazoans and soft-bodied Ediacaran organisms was limited," Darroch said. "Here, we describe new fossil localities from southern Namibia that preserve soft-bodied Ediacara biota, enigmatic tubular organisms thought to represent metazoans and vertically oriented metazoan trace fossils. Although the precise identity of the tracemakers remains elusive, the structures bear several striking similarities with a cone-shaped organism called Conichnus that has been found in the Cambrian period."

In a previous paper that Darroch and his collaborators published last September, they reported on a fossil record that showed stressed-looking communities of Ediacara associated with a suite of animal burrows.

"With this paper we're narrowing in on causation; we've discovered some new fossil sites that preserve both Ediacara biota and animal fossils (both animal burrows - 'trace fossils' - and the remains of animals themselves) sharing the same communities, which lets us speculate about how these two very different groups of organisms interacted," he said.

"Some of the burrow fossils we've found are usually interpreted as being formed by sea anemones, which are passive predators that may have preyed upon Ediacaran larvae. We've also found stands of Ediacaran frondose organisms, with animal fossils preserved in place coiled around their bases. In general, these new fossil sites reveal a snapshot of a very unusual 'transitional' ecosystem existing right before the Cambrian explosion, with the last of the Ediacara biota clinging on for grim death, just as modern-looking animals are diversifying and starting to realize their potential."

Although Darroch is studying events that took place 540 million years ago, he believes there is a message relevant for today. "There is a powerful analogy between the Earth's first mass extinction and what is happening today," he said. "The end-Ediacaran extinction shows that the evolution of new behaviors can fundamentally change the entire planet, and today we humans are the most powerful 'ecosystems engineers' ever known."

Thomas H. Boag at Stanford University; Rachel A. Racicot, Sarah Tweedt and Douglas H. Erwin from the Smithsonian Institution; and Sara J. Mason and Marc Laflamme from the University of Toronto collaborated on the study.

The research was supported by funding from National Science Foundation grants DEB 1331980 and PLR134175, NASA Astrobiology Institute grant NNA13AA90A and National Geographic Society grant 9241-13.

http://bit.ly/2aEOyb3

Fungal Disease 'Valley Fever' Is Often Misdiagnosed

Fungal infection called valley fever is often misdiagnosed because the symptoms can resemble those of the flu

By Rachael Rettner, Senior Writer | July 29, 2016 12:36pm ET

A fungal infection called valley fever, which can cause mild to severe lung problems (including holes in the lungs), is often misdiagnosed because the symptoms can resemble those of the flu or other illness, experts say.

The misdiagnoses can lead to unnecessary medications that don't treat the fungal infection, according to new guidelines from the Infectious Diseases Society of America.

The guidelines stress that primary care doctors should consider the possibility of valley fever in patients who have pneumonia or continuing flu-like symptoms if they live in or have visited the western or southwestern United States, where the fungus is found naturally in the soil.

"Valley fever is underdiagnosed, in part because past guidelines were directed to the specialists, whereas most of these patients initially see their primary care physicians, many of whom aren't aware [of] just how common this infection is," Dr. John Galgiani, lead author of the guidelines and a professor at the University of Arizona College of Medicine, said in a statement. "About a third of cases of pneumonia in Arizona are caused by valley fever," Galgiani said, and the illness has been on the rise in recent years, with a 10-fold increase in cases in the Southwest over the past decade.

People get valley fever when they breathe in fungal spores, which can become airborne when the wind disturbs the soil. The fungus can cause a lung infection known as coccidioidomycosis. The fungus that causes the illness is found in desert regions, including western Texas, Arizona, northern Mexico and the central San Joaquin Valley in California. [10 Bizarre Diseases You Can Get Outdoors]

"It's an equal-opportunity bug, and everyone who is exposed has the same chance of getting infected," Galgiani said.

People with valley fever often have mild or no symptoms, but the infection can cause fever, fatigue, cough, headache, chest pain, skin rash and joint aches. In some cases, it can cause severe pneumonia, holes in the lungs, skin sores and meningitis (inflammation of the membranes that cover the brain and spinal cord.) People are at increased risk of developing complications from the illness if they are pregnant, have diabetes or are taking medications that suppress the immune system.

Each year, an estimated 150,000 people get valley fever, according to the guidelines. About 50,000 cases will result in an illness that needs medical attention, and of these 10,000 to 20,000 cases are diagnosed and reported, the guidelines said. Doctors who misdiagnose the illness may end up prescribing unnecessary antibiotic mediations, which will not treat valley fever.

About 50 to 80 percent of people with valley fever won't need medications for the illness, but they may benefit from physical therapy, and should check in with their doctor to make sure their symptoms aren't getting worse, the guidelines say. People who do need treatment will require prescription antifungal medications.

A new recommendation from the guidelines is that pregnant women with valley fever who are experiencing complications from the illness should take the antifungal medication fluconazole if they are in their second or third trimester of pregnancy. (The medication was previously not recommended because it may be toxic to the fetus in the first trimester, but it appears to be safe in the second and third trimesters.)

The new guidelines were published yesterday (July 28) in the journal Clinical Infectious Disease.

http://www.eurekalert.org/pub_releases/2016-08/yu-yrs072816.php

Yale researchers shed light on evolutionary mystery: Origins of the female orgasm

Female orgasm seems to be a happy afterthought of our evolutionary past when it helped stimulate ovulation, a new study of mammals shows.

The role of female orgasm, which plays no obvious role in human reproduction, has intrigued scholars as far back as Aristotle. Numerous theories have tried to explain the origins of the trait, but most have concentrated on its role in human and primate biology.

Now scientists at Yale and the Cincinnati Children's Hospital have provided fresh insights on the subject by examining the evolving trait across different species. Their study appears Aug. 1 in the journal JEZ-Molecular and Developmental Evolution.

"Prior studies have tended to focus on evidence from human biology and the modification of a trait rather than its evolutionary origin," said Gunter Wagner, the Alison Richard Professor of Ecology and Evolutionary biology, and a member of Yale's Systems Biology Institute.

Instead, Wagner and Mihaela Pavličev of the Center for Prevention of Preterm Birth at Cincinnati Children's Hospital propose that the trait that evolved into human female orgasm had an ancestral function in inducing ovulation.

Since there is no apparent association between orgasm and number of offspring or successful reproduction in humans, the scientists focused on a specific physiological trait that accompanies human female orgasm -- the neuro-endocrine

discharge of prolactin and oxytocin -- and looked for this activity in other placental mammals. They found that in many mammals this reflex plays a role in ovulation.

In spite of the enormous diversity of mammalian reproductive biology, some core characteristics can be traced throughout mammalian evolution, note the researchers. The female ovarian cycle in humans, for instance, is not dependent upon sexual activity. However, in other mammalian species ovulation is induced by males. The scientists' analysis shows male-induced ovulation evolved first and that cyclical or spontaneous ovulation is a derived trait that evolved later.

The scientists suggest that female orgasm may have evolved as an adaptation for a direct reproductive role -- the reflex that, ancestrally, induced ovulation. This reflex became superfluous for reproduction later in evolution, freeing female orgasm for secondary roles.

A comparative study of female genitalia also revealed that, coincidental with the evolution of spontaneous ovulation, the clitoris was relocated from its ancestral position inside the copulatory canal. This anatomical change made it less likely that the clitoris receives adequate stimulation during intercourse to lead to the neuro-endocrine reflex known in humans as orgasm.

"Homologous traits in different species are often difficult to identify, as they can change substantially in the course of evolution," said Pavlicev. "We think the hormonal surge characterizes a trait that we know as female orgasm in humans. This insight enabled us to trace the evolution of the trait across species."

Such evolutionary changes are known to produce new functions, as is well established for feathers, hair, or swim bladders, etc., which originated for one purpose and were coopted into secondary functions later.