http://bit.ly/16SzGsP

Researchers Seek Scapegoat for Lyme Disease's Startling Prevalence

What's to blame?

By Shraddha Chakradhar

The fear of ticks, and of the Lyme disease these bloodsuckers carry, is well founded: roughly 30,000 cases of Lyme are reported to the U.S. Centers for Disease Control and Prevention every year. Because most cases go unreported, the true toll is more like 300,000, the CDC estimated in August. The new figure "confirms that Lyme disease is a tremendous public health problem," Paul Mead, the CDC's chief of Lyme epidemiology and surveillance, said at the time.

As investigators struggle to explain Lyme's prevalence, some have shifted focus from the long-maligned deer that carry adult ticks to a smaller culprit. The white-footed mouse, which hosts immature ticks, is especially efficient at passing the Lyme-causing bacterium Borrelia burgdorferi from one generation of ticks to the next. The mouse is also an opportunist that thrives where other species cannot. As human development fragments forests into smaller patches, white-footed mice increase in density even as other animals disappear. "It is an animal weed," says Felicia Keesing, a professor of biology at Bard College. "Anything that causes a surge in the population of these mice is something to watch." Predator removals can cause just such a surge. A 2012 study found that Lyme incidence in recent decades coincided not with deer abundance but with declines in the population of red foxes, which eat mice and other small mammals.

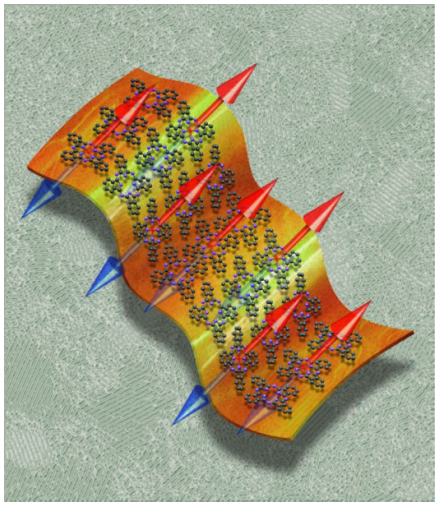
Testing ideas about Lyme in the wild is exceedingly difficult. As a result, some researchers contend that the best protection is a diverse animal population that controls or dilutes the effects of white-footed mice. Others argue that targeting deer, which allow ticks to reproduce, remains the better strategy. In the meantime, as researchers debate the relative importance of the species implicated in Lyme disease, B. burgdorferi is doing just fine.

http://phys.org/news/2013-10-material-quantum-blue.html

New material for quantum computing discovered out of the blue

A common blue pigment used in the £5 note could have an important role to play in the development of a quantum computer, according to a paper published today in the journal Nature.

The pigment, copper phthalocyanine (CuPc), which is similar to the light harvesting section of the chlorophyll molecule, is a low-cost organic semiconductor that is found in many household products. Crucially, it can be processed into a thin film that can be readily used for device fabrication, a significant advantage over similar materials that have been studied previously.



***Phthalocyanine thin film on a flexible plastic substrate, showing the coexistence of long-lived "0" and "1" qubits on the copper spin. The molecules form a regular array together with the metal-free analogues, and the background represents the lattice fringes of the molecular crystals obtained by transmission electron microscopy. Cre*dit: Phil Bushell, Sandrine Heutz and Gabriel Aeppli**

Now, researchers from the London Centre for Nanotechnology at UCL and the University of British Columbia have shown that the electrons in CuPc can remain in 'superposition' – an intrinsically quantum effect where the electron exists in two states at once - for surprisingly long times, showing this simple dye molecule has potential as a medium for quantum technologies.

The development of quantum computing requires precise control of tiny individual "qubits", the quantum analogs of the classical binary bits, '0' and '1', which underpin all of our computation and communications technologies today. What distinguishes the "qubits" from classical bits is their ability to exist in superposition states.

The decay time of such superpositions tells us how useful a candidate qubit could be in quantum technologies. If this time is long, quantum data storage, manipulation and transmission become possible.

Lead author Marc Warner from the London Centre for Nanotechnology, said: "In theory, a quantum computer can easily solve problems that a normal, classical, computer would not be able to answer in the lifetime of the universe. We just don't know how to build one yet.

"Our research shows that a common blue dye has more potential for quantum computing than many of the more exotic molecules that have been considered previously." CuPc possesses many other attributes that could exploit the spin of electrons, rather than their charge, to store and process information which are highly

desirable in a more conventional quantum technology. For example, the pigment strongly absorbs visible light and is easy to modify chemically and physically, so its magnetic and electrical properties can be controlled.
Dr Warner added: "The properties of copper phthalocyanine make it of interest for the emerging field of quantum engineering, which seeks to exploit the quantum properties of matter to perform tasks like information processing or sensing more effectively than has ever been possible."

http://bit.ly/1g6vu12

Is Europa Too Prickly to Land On?

A deadly bed of icy javelins could be awaiting any spacecraft that tries to land on some parts of the ice-covered world Europa, say researchers who have carefully modeled the ice processes at work on parts of the Jovian moon to detect features beyond the current low resolution images.

Oct 27, 2013 07:00 AM ET // by Larry O'Hanlon

If the prediction of long vertical blades of ice is correct, it will not only help engineers design a lander to tame or avoid the sabers, but also help explain a couple of nagging mysteries about the strange moon.
Currently, the very best images of Europa only see 10 meters per pixel, at best, said Daniel Hobley of the University of Colorado. That means that if giant ice daggers do exist, they could still be several meters long and still escape detection.
To learn more, Hobley and his colleagues looked to Chile, where high in the mountains there are peculiar icy features called penitentes that are not found in polar regions.
"Penitentes are very, very sharp blades and spikes of ice," said Hobley. "They are famously well developed in Chile and only develop in the tropics on Earth."

A field of penitentes in Chile -- could the same features on the Jovian moon Europa pose a challenge for surface missions? **ESO**

The reason for the tropical location is that in order to sculpt the blade, the sun's rays must shine down almost vertically throughout the year so the light is always drilling down at the bottom of the crevices, between the blades, rather than the sides of the blades. In contrast, at higher latitudes the sun's angle changes dramatically through even a single season, so that light would shine on the sides of the blades and melt them before they had time to develop to any significant size.
The researchers also predict that penitentes, perhaps up to five meters long, could crowd Europa's surface in a wide band centered on the equator. Beyond that band there might be less hostile features called sun cups.
"Sun cups are amazingly open bowls on snow ice," Hobley explained. "They look like giant thumbprints. They sit next to each other and are a half meter in width, approximately."
Surprisingly, there is already circumstantial evidence that the penitentes might exist on Europa.
Temperature maps of the dark side of Europa have long puzzled scientists because they show a band of unusually cold surface centered on the equator. Penitentes could explain that if they act as cooling fins and speed the cooling of that surface.
Also, radar signals aimed form Earth to Europa and bounced off the surface also show an inexplicable band of poor radar reflection at low latitudes. This could be caused by the baffle-like surfaces of penitentes that are scattering the radar signal, explained Hobley, who is presenting a poster about the work on Oct. 30 at the meeting of the Geological Society of America in Denver.
The new modeling is already a critical factor in the ongoing NASA planning for the exploration of Europa.
"This is a game changer," said planetary scientist Don Blankenship of the University of Texas in Austin.
Blankenship has been involved in NASA's planning process for sending a reconnaissance spacecraft and eventually a lander to Europa. Already the new ice models have spurred changes in the instruments being planned for the Europa Clipper mission, hopefully to launch in November 2021, which will do extensive reconnaissance work to prepare the way for a future Europa lander.
"Clipper is getting a topographic imager with resolution of less than a meter."
That should settle whether there are penitentes, Blankenship said, which directly affects where the future lander would be looking to set down.
Europa is the target of a lander because it shows signs of having a global liquid water ocean beneath its glacial surface and is one of the few places in the solar system that might harbor life.
"This is a big deal," said Blankenship. "Everyone wants this lander to go."

http://bit.ly/17TuJ3e

Lost da Vinci Artwork Unearthed Beneath Paint

Drawings sketched by Leonardo da Vinci are emerging from the walls of an Italian castle, announced restorers working on an elaborate fresco devised by the Renaissance master.

Oct 28, 2013 09:45 AM ET // by Rossella Lorenzi

One of most original paintings of the 15th century, the mural covers the vault and walls of the Sala delle Asse in the Sforza Castle in Milan. It depicts a garden pergola made of 16 mulberry trees bound together by a golden, knotted rope. The trunk of each tree rises as a column supporting 16 half-moon-shaped spaces above a Gothic vault, producing an evocative, fictive grove.

Now restorers might be able to bring to light extra sections of the original work, possibly providing further insights into Da Vinci's vision of the highly symbolic decoration.

A mural on the roof of the Milan castle where Da Vinci work was recently recovered. The mural is made up of 16 mulberry trees bound together by a knotted rope. **Comune di Milano**

The work was commissioned in 1498 by the duke of Milan, Ludovico Maria Sforza, nicknamed il Moro (the Moor) and was executed by Leonardo, who at that time was the court artist, and his assistants.

Experts agree the master's hand can be detected in a monochrome section of the fresco on the northeast and northwest corner of the room. The apparently unfinished work depicts sturdy roots bursting through rocks.

"Large parts of this mural can be recovered beneath several layers of whitewash," the Opificio Pietre Dure (OPD) the Florence based institute who is carrying out the restoration, wrote in a report.

Preliminary analysis produced "quite interesting results," lending hope that the work will recover "important parts of the preparatory drawings," Marco Ciatti, superintendent of the OPD art restoration institute, said.

Leonardo's work in the Sala delle Asse, or Room of the Planks (after the wood panels that lined it) has remained largely unknown. In 1499 Milan was conquered by the French who stormed the castle. In 1706, when Milan was under the Austrian rule, the castle became soldier barracks and the Sala delle Asse was turned into a stable, its walls covered with abundant layers of whitewash.

The arboreal decoration remained hidden beneath up to 13 layers of paint until 1893, when renovations to the castle revealed traces of frescoes. In 1901, amid much criticism, the mural was heavily restored.

Only in 1954, the paint applied during the disastrous restoration was finally removed. But damage to Leonardo's work remained. "The mural is covered by a thick layer of grime. However, our cleaning tests indicate that it can be easily removed. Leonardo's paint won't be damaged in the procedure," the restorers wrote.

Meanwhile, archival research also revealed the room's original name. It was called "Camera dei Moroni" -- a clear allusion to Ludovico il Moro.

Indeed Leonardo's decoration is filled with punning allusions. The mulberry, or Morus tree, refers to the Duke's well known nickname, Il Moro, the Moor. The tree is also a symbol for the Milanese silk industry - mulberries were cultivated in the region as food for the silkworm.

"This restoration is extremely important to fully understand Leonardo's work," Milan culture councillor Filippo Del Corno said. "The project will last two years, ending just in time for the Milan's Expo 2015," he added.

http://phys.org/news/2013-10-world-plastic-devoured-ocean.html

World's plastic devoured by ocean organism

An abundant organism may be acting as a sink for the smallest plastic particles which make up the majority of the ocean's plastic load.

UWA Oceans Institute director Carlos Duarte, along with EWE PhD student Julia Reiser, has been surveying the ocean to uncover the distribution of plastic across the world.

Professor Duarte presented the findings in a public lecture as part of the UWA Inquiring Minds series, showing for the first time a global picture of plastic concentrations in the ocean. "Even though there's been reports of high loads of plastics in particular regions of the ocean, until now we didn't have a really good survey," Prof Duarte said.

The researchers' modelling indicated plastic debris should accumulate in central gyres of the ocean – areas of stagnant water unaffected by currents around coastal areas – but only one, in the Pacific Ocean, had previously been sampled.

"In that gyre, there's a high amount of plastic debris, but we don't really know whether this is true for the other four gyres in the ocean—two in the Pacific, one in the northern and one in the southern hemisphere, two in the Atlantic, and only one in the Indian ocean," Prof Duarte said.

To build a global picture, the Oceans Institute used Neuston samplers, similar to small catamarans, to skim the top 10cm of the ocean and collect samples containing small buoyant plastic particles in collaboration with Ms Reiser surveying the Australian coast, and colleagues in Chile.
The particle concentration in the gyres was 100 to 1000 times greater than in the rest of the ocean.
However, the sampling came up with a "surprisingly small" estimate of the particle debris in the entire ocean.
"We were expecting values in excess of one million tonnes of plastic, and only found between 10 and 30,000 tonnes of plastic," Prof Duarte said.
"This doesn't mean plastic isn't being produced and released, it means plastic is being lost somewhere."
Prof Duarte said the pathways of loss included particles breaking into smaller and smaller pieces due to UV radiation, degradation by bacteria, and abundant organisms called myctophids, or lanternfish, acting as a sink for the particles.


Myctophum punctatum

The fish, which are found in the ocean's gyres, come to the surface to feed at night, where they ingest the plastic particles which resemble the size of their usual prey.
Several samples of the myctophids uncovered significant loads of plastic the size of appropriate particles inside the guts of the animal. "We believe these organisms may hold part of the response to where is the plastic going, because … they are the dominant species in the gyres of the ocean."

http://www.eurekalert.org/pub_releases/2013-10/uowo-nir102813.php

New imaging research shows increased iron in the brain in earliest stages of MS

Iron deposits in deep gray matter, suggest the accumulation occurs very early in the course of Muscular Sclerosis

While it's been known for over a century that iron deposits in the brain play a role in the pathology of Multiple Sclerosis (MS), new imaging research from Western University (London, Canada) helps to answer the question of whether these accumulations are a cause or consequence of the disease. The study led by Ravi Menon, PhD, of the Robarts Research Institute found iron deposits in deep gray matter, suggesting the accumulation occurs very early in the disease course.
The researchers also found evidence casting further doubt on the controversial liberation therapy for MS. The research is in early publication online in Multiple Sclerosis and Related Disorders.
Menon and PhD candidate Matthew Quinn used 3-Tesla Magnetic Resonance Imaging (MRI) to scan 22 patients with clinically isolated syndrome (CIS). These are patients who've had a single clinical attack, at least half of whom will go on to be diagnosed with MS. The others may have a different disease. Sixteen age and sex matched controls were also studied.
"We wanted to know if the iron deposits happen early in the process, or whether it's something that accumulates with time as the disease progresses," says Menon, who holds a Canada Research Chair in Functional Magnetic Imaging.
"We also studied the veins that drain from the brain and looked for a correlation between the diameter of these veins and iron accumulation. One of the reasons to do this, of course was the hypothesis proposed by Paolo Zamboni that if you had narrow jugular veins, this would give rise to additional iron and in turn cause MS."
The scientists found iron deposits in the CIS group were well above the amounts found in the control group.
The MRIs also revealed for the first time, subtle damage to the brain's white matter even at this early stage.
The researchers also found no correlation between the iron deposits and diameter of the veins.
"So while the iron in the brain correlates with the disability of the subjects, the iron in the brain does not correlate with the actual diameter of the jugular veins. So the Zamboni hypothesis is incorrect as far as the iron being related to some kind of obstruction."
Menon found narrowed veins in the control group as well as the CIS group, and both groups had narrower veins on one side compared to the other.
Menon hopes this imaging research will lead to the earlier diagnosis of MS. He plans to follow the patients every four months for the next two years, to see retrospectively, what characterizes those patients that go on to be diagnosed with MS compared to those who do not.
"We're looking at a couple of different approaches to diagnostics using this imaging research. In suspected MS cases –the very first time they appear in clinic, if they have an abnormally high amount of iron in the frontal cortex of the brain –that's probably a pretty good sign they have MS or some other white matter disease."
This research was funded primarily by the Canadian Institutes of Health Research.
MS is the most common neurological disease affecting young adults, with symptoms that include loss of balance, impaired speech, double vision, extreme fatigue and paralysis.

http://phys.org/news/2013-10-metamaterial-lens-ten-power.html

A new way of seeing: Metamaterial lens has ten times more power

A lens with ten times the resolution of any current lens, making it a powerful new tool for the biological sciences has been developed by researchers at the University of Sydney.

Phys.org - "This advance means we can unlock previously inaccessible information on the structure of molecules, their chemical make-up and the presence of certain proteins," said Alessandro Tuniz, lead author of an article on the lens published in Nature Communications today.

Tuniz, a postdoctoral associate at the University, said, "This opens up an entirely new tool for biological studies. It could allow earlier skin cancer diagnosis, because smaller melanomas can be recognised. For breast cancer, it can also be used to more accurately check that all traces of a tumour have been cut out during surgery."

The four member research team from the University's School of Physics, including Alessandro Tuniz, are all authors on the paper. They created the lens using fibre optic manufacturing technology.

The lens is a metamaterial - a material with completely new properties not found in nature.

Making the lens was not a matter of making a better form of the lenses already in existence but of making a lens which uses light waves in a way not previously possible.

"Creating metamaterials is a cutting-edge area of science with a massive range of potential uses from aerospace to solar power, telecommunications to defence," said researcher Dr Boris Kuhlmey.

"The major challenge is making these materials on a scale that is useful. This is one of the first times a metamaterial with a real world application, quickly able to be realised, has been feasible. Within the next two to three years, new terahertz microscopes that are ten times more powerful than current ones will be possible using our metamaterial.

"We know of only two or three other cases worldwide, including for wireless internet and MRI applications, where metamaterials could also be put into practice in the next couple of years."

The potential to create a new high power lens, able to see much finer details than using conventional lenses was spotted almost a decade ago. It has taken until now to make the lens on a useful scale, a thousand times smaller than the early experimental models.

"The difficulty was making large quantities of matter structured on a micrometric scale," said Alessandro Tuniz.

The new lens, made of plastic and metal, uses terahertz waves, electromagnetic waves with frequencies higher than microwaves but lower than infrared radiation and visible light. It operates in a region of the spectrum where very few other optical tools are available and all of them have limitations, in particular in terms of resolution.

"If we think of this in comparison to an X-ray which allows us to see inside objects at a high resolution but with associated danger from radiation, by contrast our metamaterial lens allows us not only to see through some opaque materials, but also to gather information on their chemical composition, and even information on interaction between certain molecules, without the danger of X-rays," Tuniz said. This means the lens is perfectly suited to analysing the delivery of drugs to cells, which is crucial to medical research.

More information: www.nature.com/ncomms/2013/131028/ncomms3706/full/ncomms3706.html

http://bit.ly/19iX6eR

Night Light Color Could Be Attitude Adjuster

The light you're exposed to at night from gadgets may influence mood, and the light's color could be a determining factor. Allie Wilkinson reports

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Our homes glow at night. Light bulbs, TVs, and now computers, e-readers, tablets and smartphones expose people to an increasing amount of light after dark. And the color of that light may influence mood and brain function. That's according to a study in the Journal of Neuroscience. [Tracy A. Bedrosian et al., Nocturnal Light Exposure Impairs Affective Responses in a Wavelength-Dependent Manner]

Researchers looked at the role of specialized photosensitive cells in the retina. The cells, called ipRGCs, are responsible for regulating circadian rhythms. And recent evidence suggests these cells may also play a role in mood and cognition.

To test how nocturnal lighting color affects mood, the researchers exposed hamsters to nighttime conditions of no light, red light, white light or blue light for four weeks each. Hamsters exposed to red light at night had the fewest brain changes associated with depression in humans, while blue and white light had the worst effects on mood.

So late-night work e-mail may not be the only thing ticking you off—the blue glow of your machine may also be getting you down. The best bet: shut down and get some shut-eye.

http://www.eurekalert.org/pub_releases/2013-10/uoc--sot102813.php

Snakes on the brain: Are primates hard-wired to see snakes?

Was the evolution of high-quality vision in our ancestors driven by the threat of snakes?

Work by neuroscientists in Japan and Brazil is supporting the theory originally put forward by Lynne Isbell, professor of anthropology at the University of California, Davis.

In a paper published Oct. 28 in the journal Proceedings of the National Academy of Sciences, Isbell; Hisao Nishijo and Quan Van Le at Toyama University, Japan; and Rafael Maior and Carlos Tomaz at the University of Brasilia, Brazil; and colleagues show that there are specific nerve cells in the brains of rhesus macaque monkeys that respond to images of snakes.

The snake-sensitive neurons were more numerous, and responded more strongly and rapidly, than other nerve cells that fired in response to images of macaque faces or hands, or to geometric shapes. Isbell said she was surprised that more neurons responded to snakes than to faces, given that primates are highly social animals.

"We're finding results consistent with the idea that snakes have exerted strong selective pressure on primates," Isbell said.

Isbell originally published her hypothesis in 2006, following up with a book, "The Fruit, the Tree and the Serpent" (Harvard University Press, 2009) in which she argued that our primate ancestors evolved good, close-range vision primarily to spot and avoid dangerous snakes.

Modern mammals and snakes big enough to eat them evolved at about the same time, 100 million years ago. Venomous snakes are thought to have appeared about 60 million years ago - "ambush predators" that have shared the trees and grasslands with primates.

Nishijo's laboratory studies the neural mechanisms responsible for emotion and fear in rhesus macaque monkeys, especially instinctive responses that occur without learning or memory. Previous researchers have used snakes to provoke fear in monkeys, he noted. When Nishijo heard of Isbell's theory, he thought it might explain why monkeys are so afraid of snakes.

"The results show that the brain has special neural circuits to detect snakes, and this suggests that the neural circuits to detect snakes have been genetically encoded," Nishijo said. The monkeys tested in the experiment were reared in a walled colony and neither had previously encountered a real snake.

"I don't see another way to explain the sensitivity of these neurons to snakes except through an evolutionary path," Isbell said.

Isbell said she's pleased to be able to collaborate with neuroscientists. "I don't do neuroscience and they don't do evolution, but we can put our brains together and I think it brings a wider perspective to neuroscience and new insights for evolution," she said.

Other co-authors on the paper were: Jumpei Matsumoto, Minh Nguyen, Etsuro Hori, Anh Hai Tran and Taketoshi Ono at Toyama University. The work is an international collaboration under the Asian Core Program of the Japan Society for the Promotion of Science.

http://www.bbc.co.uk/news/health-24710089

Gardening 'linked to longer lives'

Pottering around the garden or fixing up the house has been linked to a longer life in a study of people over the age of 60.

By James Gallagher Health and science reporter, BBC News

Older people can struggle to exercise vigorously, but the study said simply getting off the sofa and avoiding a sedentary lifestyle was a lifesaver. The Swedish study of 4,232 people suggested the risks of heart attack and stroke were cut. The findings were published in the British Journal of Sports Medicine.

The researchers at the Karolinska University Hospital in Stockholm, said elderly people tended to spend more time being sedentary and less time exercising than people in other age groups. So they looked at the activity levels in-between sitting down and full-on exercise - such as fixing up the car, home repairs, cutting the lawn, blackberry picking or going hunting.

Longer life

The results showed that people who were more active on a daily basis had the lowest risk of a heart attack, but those who were merely active without exercising still had a lower risk than those doing nothing. Being active reduced the risk of a heart attack or stroke by 27%, and death from any cause by 30%, during the 12-year study.

The report said: "A generally active daily life had important beneficial associations with cardiovascular health and longevity in older adults, which seemed to be regardless of regular exercise." It said the findings had "high clinical relevance" for older people, who risked spending a lot of time on the sofa or lying in bed.

The scientists involved suggest that sitting for long periods of time may lower people's metabolic rate, or a lack of activity may alter hormones produced in muscle tissue. These could then have knock-on effects for overall health.

'On your feet'

Dr Tim Chico, honorary consultant cardiologist at Sheffield Teaching Hospitals, said: "Although this study only examined people aged 60, it is reasonable to assume that the more active someone is throughout their life, the lower their risk of cardiovascular disease.

"The message I take from this study is simple. If you want to reduce your risk of heart disease, be more active. Don't sit down for long periods; get up on your feet and do something you enjoy that involves moving around."

Christopher Allen, Senior Cardiac Nurse at the British Heart Foundation, said: "Being physically active is important in maintaining good heart health. But, as this study demonstrates, you don't need a gym membership to do that.

"As long as they make you feel warmer, breathe harder and make your heart beat faster, activities such as DIY and gardening count towards the 150 minutes of moderate-intensity [weekly] activity recommended for a healthy lifestyle."

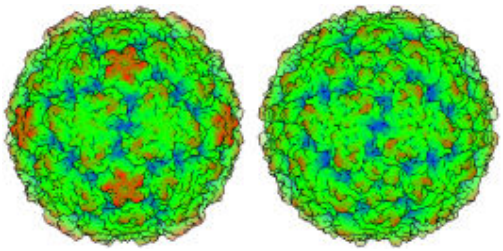
http://www.eurekalert.org/pub_releases/2013-10/uow-mvs102813.php

Model virus structure shows why there's no cure for common cold

In a pair of landmark studies that exploit the genetic sequencing of the "missing link" cold virus, rhinovirus C, scientists at the University of Wisconsin-Madison have constructed a three-dimensional model of the pathogen that shows why there is no cure yet for the common cold.

MADISON, Wis. –Writing today (Oct. 28, 2013) in the journal Virology, a team led by UW-Madison biochemistry Professor Ann Palmenberg provides a meticulous topographical model of the capsid or protein shell of a cold virus that until 2006 was unknown to science.

Rhinovirus C is believed to be responsible for up to half of all childhood colds, and is a serious complicating factor for respiratory conditions such as asthma. Together with rhinoviruses A and B, the recently discovered virus is responsible for millions of illnesses yearly at an estimated annual cost of more than $40 billion in the United States alone.



Two faces of the common cold. The protein coat of the "missing link" cold virus, Rhinovirus C (right), has significant differences from the more observable and better studied Rhinovirus A. Those surface differences, revealed in a new three-dimensional model of Rhinovirus C from the UW–Madison lab of Ann C. Palmenberg, explain why no effective drugs have yet been devised to thwart the common cold.

The work is important because it sculpts a highly detailed structural model of the virus, showing that the protein shell of the virus is distinct from those of other strains of cold viruses. "The question we sought to answer was how is it different and what can we do about it? We found it is indeed quite different," says Palmenberg, noting that the new structure "explains most of the previous failures of drug trials against rhinovirus."

The A and B families of cold virus, including their three-dimensional structures, have long been known to science as they can easily be grown and studied in the lab. Rhinovirus C, on the other hand, resists culturing and escaped notice entirely until 2006 when "gene chips" and advanced gene sequencing revealed the virus had long been lurking in human cells alongside the more observable A and B virus strains.

The new cold virus model was built "in silico," drawing on advanced bioinformatics and the genetic sequences of 500 rhinovirus C genomes, which provided the three-dimensional coordinates of the viral capsid.

"It's a very high-resolution model," notes Palmenberg, whose group along with a team from the University of Maryland was the first to map the genomes for all known common cold virus strains in 2009. "We can see that it fits the data."

With a structure in hand, the likelihood that drugs can be designed to effectively thwart colds may be in the offing. Drugs that work well against the A and B strains of cold virus have been developed and advanced to clinical trials. However, their efficacy was blunted because they were built to take advantage of the surface features of the better known strains, whose structures were resolved years ago through X-ray crystallography, a well-established technique for obtaining the structures of critical molecules.

Because all three cold virus strains all contribute to the common cold, drug candidates failed as the surface features that permit rhinovirus C to dock with host cells and evade the immune system were unknown and different from those of rhinovirus A and B.

Based on the new structure, "we predict you'll have to make a C-specific drug," explains Holly A. Basta, the lead author of the study and a graduate student working with Palmenberg in the UW-Madison Institute for Molecular Virology. "All the [existing] drugs we tested did not work."
Antiviral drugs work by attaching to and modifying surface features of the virus. To be effective, a drug, like the right piece of a jigsaw puzzle, must fit and lock into the virus. The lack of a three-dimensional structure for rhinovirus C meant that the pharmaceutical companies designing cold-thwarting drugs were flying blind.
"It has a different receptor and a different receptor-binding platform," Palmenberg explains. "Because it's different, we have to go after it in a different way."
In addition to Basta and Palmenberg, co-authors of the new studies include Jean-Yves Sgro, Shamaila Ashraf, Yury Bochkov and James E. Gern, all of UW-Madison.

http://arstechnica.com/science/2013/10/chemists-find-biological-complexes-that-beat-chance/

Chemists find biological complexes that beat chance

A mixture that shouldn't be biologically active forms functional complexes.

by Andrew Bissette, The Conversation Oct 28 2013, 8:00am TST

How life originated from an inanimate set of chemicals is still a mystery.
While we may never be certain about precisely which chemicals existed on prebiotic Earth, we can study the biomolecules we have today to give us clues about what happened three billion years ago.
Now, scientists have used a set of modern biomolecules to show that the formation of larger, more complex groupings of molecules may be inherently favored.
They found that when components of the molecular machines that exist in living cells today are mixed with membrane material, functional complexes form more often than you'd expect from chance.
As of now, we don't know how this form of self-organization takes place.
Figuring it out may help us understand life's origins on Earth and perhaps how it might form on other planets.
The 1987 Nobel Prize in Chemistry was given to chemists for building complex molecules that could bind very specifically to other atoms and chemicals.
In the right combinations, these molecules can self-organize, forming a molecular complex that can be capable of even more complicated tasks.
Each living cell is full of molecular machines, formed, in part, by their ability to self-organize.
Pasquale Stano at the University of Roma Tre and his colleagues were interested in using this knowledge to probe the origins of life. To make things simple, they chose an assembly that produces proteins.
This assembly consists of 83 different molecules, including an RNA that encoded a special green fluorescent protein (GFP) that could be used to identify places where complexes formed successfully.
The assembly can only produce proteins when all of its molecules are close enough together to interact with each other.
When the assembly is diluted with water, no GFP gets made.
(This is one reason that the insides of living cells are very crowded: it allows the chemistry of life to work.)
In order to recreate this molecular crowding, Stano added a chemical called POPC to the dilute solution.
Fatty molecules such as POPC do not mix with water, and when placed into water they spontaneously form small, spherical bodies called liposomes. Liposomes have a very similar structure to the membranes of living cells and are widely used to study the evolution of cells.
Stano reports in the journal Angewandte Chemie that many of these liposomes trapped some of the other molecules present in the mixture.
But remarkably, five in every 1,000 of them had all 83 of the molecules needed to produce a protein.
These liposomes ended up filled with GFP and glowed green under a microscope.
Computer calculations reveal that, by chance, five liposomes in 1,000 could not have trapped all 83 molecules of the assembly—they calculated the possibility of forming even one such liposome essentially zero.
The fact that any GFP was produced means something quite unexpected is happening.
Stano and his colleagues do not yet understand why the formation of complexes was favored.
It may be that these particular molecules are suited to this kind of self-organization because they are already highly evolved to interact.
An important next step is to see if similar, but less complex, molecules are also capable of this feat.
Regardless of the limitations, Stano's experiment has shown for the first time that self-assembly into simple cells may be an inevitable physical process.
Finding out how exactly this self-assembly happens could mean taking a big step towards understanding how life was formed. **The Conversation**

Angewandte Chemie, 2013. DOI: 10.1002/anie.201306613 (About DOIs).

http://www.eurekalert.org/pub_releases/2013-10/ca-bca103013.php

Bats confirmed as SARS origin

A team of international scientists has isolated a very close relative of the Severe Acute Respiratory Syndrome coronavirus (SARS-CoV) from horseshoe bats in China, confirming them as the origin of the virus responsible for the 2002-3 pandemic.

The SARS-CoV pandemic killed 774 people of the 8094 people infected, a case fatality ratio of almost 10 per cent. With cases diagnosed across the world, the pandemic had an impact on international travel and trade.

The research team, led by Professor Shi Zhengli from Wuhan Institute of Virology, Chinese Academy of Sciences and including CSIRO and Duke-NUS scientist Professor Linfa Wang, have just had their breakthrough results published in Nature.

While researchers globally have previously used genetic sequencing to demonstrate that bats are the natural reservoirs of SARS-like CoVs, this is the first time that live virus has been successfully isolated from bats to definitively confirm them as the origin of the virus.

The team successfully isolated a SARS-like CoV, named SL-CoV WIV1, directly from faecal samples of Chinese Horseshoe bats using the world renowned bat virus isolation methodology developed by scientists at CSIRO's Australian Animal Health Laboratory in Geelong.

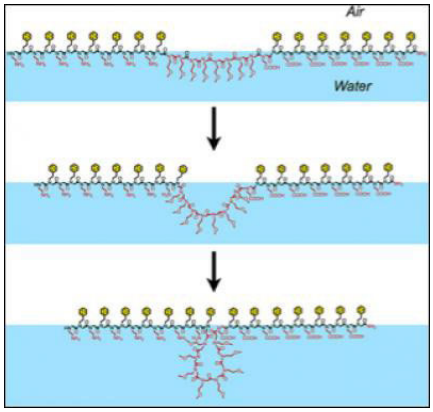
The results will help governments design more effective prevention strategies for SARS and similar epidemics. Horseshoe bats are found around the world, including Australia and play an important ecological role. Their role in SARS-CoV transmission highlights the importance of protecting the bat's natural environment so they are not forced into highly populated urban areas in search of food.

http://scitechdaily.com/researchers-develop-peptoid-nanosheets-mimic-natural-antibodies/

Researchers Develop Peptoid Nanosheets that Mimic Natural Antibodies

Taking inspiration from the human immune system, researchers at the U.S. Department of Energy's Lawrence Berkeley National Laboratory (Berkeley Lab) have created a new material that can be programmed to identify an endless variety of molecules.

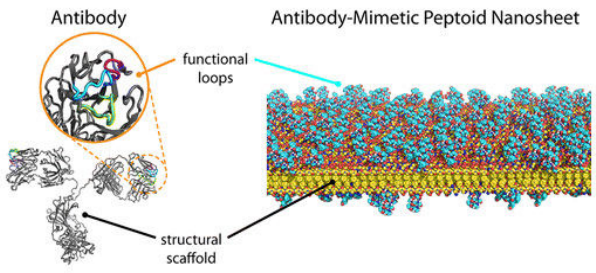
The new material resembles tiny sheets of Velcro, each just one-hundred nanometers across. But instead of securing your sneakers, this molecular Velcro mimics the way natural antibodies recognize viruses and toxins, and could lead to a new class of biosensors.



"Antibodies have a really effective architectural design: a structural scaffold that pretty much stays the same, whether it's for snake venom or the common cold, and endlessly variable functional loops that bind foreign invaders," says Ron Zuckermann, a senior scientist at Berkeley Lab's Molecular Foundry. "We've mimicked that here, with a two-dimensional nanosheet scaffold covered with little functional loops like Velcro." Zuckermann, Director of the Molecular Foundry's Biological Nanostructures Facility, is corresponding author on a paper reporting these results in ACS Nano, titled "Antibody-Mimetic Peptoid Nanosheets for Molecular Recognition." Coauthoring the paper are Gloria K. Olivier, Andrew Cho, Babak Sanii, Michael D. Connolly, and Helen Tran.

Long organic molecules called peptoids self-assemble into a molecular film on the surface of a water solution. As this film gets folded into a nanosheet, segments of the peptoid get pushed out into loops, which eventually decorate the surface of the nanosheet. Credit: Berkeley Lab

Zuckermann's nanosheet scaffolds are self-assembled from peptoids – synthetic, bio-inspired polymers capable of folding into protein-like architectures. Like beads on a string, each peptoid molecule is a long chain of small molecular units arranged in a specific pattern. In earlier work, Zuckermann showed how certain simple peptoids can fold themselves into nanosheets just a few nanometers thick but up to one-hundred micrometers across – dimensions equivalent to a one-millimeter-thick plastic sheet the size of a football field.



Antibody-inspired "molecular Velcro" designed at Berkeley Lab could lead to a new class of biosensors. Researchers took cues from the architecture of a natural antibody (left) in designing a new material that resembles tiny sheets of Velcro (right). Credit: Berkeley Lab

"The reason that nanosheets form is because there's a code for it programmed directly into the peptoids," says Zuckermann. "In this case it's admittedly a pretty rudimentary program, but it shows how if you bring in just a little bit of sequence information: Boom! You can make a nanosheet."
To create functional loops on the nanosheets, the researchers insert short molecular segments into nanosheet-forming peptoid polymers. As the peptoids knit themselves together into sheets, the inserted segments are excluded from the fold, pushed out instead into loops upon the nanosheet surface. The functional loops can be programmed to selectively bind certain enzymes or inorganic materials, which makes the new material promising for chemical sensing and catalysis.
"The advantage here is that we're able to make these materials in very high yield," says Gloria Olivier, a postdoctoral researcher and lead author on the paper. "We're borrowing this idea of stringing together a particular sequence of monomers, which Nature uses to build 3D protein structures, and applying it to the world of non-natural materials, to create a really useful material that can assemble itself."
The researchers demonstrated the flexibility of their method by creating nanosheets with loops of varying composition, length, and density; they made nanosheets that can pick specific enzymes out of a solution, causing chemical changes that can be detected with standard techniques, and others that bind selectively to gold metal, seeding the growth of gold nanoparticles and films.
"Peptoids can withstand much harsher conditions than peptides, their counterpart in nature," says Olivier. "So if you wanted to build a diagnostic device that can be taken outside of a laboratory, or a device that can screen for biomarkers in the presence of a mixture of proteins like proteases, peptoids are an excellent choice."
Looking beyond the exciting applications, Zuckermann points out that this work represents an important step toward extending the rules of protein folding to the world of synthetic materials.
Says Zuckermann, "That's kind of what my whole research program here is about: learning from the richness of chemical sequence information found in biology to create new types of advanced synthetic materials. We're really just starting to scratch the surface."
This research was funded by the DOE Office of Science and the Defense Threat Reduction Agency. The work was conducted at the Molecular Foundry with support from the Advanced Light Source, and at the Advanced Photon Source at Argonne National Laboratory.
***Publication**: Gloria K. Olivier, et al., "Antibody-Mimetic Peptoid Nanosheets for Molecular Recognition," ACS Nano, 2013, 7 (10), pp 9276–9286; DOI: 10.1021/nn403899y Source: Lawrence Berkeley National Laboratory*

http://www.bbc.co.uk/news/health-24745611

HIV antibodies 'have potent impact'

A potential new HIV treatment has a "profound and unprecedented" impact on the virus, according to animal studies published in the journal Nature.

By James Gallagher Health and science reporter, BBC News

Potent antibodies were able to wipe a hybrid of human and monkey immunodeficiency viruses from the bloodstream of monkeys within days. The findings could "revolutionise" the search for an HIV cure, say experts. The US researchers said trials in patients with HIV now needed to take place.
The immune system produces precisely targeted antibodies to take out HIV, but the virus is able to rapidly mutate to evade the immune assault. However, some antibodies have been discovered that target the "conserved" parts of HIV - those that the virus struggles to change because they are vital for it to function.

'Undetectable'

Two groups, from Harvard Medical School and the National Institute of Allergy and Infectious Diseases, performed the first trials of these antibodies. They used rhesus macaques that had been infected with simian-human immunodeficiency virus (SHIV), a blend of HIV and the monkey equivalent. Data from the Harvard team showed that injection of the antibodies drove SHIV from the bloodstream until it reached undetectable levels after three to seven days. The effect lasted for one to three months, but in three monkeys the virus did not return to the blood during the 250-day study.
Prof Dan Barouch told the BBC: "The effect with these potent antibodies is profound and unprecedented. It's probably as large an antiviral therapeutic effect as has ever been seen. "But we have to make sure we don't overhype and the limitation is the study is in animals, not humans." The antibodies were also able to attack the virus in some tissues. Drugs can assault the virus in the blood during normal HIV treatment, but the virus can hide in other parts of the body. These early findings raise the prospect of using antibodies to clear these tissues as well. Similar results were produced by the team at the National Institute of Allergy and Infectious Diseases

'Revolutionise'

HIV infection is incurable, although taking a daily dose of medication can keep the virus in check, giving patients a near-normal life expectancy.

The antibodies will be tested in human clinical trials and if successful they could be used alongside antiretroviral drugs as a treatment. It may also be possible to devise a vaccine that could train the immune system to produce these antibodies. However, both these ideas are dependent on human trials being successful. Commenting on the findings, Prof Louis Picker and Prof Steven Deeks said: "The findings of these two papers could revolutionise efforts to cure HIV." However, they warned that HIV was so prone to mutation that it was "likely that some people will harbour viruses that are resistant to one or more" of the antibodies.

http://www.eurekalert.org/pub_releases/2013-10/nsfc-ssp103113.php

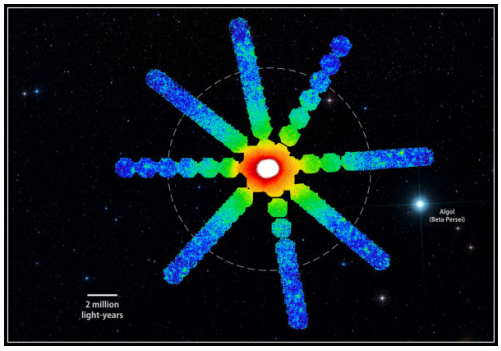
Suzaku study points to early cosmic 'seeding'

Most of the universe's heavy elements, including the iron central to life itself, formed early in cosmic history and spread throughout the universe, according to a new study of the Perseus Galaxy Cluster using Japan's Suzaku satellite.

Between 2009 and 2011, researchers from the Kavli Institute for Particle Astrophysics and Cosmology (KIPAC), jointly run by Stanford University and the Department of Energy's SLAC National Accelerator Laboratory in California, used Suzaku's unique capabilities to map the distribution of iron throughout the Perseus Galaxy Cluster.

What they found is remarkable: Across the cluster, which spans more than 11 million light-years of space, the concentration of X-ray-emitting iron is essentially uniform in all directions.

"This tells us that the iron -- and by extension other heavy elements -- already was widely dispersed throughout the universe when the cluster began to form," said KIPAC astrophysicist Norbert Werner, the study's lead researcher. "We conclude that any explanation of how this happened demands lead roles for supernova explosions and active black holes."



Suzaku explored faint X-ray emission along eight different directions in the Perseus Galaxy Cluster, shown here in false color. Bluer colors indicate fainter X-ray emission. The dashed circle marks the cluster's effective boundary, where new gas is now entering, and is 2.7 degrees wide. **NASA/ISAS/DSS/O. Urban et al., MNRAS**

The most profligate iron producers are type Ia supernovae, which occur either when white dwarf stars merge or otherwise acquire so much mass that they become unstable and explode. According to the Suzaku observations, the total amount of iron contained in the gas filling the cluster amounts to 50 billion times the mass of our sun, with about 60 percent of that found in the cluster's outer half.

The team estimates that at least 40 billion type Ia supernovae contributed to the chemical "seeding" of the space that later became the Perseus Galaxy Cluster.

Making the iron is one thing, while distributing it evenly throughout the region where the cluster formed is quite another. The researchers suggest that everything came together during one specific period of cosmic history.

Between about 10 and 12 billion years ago, the universe was forming stars as fast as it ever has. Abundant supernovae accompany periods of intense star formation, and the rapid-fire explosions drove galaxy-scale outflows. At the same time, supermassive black holes at the centers of galaxies were at their most active, rapidly accreting gas and releasing large amounts of energy, some of which drove powerful jets. Together, these galactic "winds" blew the chemical products of supernovae out of their host galaxies and into the wider cosmos.

Sometime later, in the regions of space with the largest matter densities, galaxy clusters formed, scooping up and mixing together the cosmic debris from regions millions of light-years across.

"If our scenario is correct, then essentially all galaxy clusters with masses similar to the Perseus Cluster should show similar iron concentrations and smooth distributions far from the center," said co-author Ondrej Urban, also at KIPAC.

Galaxy clusters contain hundreds to thousands of galaxies, as well as enormous quantities of diffuse gas and dark matter, bound together by their collective gravitational pull.

New gas entering the cluster falls toward its center, eventually moving fast enough to generate shock waves that heat the infalling gas. In the Perseus Cluster, gas temperatures reach as high as 180 million degrees Fahrenheit (100 million C), so hot that the atoms are almost completely stripped of their electrons and emit X-rays.

The Perseus Galaxy Cluster, which is located about 250 million light-years away and named for its host constellation, is the brightest extended X-ray source beyond our own galaxy, and the brightest and closest cluster for which Suzaku has attempted to map outlying gas.

The team used Suzaku's X-ray telescopes to make 84 observations of the Perseus Cluster, resulting in radial maps along eight different directions. Thanks to the sensitivity of the spacecraft's instruments, the researchers could measure the iron distribution of faint gas in the cluster's outermost reaches, where new gas continues to fall into it.

The findings will be published in the Oct. 31 issue of the journal Nature.

Suzaku (Japanese for "red bird of the south") was launched as Astro-E2 on July 10, 2005, and renamed in orbit. The observatory was developed by the Japan Aerospace Exploration Agency's Institute of Space and Astronautical Science in collaboration with NASA and other Japanese and U.S. institutions. NASA Goddard supplied Suzaku's X-ray telescopes and data-processing software and continues to operate a facility that supports U.S. astronomers who use the spacecraft.

http://www.eurekalert.org/pub_releases/2013-10/uoc-pi103113.php

Patient in 'vegetative state' not just aware, but paying attention

Research raises possibility of devices in the future to help some patients in a vegetative state interact with the outside world

A patient in a seemingly vegetative state, unable to move or speak, showed signs of attentive awareness that had not been detected before, a new study reveals. This patient was able to focus on words signalled by the experimenters as auditory targets as successfully as healthy individuals. If this ability can be developed consistently in certain patients who are vegetative, it could open the door to specialised devices in the future and enable them to interact with the outside world.

The research, by scientists at the Medical Research Council Cognition and Brain Sciences Unit (MRC CBSU) and the University of Cambridge, is published today, 31 October, in the journal Neuroimage: Clinical.

For the study, the researchers used electroencephalography (EEG), which non-invasively measures the electrical activity over the scalp, to test 21 patients diagnosed as vegetative or minimally conscious, and eight healthy volunteers. Participants heard a series of different words - one word a second over 90 seconds at a time - while asked to alternatingly attend to either the word 'yes' or the word 'no', each of which appeared 15% of the time. (Some examples of the words used include moss, moth, worm and toad.) This was repeated several times over a period of 30 minutes to detect whether the patients were able to attend to the correct target word.

They found that one of the vegetative patients was able to filter out unimportant information and home in on relevant words they were being asked to pay attention to. Using brain imaging (fMRI), the scientists also discovered that this patient could follow simple commands to imagine playing tennis. They also found that three other minimally conscious patients reacted to novel but irrelevant words, but were unable to selectively pay attention to the target word.

These findings suggest that some patients in a vegetative or minimally conscious state might in fact be able to direct attention to the sounds in the world around them.

Dr Srivas Chennu at the University of Cambridge, said: "Not only did we find the patient had the ability to pay attention, we also found independent evidence of their ability to follow commands – information which could enable the development of future technology to help patients in a vegetative state communicate with the outside world.

"In order to try and assess the true level of brain function and awareness that survives in the vegetative and minimally conscious states, we are progressively building up a fuller picture of the sensory, perceptual and cognitive abilities in patients. This study has added a key piece to that puzzle, and provided a tremendous amount of insight into the ability of these patients to pay attention."

Dr Tristan Bekinschtein at the MRC Cognition and Brain Sciences Unit said: "Our attention can be drawn to something by its strangeness or novelty, or we can consciously decide to pay attention to it. A lot of cognitive neuroscience research tells us that we have distinct patterns in the brain for both forms of attention, which we can measure even when the individual is unable to speak. These findings mean that, in certain cases of individuals who are vegetative, we might be able to enhance this ability and improve their level of communication with the outside world."

This study builds on a joint programme of research at the University of Cambridge and MRC CBSU where a team of researchers have been developing a series of diagnostic and prognostic tools based on brain imaging techniques since 1998. Famously, in 2006 the group was able to use fMRI imaging techniques to establish that a patient in a vegetative state could respond to yes or no questions by indicating different, distinct patterns of brain activity.

*The paper, 'Dissociable Endogenous and Exogenous Attention in Disorders of Consciousness', is published online in the journal Neuroimage: Clinical.*Please note that it is the final proof of the paper published on 31 October 2013. Any previous versions were uncorrected proofs.*

http://www.eurekalert.org/pub_releases/2013-10/cp-dka102413.php

Dogs know a left-sided wag from a right

You might think a wagging tail is a wagging tail, but for dogs there is more to it than that.

Dogs recognize and respond differently when their fellow canines wag to the right than they do when they wag to the left. The findings reported in the Cell Press journal Current Biology on October 31 show that dogs, like humans, have asymmetrically organized brains, with the left and right sides playing different roles.

The discovery follows earlier work by the same Italian research team, which found that dogs wag to the right when they feel positive emotions (upon seeing their owners, for instance) and to the left when they feel negative emotions (upon seeing an unfriendly dog, for example). That biased tail-wagging behavior reflects what is happening in the dogs' brains. Left-brain activation produces a wag to the right, and right-brain activation produces a wag to the left.

But does that tail-wagging difference mean something to other dogs? Yes it does, the new study shows. While monitoring their reactions, the researchers showed dogs videos of other dogs with either left- or right-asymmetric tail wagging. When dogs saw another dog wagging to the left, their heart rates picked up and they began to look anxious. When dogs saw another dog wagging to the right, they stayed perfectly relaxed.

"The direction of tail wagging does in fact matter, and it matters in a way that matches hemispheric activation," says Giorgio Vallortigara of the Center for Mind/Brain Sciences of the University of Trento. "In other words, a dog looking to a dog wagging with a bias to the right side—and thus showing left-hemisphere activation as if it was experiencing some sort of positive/approach response—would also produce relaxed responses. In contrast, a dog looking to a dog wagging with a bias to the left—and thus showing right-hemisphere activation as if it was experiencing some sort of negative/withdrawal response—would also produce anxious and targeting responses as well as increased cardiac frequency. That is amazing, I think."

Vallortigara doesn't think that the dogs are necessarily intending to communicate those emotions to other dogs. Rather, he says, the bias in tail wagging is likely the automatic byproduct of differential activation of the left versus the right side of the brain. But that's not to say that the bias in wagging and its response might not find practical uses; veterinarians and dog owners might do well to take note.

"It could be that left/right directions of approach could be effectively used by vets during visits of the animals or that dummies could be used to exploit asymmetries of emotional responses," Vallortigara says.

Current Biology, Siniscalchi et al.: "Seeing left or right asymmetric tail wagging produces different emotional responses in dogs."

http://www.sciencedaily.com/releases/2013/10/131031090431.htm

Seeing in the Dark: Most People Can See Their Body's Movement in the Absence of Light

At least 50 percent of people can see the movement of their own hand in the absence of all

Find a space with total darkness and slowly move your hand from side to side in front of your face. What do you see?

If the answer is a shadowy shape moving past, you are probably not imagining things. With the help of computerized eye trackers, a new cognitive science study finds that at least 50 percent of people can see the movement of their own hand even in the absence of all light.

"Seeing in total darkness? According to the current understanding of natural vision, that just doesn't happen," says Duje Tadin, a professor of brain and cognitive sciences at the University of Rochester who led the investigation. "But this research shows that our own movements transmit sensory signals that also can create real visual perceptions in the brain, even in the complete absence of optical input."

Through five separate experiments involving 129 individuals, the authors found that this eerie ability to see our hand in the dark suggests that our brain combines information from different senses to create our perceptions. The ability also "underscores that what we normally perceive of as sight is really as much a function of our brains as our eyes," says first author Kevin Dieter, a post-doctoral fellow in psychology at Vanderbilt University.

The study seems to confirm anecdotal reports that spelunkers in lightless caves often are able to see their hands. In other words, the "spelunker illusion," as one blogger dubbed it, is likely not an illusion after all.

For most people, this ability to see self-motion in darkness probably is learned, the authors conclude. "We get such reliable exposure to the sight of our own hand moving that our brains learn to predict the expected moving image even without actual visual input," says Dieter. Tadin, Dieter, and their team from the University of Rochester and Vanderbilt University reported their findings online October 30 in Psychological Science, the flagship journal of the Association for Psychological Science.

Although seeing one's hand move in the dark may seem simple, the experimental challenge in this study was to measure objectively a perception that is, at its core, subjective. That hurdle at first stumped Tadin and his

postdoctoral advisor at Vanderbilt Randolph Blake after they initially stumbled upon the puzzling observation in 2005. "While the phenomenon looked real to us, how could we determine if other people were really seeing their own moving hand rather than just telling us what they thought we wanted to hear?" asks Blake, the Centennial Professor of Psychology at Vanderbilt and a co-author on the paper.

Years later, Dieter, at the time a doctoral student working in Tadin's Rochester lab, helped devise several experiments to probe the sight-without-light mystery. For starters, the researchers set up false expectations. In one scenario, they led subjects to expect to see "motion under low lighting conditions" with blindfolds that appeared to have tiny holes in them. In a second set up, the same participants had similar blindfolds without the "holes" and were led to believe they would see nothing. In both set ups, the blindfolds were, in fact, equally effective at blocking out all light. A third experiment consisted of the experimenter waving his hand in front of the blindfolded subject. Ultimately, participants were fitted with a computerized eye tracker in total darkness to confirm whether self-reported perceptions of movement lined up with objective measures.

In addition to testing typical subjects, the team also recruited people who experience a blending of their senses in daily life. Known as synesthetes, these individuals may, for example, see colors when they hear music or even taste sounds. This study focused on grapheme-color synesthetes, individuals who always see numbers or letters in specific colors.

The researchers enlisted individuals from Rochester, Nashville, Fenton, Michigan, and Seoul, South Korea, but, in a lucky coincidence, one synesthete could not have been closer. At the time, Lindsay Bronnenkant was working as a lab technician for co-author David Knill, a professor of brain and cognitive sciences at Rochester. "As a child, I just assumed that everybody associated colors with letters," says the 2010 Rochester graduate who majored in brain and cognitive sciences. For Bronnenkant, "A is always yellow, but Y is an oranger yellow." B is navy, C burnt orange, and so on. She thought of these associations as normal, "like when you smell apple pie and you think of grandma." She doesn't remember a time when she did not see numbers and letters in color, but she does wonder if the particular colors she associates with numbers derived from the billiard balls her family had going up. When she donned the blindfold and waved her hand in the experiment, "what I saw was a blur. It was very dim, but it was almost like I was looking at a light source."

Bronnenkant was not atypical in that respect. Across all types of participants, about half detected the motion of their own hand and they did so consistently, despite the expectations created with the faux holes. And very few subjects saw motion when the experimenter waved his hand, underscoring the importance of self-motion in this visual experience. As measured by the eye tracker, subjects who reported seeing motion were also able to smoothly track the motion of their hand in darkness more accurately than those who reported no visual sensation -- 46 percent versus 20 percent of the time.

Reports of the strength of visual images varied widely among participants, but synesthetes were strikingly better at not just seeing movement, but also experiencing clear visual form. As an extreme example in the eye tracking experiment, one synesthete exhibited near perfect smooth eye movement -- 95 percent accuracy -- as she followed her hand in darkness. In other words, she could track her hand in total darkness as well as if the lights were on.

"You can't just imagine a target and get smooth eye movement," explains Knill. "If there is no moving target, your eye movements will be noticeably jerky."

The link with synesthesia suggests that our human ability to see self-motion is based on neural connections between the senses, says Knill. "We know that sensory cross talk underlies synesthesia. But seeing color with numbers is probably just the tip of the iceberg; synesthesia may involve many areas of atypical brain processing."

Does that mean that most humans are preprogrammed to see themselves in the dark? Not likely, says Tadin. "Innate or experience? I'm pretty sure it's experience," he concludes. "Our brains are remarkably good at finding such reliable patterns. The brain is there to pick up patterns -- visual, auditory, thinking, movement. And this is one association that is so highly repeatable that it is logical our brains picked up on it and exploited it."

Whether hardwired or learned, Bronnenkant finds the cross talk between her senses a potent reminder of the underlying interconnectivity of nature. "It's almost a spiritual thing," she says. "Sometimes, yeah, I think to myself, 'I just got this sense from a billiard ball,' but other times I think that being able to cross modalities actually reflects how unified the world is. We think of math and chemistry and art as different fields, but really they are facets of the same world; they are just ways of looking at the world through different lenses."

See video: http://www.youtube.com/watch?v=fNTOvMwbPsc

K. C. Dieter, B. Hu, D. C. Knill, R. Blake, D. Tadin. Kinesthesis Can Make an Invisible Hand Visible. Psychological Science, 2013; DOI: 10.1177/0956797613497968

http://bit.ly/1ixTCq6

Reindeer Eyes Turn Blue as Christmas Nears

Part of the reindeer eye shifts from gold to winter blue, improving their ability to use light when the days become shorter

Oct 31, 2013 11:18 AM ET // by Jennifer Viegas

The fictional Rudolph had a shiny nose to cope with winter darkness, but real-life reindeer possess some magic of their own. Part of the reindeer eye shifts from gold to winter blue, improving their ability to use light when the days become shorter, according to a new study. The study, published in the latest Proceedings of the Royal Society B, helps to explain how Arctic reindeer continue to see in near darkness.

The part of the eye that changes color is the tapetum lucidum, commonly known as the 'cat's eye.' It resides under an unpigmented part of the retina. "In summer, it is golden with most light reflected back directly through the retina, whereas in winter it is deep blue with less light reflected out of the eye," wrote Karl-Arne Stokkan, of the University of Tromso in Norway, and colleagues.

Stokka was able to study reindeer right at the university. Several were brought in from mountain region herders. They were maintained in large outdoor pens. The researchers studied their eyes during two weeks on either side of the summer and winter solstices.

The blue reflection in winter is associated with significantly increased retinal sensitivity, they explained. It may scatter light, which could force the eye to work harder, thereby improving the sensitivity. It's not a perfect system, though. "Increased sensitivity occurs at the cost of reduced acuity, but may be an important adaptation in reindeer to detect moving predators in the dark Arctic winter," the researchers explained.

Unfortunately for reindeer, they are good eats for all kinds of carnivores, including some humans.

Another study, conducted earlier this year at the same university, found that reindeer meat is one of the healthiest, leanest meats around. It has nearly double the amount of nutrients of other more common meats, and yet its fat content is comparable to that of a chicken.

At least this eye adaptation, which sounds like something Santa himself would have come up with, gives reindeer a chance to see the predators coming and to high tail it out of there.

http://www.sciencedaily.com/releases/2013/10/131031125319.htm

Lefties More Likely to Have Psychotic Disorders Such as Schizophrenia

Among those with mental illnesses, people with psychotic disorders like schizophrenia are much more likely to be left-handed than those with mood disorders like depression or bipolar syndrome

Being left-handed has been linked to many mental disorders, but Yale researcher Jadon Webb and his colleagues have found that among those with mental illnesses, people with psychotic disorders like schizophrenia are much more likely to be left-handed than those with mood disorders like depression or bipolar syndrome.

The new study is published in the October-December 2013 issue of the journal SAGE Open.

About 10% of the U.S. population is left-handed. When comparing all patients with mental disorders, the research team found that 11% of those diagnosed with mood disorders such as depression and bipolar disorder are left-handed, which is similar to the rate in the general population. But according to Webb, a child and adolescent psychiatry fellow at the Yale Child Study Center with a particular interest in biomarkers of psychosis, "a striking of 40% of those with schizophrenia or schizoaffective disorder are left-handed."

"In general, people with psychosis are those who have lost touch with reality in some way, through hallucinations, delusions, or false beliefs, and it is notable that this symptom constellation seems to correlate with being left-handed," said Webb. "Finding biomarkers such as this can hopefully enable us to identify and differentiate mental disorders earlier, and perhaps one day tailor treatment in more effective ways."

Webb and his colleagues studied 107 individuals from a public outpatient psychiatric clinic seeking treatment in an urban, low-income community. The research team determined the frequency of left-handedness within the group of patients identified with different types of mental disorders.

The study showed that white patients with psychotic illness were more likely to be left-handed than black patients. "Even after controlling for this, however, a large difference between psychotic and mood disorder patients remained," said Webb.

What sets this study apart from other handedness research is the simplicity of the questionnaire and analysis, said Webb. Patients who were attending their usual check-ups at the mental health facility were simply asked "What hand do you write with?"

"This told us much of what we needed to know in a very simple, practical way," said Webb. "Doing a simple analysis meant that there were no obstacles to participating and we had a very high participation rate of 97%.

Patients dealing with serious symptoms of psychosis might have had a harder time participating in a more complicated set of questions or tests. By keeping the survey simple, we were able to get an accurate snapshot of a hard-to-study subgroup of mentally ill people -- those who are often poverty-stricken with very poor family and community support."

J. R. Webb, M. I. Schroeder, C. Chee, D. Dial, R. Hana, H. Jefee, J. Mays, P. Molitor. Left-Handedness Among a Community Sample of Psychiatric Outpatients Suffering From Mood and Psychotic Disorders. SAGE Open, 2013; 3 (4) DOI: 10.1177/2158244013503166

http://bit.ly/17Bi2jk

Earth's first life may have sprung up in ice

IF YOU thought life evolved in bubbling hot springs, think again.

01 November 2013 by Linda Geddes

Pieces of RNA have been made that can copy RNA strands longer than themselves, supporting the idea that the first life was based on self-replicating RNA, not DNA. What's more, they work best in the cold, hinting that life began on ice.

RNA is a jack-of-all trades. Like DNA it can store genetic material, but it can also catalyse chemical reactions. For this reason, many believe it was the basis of the first life. If this was the case then those early organisms must have had an enzyme created out of RNA to copy their RNA genomes. But no known RNA enzyme can copy a stretch of RNA as long as itself, without which RNA organisms couldn't have survived for long.

To find such an enzyme, Philipp Holliger of the MRC Laboratory of Molecular Biology in Cambridge, UK, has been creating libraries of RNA sequences and screening them for the ability to copy other RNA. In 2011, his team created an RNA enzyme that could copy RNA sequences up to 96 nucleotides long. They also found that such enzymes work better in the cold.

Their latest creation goes a step further. "It makes RNA big enough to encode itself," says Holliger. "There's no reason why self-replication couldn't occur." The RNA enzyme is 202 nucleotides long and makes RNA 206 nucleotides long, even at -17 °C (Nature Chemistry, doi.org/pcs).

Crucially, the enzyme does not yet copy itself. The main barrier seems to be the folded structure that allows it to copy other RNA. Enzymes that copy DNA have a similar issue: DNA is folded up, so they use tools to unzip it. Holliger hopes to add this function.

The RNA enzyme's effectiveness at cold temperatures suggests ice was crucial to the first life. When a mix of RNA and metal ions freezes, growing ice crystals suck up the water, leaving tiny pockets of RNA and concentrated salt. RNA replication can happen in these pockets. "They're a little bit like artificial cells," says Holliger, and could be where evolution started.

"It certainly makes a cold RNA world something to think about," says RNA expert Adrian Ferré-D'Amaré of the National Heart, Lung and Blood Institute in Bethesda, Maryland.

However, the theory has some weaknesses. At cold temperatures, RNA strands often stick together, making it tricky to separate them after the RNA has been copied. Primitive life would need to warm up to separate the strands, says Jack Szostak of Harvard Medical School. "It couldn't just live at continuously cold temperatures."

True, says Holliger, but there's a fix. "Ice freezes and melts all the time, so you can easily see how an RNA replicator could be enclosed and then released in a cyclical way and allowed to spread."

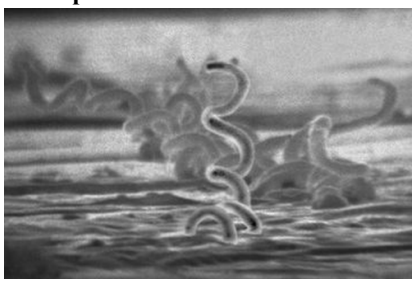
Szostak also points out that the enzyme only occasionally makes long strands of RNA. "I'm afraid we still have a long way to go to get a self-replicating ribozyme."

http://www.livescience.com/40885-syphilis-origin-mystery.html

Origins of Syphilis Still a Mystery, Researchers Say

The origin of syphilis remains an enigma, say researchers who recently reviewed the literature about syphilis

By Bahar Gholipour, Staff Writer | November 01, 2013 01:33pm ET



Syphilis is caused by Treponema pallidum, a spiral-shaped bacterium called a spirochete. **Credit: CDC**

Syphilis has been infecting people for centuries, and many researchers have tried to pinpoint the part of the world where the bacterium that causes the disease first appeared, before spreading across the globe and becoming the international disease that it is today.

Yet, despite researchers delving into studying the disease - looking at it from the angles of history, politics, paleopathology and molecular chemistry - the origin of syphilis remains an enigma, say researchers who recently reviewed the literature about syphilis.

The main hypotheses about the origin of syphilis revolve around the voyages of Christopher Columbus to the New World. According to the "Columbian" theory, the crews of Columbus brought the disease from America to

Europe when they returned home in 1492. Not long afterward, the first recorded epidemic of syphilis happened, during the French invasion of the Italian city of Naples in 1495.
However, critics of the Columbian theory claim that syphilis may have existed in Europe prior to Columbus' return, and the disease simply wasn't distinguished from other conditions such as leprosy until 1495.
Syphilis - a sexually transmitted disease that can damage the heart, brain, eyes and bones, and even cause death if untreated - first appears in the historical record in the 1496 writings of a man named Joseph Grünpeck. But it was the Italian physician and poet Girolamo Fracastoro who first used the term "syphilis" in 1530 in a Latin poem. Fracastoro said that this "vulgar disease was born in the west of the Atlantic seas, over those unhappy, recently discovered edges," researchers Ismael Maatouk and Roy Moutran wrote in their article, published Oct. 25 in the Journal of Sexual Medicine.
But before getting its current name, syphilis had many other monikers. In fact, each regional population had several names for the disease, often blaming its enemy of being responsible. The Italians called syphilis the French disease, the Japanese called it the Portuguese disease, the Turkish called it "the French or Christian evil," and the Persians called it the "Turk evil." "These attributions reflect the fact that people wanted to clear their responsibility for the dissemination of this rapid and unknown disease," the researchers said.
Syphilis also had more than 50 appellations that corresponded to saints - including St. Job, St. Roch and St. Reine - believed to help heal the disease, the researchers said.
What is known about the etymology of the word "syphilis" goes back to a story that Fracastoro told in his book in 1530 about a Greek shepherd, Syphilus, who led a revolt against the god of the sun and suffered later from this disease, the researchers said. The majority of Renaissance authors used the term "syphilis" after Fracastoro had mentioned Syphilus's myth in his book.
Although the main hypotheses about the origins of syphilis focus on either an American or European origin, other possibilities exist. It was later recognized that different varieties of the disease existed, such as bejel, pinta and yaws, all caused by subspecies of the bacterium Treponema pallidum, which causes syphilis.
According to one theory, T. pallidum bacteria have existed since antiquity, infecting humans all along but giving rise to variable symptoms that prevented doctors from realizing it was one disease. The bacteria were detected in 1905.
Syphilis has four stages, each of which has different symptoms ranging from sores and skin rashes to blindness, paralysis and dementia. Symptoms of late-stage syphilis can appear 30 years after the early-stage symptoms have disappeared in an untreated person.
Paleopathologists have played a pivotal role in addressing the question surrounding the origin of syphilis, the researchers said. Syphilis and its related diseases leave distinct marks on the bones, allowing researchers to examine the remains of past generations.
Evidence from pre-Columbian sites in America shows a high rate of syphilis in young people, suggesting there may have been a nonsexually transmitted form of the disease, similar to today's yaws or bejel, the researchers said. It is possible that the responsible bacterium would have evolved once it arrived in Europe, under a new set of selective pressures and different climates. "Perhaps it was the exposure to this novel host environment that resulted in the birth of the T. palladium subspecies that causes syphilis," the researchers said.
Today, syphilis is easy to cure in its early stages with antibiotics. However, it remains a global problem, infecting an estimated 12 million people each year, mostly through unsafe sexual practices.

http://www.eurekalert.org/pub_releases/2013-11/scp-tbm110113.php

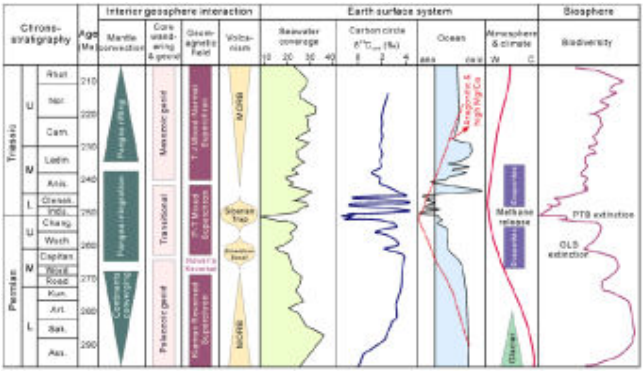
The biggest mass extinction and Pangea integration

Study shows that Pangea integration resulted in environmental deterioration which caused the Permian-Triassic extinction

The mysterious relationship between Pangea integration and the biggest mass extinction happened 250 million years ago was tackled by Professor YIN Hongfu and Dr. SONG Haijun from State Key Laboratory of Geobiology and Environmental Geology, China University of Geosciences (Wuhan). Their study shows that Pangea integration resulted in environmental deterioration which further caused that extinction. Their work, entitled "Mass extinction and Pangea integration during the Paleozoic-Mesozoic transition", was published in SCIENCE CHINA Earth Sciences.2013, Vol 56(7).
The Pangea was integrated at about the beginning of Permian, and reached its acme during Late Permian to Early Triassic. Formation of the Pangea means that the scattered continents of the world gathered into one integrated continent with an area of nearly 200 million km2. Average thickness of such a giant continental lithosphere should be remarkably greater than that of each scattered continent. Equilibrium principle implies that the thicker the lithosphere, the higher its portion over the equilibrium level, hence the average altitude of

the Pangea should be much higher than the separated modern continents. Correspondingly, all oceans gathered to form the Panthalassa, which should be much deeper than modern oceans. The acme of Pangea and Panthalassa was thus a period of high continent and deep ocean, which should inevitably induce great regression and influence the earth's surface system, especially climate.

The Tunguss Trap of Siberia, the Emeishan Basalt erupted during the Pangea integration. Such global-scale volcanism should be evoked by mantle plume and related with integration of the Pangea. Volcanic activities would result in a series of extinction effects, including emission of large volume of CO2, CH4, NO2 and cyanides which would have caused green house effects, pollution by poisonous gases, damage of the ozone layer in the stratosphere, and enhancement the ultra-violet radiation.



Causal relationships between geosphere disturbances and mass extinction during the Late Permian and Early Triassic, modified from (Yin et al., 2007). Redox data of the ocean are from (Isozaki, 1997; Song et al., 2012a).

Increase of CO2 concentration and other green house gases would have led to global warming, oxygen depletion and carbon cycle anomaly; physical and chemical anomalies in ocean (acidification, euxinia, low sulfate concentration, isotopic anomaly of organic nitrogen) and great regression would have caused marine extinction due to unadaptable environments, selective death and hypercapnia; continental aridity, disappearance of monsoon system and wild fire would have devastated the land vegetation, esp. the tropical rain forest.

The great global changes and mass extinction were the results of interaction among earth's spheres. Deteriorated relations among lithosphere, atmosphere, hydrosphere, and biosphere (including internal factors of organism evolution itself) accumulated until they exceeded the threshold, and exploded at the Permian-Triassic transition time. Interaction among bio- and geospheres is an important theme. However, the processes from inner geospheres to earth's surface system and further to organism evolution necessitate retardation in time and yields many uncertainties in causation. Most of the processes are now at a hypothetic stage and need more scientific examinations.

Yin H F, Song H J. Mass extinction and Pangea integration during the Paleozoic-Mesozoic transition. Science China: Earth Sciences, 2013, 56: 1791-1803 http://earth.scichina.com:8080/sciDe/EN/10.1007/s11430-013-4624-3

http://www.eurekalert.org/pub_releases/2013-11/lifc-idf103113.php

Is DNA from mom or dad?

New technique will accelerate personalized medicine

New York, NY and San Diego, Calif. – A new technique successfully takes on a longstanding challenge in DNA sequencing – determining whether a particular genetic sequence comes from an individual's mother or father. The method, described in a Ludwig Cancer Research study in Nature Biotechnology, promises to accelerate studies of how genes contribute to disease, improve the process of matching donors with organs and help scientists better understand human migration patterns.

"The technique will enable clinicians to better assess a person's individual risk for disease. It is potentially transformative for personalized medicine," says Bing Ren, Ludwig scientist at the University of California, San Diego School of Medicine, who led the research on the new technique, called "HaploSeq."

"Current sequencing technologies are fast and rapidly getting cheaper – an individual's genome can now be sequenced in about a week for $5,000," says Ren. "In the not too distant future, everyone's genome will be sequenced. That will become the standard of care." But, he explains, "There has been a problem with this scenario." Except for the sex chromosomes, everyone has two copies of each chromosome. One copy comes from mom, and the other from dad. Current techniques cannot distinguish between the two copies of each gene and, therefore, are not very good at determining whether particular genetic differences, such as a single-letter change in the DNA, originate with an individual's mother or father – muddying genetic analyses.

Ren's new technique, a mixture of molecular biology and computational biology approaches, bypasses this problem. The method enables researchers to quickly determine which genetic variants occur together on the same stretch of chromosome and, therefore, came from the same parent. "This advance has direct implications for the utility of genomics in clinical practice and will also have profound effects on genetic research and discovery," says Ludwig scientist Siddarth Selvaraj, who contributed to the study with Ren and fellow Ludwig researcher Jesse Dixon.

More immediately, the technique will enable clinicians to better assess a person's individual risk for disease, a cornerstone of personalized medicine. For instance, people at risk for a disease such as cancer often have more

than one DNA mutation. HaploSeq could enable clinicians to determine if the two mutations are on the same chromosome or on different chromosomes, which can help in risk assessment – for instance, risk may be reduced if two mutations are on the same chromosome, since the 'good' chromosome can often compensate. Similarly, the method, with further honing, has the potential to refine the currently cumbersome process of determining whether there is a genetic match between an organ donor and recipient. A large number of genes contribute to compatibility between donor and recipient, but there is a lot of genetic variability in these genes. The new technique could help determine whether DNA differences between donor and recipient are likely to be a good match. "This will require more study," says Ren, "but by creating a DNA database, it may be possible to more accurately and expediently pair recipients and donors."

The new method will also help researchers analyze human migration and determine ancestry from their DNA sequences. "In principal," says Ren, "you could compare your genetic sequence to your neighbor's and ask if you have any recent ancestors in common. With our technique we can study each individual and how they relate to other individuals. As we accumulate data from many individuals we can more precisely determine their relationships." Such findings will also bolster an ongoing international project to assess worldwide human genetic variation, the HapMap project.

One advantage of the new technique is that it builds on common sequencing technologies and should be easily adapted for use by clinicians and researchers alike. Says Ren, "I anticipate that this new method will be quite widely used."

This study was funded by the Ludwig Institute for Cancer Research and the Roadmap Epigenome Project (U01 ES017166).

http://www.sciencedaily.com/releases/2013/11/131103140259.htm

Life, but Not as We Know It: Rudimentary Form of Life Sidesteps Normal Replication Process

A rudimentary form of life that is found in some of the harshest environments on earth is able to sidestep normal replication processes and reproduce by the back door, researchers at The University of Nottingham have found.

The study, published in the journal Nature, centres on Haloferax volcanii - part of a family of single-celled organisms called archaea that until recently were thought to be a type of bacteria. The findings, led by scientists from the University's School of Life Sciences, could offer new insights into how defective cells can multiply out of control in diseases such as cancer. Their discovery comes in the same year as the 50th anniversary of a landmark in the field of DNA replication - the presentation of the replicon model at the Cold Spring Harbor Symposium on DNA Replication in 1963 by François Jacob, who was later awarded the Nobel Prize in Medicine.

Dr Thorsten Allers said: "Sadly François Jacob passed away this year, but 50 years after this theory was presented it still guides the investigation of DNA replication. "Given this anniversary, our paper in Nature is rather timely. We have shown that in some organisms, the replication origins - genetic switches that control DNA replication - are not only unnecessary but cells will actually grow faster when these origins are not present. This is totally unexpected and has forced us to re-evaluate one of the cornerstones of DNA biology."

The paper, Accelerated Growth in the Absence of DNA Replication Origins, was co-authored by Dr Thorsten Allers, Dr Conrad Nieduszynski and Dr Michelle Hawkins in the University's School of Life Sciences in collaboration with Dr Sunir Malla and Dr Martin Blythe in DeepSeq, the School's state-of-the-art DNA deep sequencing laboratory.

Archaea were originally discovered in extreme environments and can survive at very high or very low temperatures, or in highly salty, acidic or alkaline water. They form one of the three distinct branches of life along with bacteria and eukaryotes, which are multi-celled organisms including humans, other animals, plants and fungi. At a genetic level, archaea have been found to be more closely related to eukaryotes, and therefore humans, than to bacteria. The salt-loving Haloferax volcanii being studied by the Nottingham scientists originates from the Dead Sea.

Dr Allers added: "Although they look like bacteria and behave like bacteria, archaea are actually more closely related to us. Where we really see the similarities is when we look at the enzymes that are responsible for DNA replication and that's why we thought this would be an interesting system to work on. We've got something that's life but not as we know it: on the outside they look like bacteria but on the inside they look like us."

"What we've discovered is that in this type of archaea, François Jacob's replicon model, which was proposed 50 years ago and was thought by everybody to be absolutely fundamental to life, is not necessarily true."

In order to reproduce, all life forms need to copy their DNA before the cell can divide. They do this via a series of 'replication origins' that are located around their chromosomes and to which proteins bind in order to start

the replication process. In eukaryotes such as humans if these replication origins are eliminated it prevents replication and eventually leads to cell death.
However, the Nottingham study, funded by the Biotechnology and Biological Sciences Research Council (BBSRC) and the Royal Society, found that the Haloferax volcanii is able to spontaneously begin a chain reaction of replication all around its chromosomes even when its replication origins have been eliminated.
In addition, the scientists discovered that far from being disadvantaged by having to employ this novel survival method, the archaea without chromosomal origins grew faster.
"The amazing thing that we found wasn't just that deleting the origins still allowed the cells to grow, but that they now actually grew almost 10 per cent faster. Everybody was thinking, 'where's the catch?' But we haven't found one" Dr Conrad Nieduszynski said. "The way cells initiates this replication process is to use a form of DNA repair that exists in all of us, but they just hijack this process for a different purpose. By using this mechanism, they kick-start replication at multiple sites around the chromosome at the same time."
Since it appears that origins are unnecessary in Haloferax volcanii, the scientists believe that replication origins in this organism could be an example of a 'selfish gene' - benefitting the origins by offering the chance to be continually replicated while offering no advantage to the organism itself.
For humans it is very important that we can regulate this process of DNA replication to ensure that our chromosomes are only copied once before the cell divides, otherwise this can lead to genetic diseases including cancer. When cancer cells develop they no longer regulate the copying of their genome - this happens because of mutations in the genes that control this process. Loss of replication control leads to cancer cells making more than just two copies of their chromosomes, which is something they have in common with what the scientists observed in Haloferax volcanii.
Dr Allers said: "Scientists think that cancer cells revert back to a more primitive state without these forms of control. This is how they resemble Haloferax volcanii. One of the other hallmarks of cancer cells is that grow faster than ordinary cells and can quickly take over the body. This is similar to what we are seeing - when you don't regulate DNA replication and dispense with the normal checks and balances, you can have unregulated, faster growth."
In the future if we can understand this mechanism it could give us an insight into how cancer cells can escape normal regulation and control. It could even identify new targets for killing cancer cells without harming normal cells.

Michelle Hawkins, Sunir Malla, Martin J. Blythe, Conrad A. Nieduszynski, Thorsten Allers. Accelerated growth in the absence of DNA replication origins. Nature, 2013; DOI: 10.1038/nature12650

http://bit.ly/HANzX0

Immune suppressor makes one flu vaccine work for many viruses

A broad-spectrum flu vaccine may rely on a regular flu vaccine and a drug.

by Diana Gitig - Nov 4 2013, 8:45am TST

The flu kills over 250,000 people every year. Flu viruses change constantly, so they can evade our immune systems, the immune systems of other host species, and the vaccines we throw at them. Each seasonal vaccine can, at best, protect only against the current circulating strain of virus—but not emerging variants. (Just so we're clear on this, YOU SHOULD STILL GET VACCINATED. Reread the first sentence.) And we currently have no way of knowing which strain might become a pandemic, or when or where such a strain might arise.
Making a universal vaccine, or at least one that could counter more than one subtype of the virus, is a priority. Efforts thus far have failed, because most of the proteins that are conserved between the different influenza subtypes are inside the virus rather than on its surface. This typically makes it tough for antibodies to access, but researchers have recently found a way to render one vaccine protective against a number of different subtypes.
Irony number one in this story: it hinges on the use of the immunosuppressant rapamycin. This drug is normally given to people who had organ transplants in order to reduce the chance that their immune system will reject the new tissue.
The researchers behind the new results immunized mice against one subtype of flu (HKx31). Along with the vaccine, some of the mice also got rapamycin, while others didn't. Then all the mice were infected with a different, highly lethal flu strain (ΔVn1203). Fewer of the mice who got rapamycin with their initial vaccine died from this lethal strain. When they gave some of the mice rapamycin alone, without the HKx31 vaccination, the lethal flu strain killed just as many treated mice as controls—so both the virus and vaccine are required to elicit the protective effect.
The team performed the same experiment with the HKx31 vaccine and then two other lethal flu strains, and they got the same results. But when they used the HKx31 vaccine and later infected the mice with the lethal

Sendai virus—i.e. not the flu—none of the mice were protected. Thus, rapamycin enhanced the protective effect of the HKx31 vaccine, expanding it so that it worked against three other flu subtypes.
Given that rapamycin is a known immunosuppressant, what on earth made them think that it might enhance the efficacy of a flu vaccine? Well, despite its immunosuppressive effects, rapamycin has been shown to promote the generation of memory CD8+ T cells. These cells cannot prevent flu viruses from infecting other cells, but they help get rid of infected cells and thus decrease influenza-related mortality.
Irony number two: the researchers picked the right drug for the wrong reason—that's not how rapamycin is working here. It enhanced the protective effect of the HKx31 vaccine against ΔVn1203 even in mice that completely lack CD8+ memory cells.
So how does it work? The researchers found that rapamycin must be present for 15 days after vaccination for the protection to work. And, although CD8+ memory T cells were dispensable for this effect, CD4+ T cells were required—these activate B cells and turn them into antibody producing factories. The team speculated that rapamycin somehow modulates the antibody response induced by the vaccine. To test this idea, they took serum from mice that were given vaccine and rapamycin and injected it into untreated mice. The untreated mice were now protected against infection by ΔVn1203, supporting the idea that antibodies are involved.
It turns out that rapamycin worked by inhibiting a process called class switching. Antibodies have two parts: a variable region that recognizes a specific antigen, like a flu protein, and a constant region that defines its class. The first antibodies that are made upon initial exposure to a pathogen are called IgM class antibodies. As the infection progresses, any highly specific antibodies get upgraded into IgG class antibodies.
This upgrading of specific antibodies never happened in the drug treated mice. Rapamycin suppressed class switching, so mice that got it along with their vaccine had more IgM class antibodies, many of which tended to be less specific to HKx31. Irony number three: these less specific antibodies might not bind as strongly to their the HKx31, but it is precisely this reduced affinity that may allow them to bind to the equivalent protein on other flu strains.
The authors suggest that using rapamycin may help make vaccines that are effective against multiple strains of flu or against multiple strains of other rapidly mutating viruses—like HIV.
Nature Immunology, 2013. DOI: 10.1038/ni.2741 (About DOIs).

http://www.sciencedaily.com/releases/2013/11/131101091729.htm

Botox to Treat 'Suicide' Headaches

A new treatment that uses Botox may offer hope to people who suffer from cluster headaches - otherwise known as 'suicide headaches' because the pain drives patients to consider suicide.

"I hit myself in the head to distract myself from the pain when I have a cluster headache. The pain is indescribable hell, and in desperate moments, I have hit my head against a brick wall and hit myself in the head with a cell phone," says Hilde Vollan (34), a PhD candidate in bioinformatics at the University of Oslo.
Four years and four months ago, her life turned upside down when she started getting cluster headaches. Her life has been transformed -- once, she was an active student with many friends, but she now lives a life in the dark at home with her parents.
She has two to five cluster headaches every day, and also suffers from migraine and tension headaches. If she dares to go out for a walk, she always brings someone who can support her, and a bag of pills -- including an oxygen bottle, a mask to breathe with and migraine medicines she takes by injection. Her attacks can come in the middle of the street or inside a store.
"For years, I have tried to hide when the pain takes over, because people are scared and shocked to see me suffer such pain. But I've stopped hiding now. It's not my fault that I get such bad headaches," says Vollan.
Now, Vollan will participate in a pilot study at the Norwegian University of Science and Technology (NTNU) where she will help in the testing of a new treatment.

Men more susceptible than women

"We also call this a suicide headache, because many sufferers become suicidal," says NTNU senior consultant and researcher Erling Tronvik.
"This is the most extreme form of a headache, and the intensity of the pain is worse than what migraine patients experience. I've had patients tell me that they bang their head against the wall because of the pain. Others say that they put their thumb in a pair of pincers while they pull with all their might, all in a desperate attempt to deflect the intense pain," says Tronvik, who is also affiliated with the Norwegian National Headache Centre at St. Olavs Hospital in Trondheim.
Unlike migraines, which mostly afflict women, cluster headaches mainly occur in men. About 5000 Norwegians suffer from cluster headaches. Some have daily seizures for a few months each year, while others have attacks several times a day, every day of the year.

Crippled by Pain

"People who get these headaches daily are crippled by the pain. It's an extremely challenging disease for both doctors and patients," Tronvik says.

Until now, it has been difficult to help these patients. Scientists do not know why some people get cluster headaches. A number of patients have found relief from injections of migraine medicine and the use of oxygen, but this treatment does not help most sufferers. The illness leaves patients with a tremendous sense of helplessness.

But now Tronvik, in collaboration with physician Daniel Bratbak at St. Olavs Hospital and Professor Ståle Nordgård at NTNU, has come up with an entirely new treatment. The gear they have developed looks a pistol with a very thin barrel, just the thickness of a knitting needle. The barrel is inserted up through the nose of the patient, and by passing through a natural hole in the nasal wall, the mouth of the barrel comes to a bundle of nerves behind the sinuses.

The surgeon pulls the trigger of the pistol, which shoots a dose of Botox to the area around the nerve bundle. The whole process takes about a half-an-hour.

In search of patients

"Botox is a neurotoxin that stops the flow of impulses along the nerves. In theory, the connection between the two nerves in the bundle is reduced or eliminated. The effect lasts from three to eight months. Then the patient has to get another injection. We designed the equipment ourselves, and Botox has never been used for this anywhere else," says Tronvik.

The researchers strongly believe in their treatment method, in part because a new study unrelated to their work has shown an effect by using an electric current to paralyse the nerve bundle. "But that approach requires a lengthy operation," Tronvik says. Now he's in search of ten patients for a pilot study.

If the method proves to be effective, the researchers will extend the experiment to include 30 to 40 cluster headache patients and approximately 80 migraine patients. The treatment uses an MRI of the patient's head to make certain that the surgeon knows exactly where the nerve bundle is. A navigation tool, composed of three small spheres on the pistol, and a plate with three spheres mounted on the patient's head, enables the surgeon to find the nerve bundle using the MRI image.

Tested on two patients

"A computer sends light signals to all the spheres to form precise points. We don't miss, but anyone who wants to participate in the study must accept the risk that it could happen, because this has never been done before. If the Botox hits an area near the nerve bundle, it could cause temporary double vision, or weaken the ability of the patient to chew. But with the use of the MRI and our navigation tools we can hit the nerve bundle without any problem. We hope that this treatment method can help give patients a life without such great pain," says Tronvik.

http://www.sciencedaily.com/releases/2013/11/131101091741.htm

Scientists Raise Alarm Over Today's Measures Against Legionellosis

According to the textbooks, both high doses of chlorine and hot water are lethal to legionella bacteria. But now Norwegian scientists are sounding the alarm that the bacteria can survive these treatments, by hiding in amoebae.

Legionella bacteria can cause deadly pneumonia via our shower water. On the basis of her own recent findings, SINTEF scientist Catrine Ahlén warns that we should not blindly assume that the measures recommended to deal with legionella infections in water systems always work.

Mystery solved

The number of cases of legionellosis, or Legionnaires' disease, has increased in Europe during the past few years, at the same time as a mystery has been building up; on board ships and in buildings all over the world, the feared bacteria have repeatedly turned up in tap-water, in spite of the recommended high doses of chlorine and hot-water treatments that have been implemented -- measures that these bacteria don't normally survive. But now the mystery appears to have been solved.

Time to extend emergency preparedness

For the past three years, Catrine Ahlén has been collaborating with the Royal Norwegian Navy and her own colleagues at SINTEF and NTNU in systematic studies of how legionella problems arise and remain in ships' water systems.

In the samples from the navy ships, the SINTEF senior scientist found evidence that the bacteria had survived the recommended treatment by using the amoebae as a shield, something that had not previously been demonstrated in a water supply system. Chlorine and hot water kill legionella, but not amoebae, so Ahlén now

strongly recommends that our contingency planning for legionella outbreaks should be extended to include the demonstration and elimination of amoebae, both at sea and ashore.

Old water pipes

On land, legionella bacteria are tend to be found in the water supply of hotels, sports halls and swimming baths, and of institutions like hospitals and nursing homes. "The Norwegian water supply system is old. The pipes contain huge amounts of internal fouling in the shape of biofilm, a slimy coating that offers amoebae first-class living conditions. The network can therefore spread amoebae, even though many purification systems at sources of drinking water are hypermodern," says Ahlén.

In view of her findings on behalf of the Navy, she therefore recommends that everyone whose tap-water has been shown to contain legionella should order a set of analyses that would show whether the water also contains amoebae.

Find themselves hosts

Amoebae are relatively large single-celled organisms. They normally eat bacteria, including legionella; in other words, they kill them. However, laboratory tests in the USA showed as long ago as 2000 that a few legionella bacteria do manage to survive and reproduce inside amoebae.

The research project with the Royal Norwegian Navy sampled water from 41 naval vessels. Half of them turned out to be infected by the species Legionella pneumophila (see fact-box). Ahlén and her colleagues also found amoebae in all the legionella-infected ships. What is more, legionella were found inside many of the amoebae.

"Our findings made it easy to realise that the bacteria would be able to survive and spread as soon as the chlorination process had finished. And not only that: the bacteria emerge from the amoebae in a new and even more dangerous form than they had when they sheltered there," says Ahlén.

Nasty "training camp"

For according to Ahlén, American studies have shown that the amoebae function as a training camp, where the legionella bacteria also learn to fight our bodies' immune defence system.

"The Americans saw that the bacteria that survive inside the amoebae manage to defend themselves against the cells that our immune defence system activates against infections. The increased threat to health makes it particularly important to extend our preparedness to deal with legionellosis by focussing on amoebae," says the SINTEF scientist.

Amoebae starve to death

On board the infected naval vessels, Ahlén and her colleagues have no launched a special water treatment process that starves the amoebae to death. "This is a time-consuming treatment, and it will continue until all the Navy's ships are free of amoebae, and thus also free of legionella," says Ahlén.

Pioneering findings on bunkering

Catrine Ahlén has been doing research on the problem of legionella bacteria at sea since 2004. She says that vessels have been overrepresented in reports of repeated outbreaks of legionellosis. Ahlén believes that she has identified the reason for this through the project for the Royal Norwegian Navy.

She explains that:

• When vessels bunker water, they do so via pipes that lead from a certified water-works, which may well lie several kilometres distant.

• These pipes may be lined with biofilm, a slimy coating in which bacteria grow.

• Amoebae are commonly found in biofilms.

"By developing new bunkering routines, such as introducing a hygienic barrier between pipe and vessel, we can reduce the risk of transferring amoebae to vessels, but no-one thought of that until we made these findings," says Ahlén.

She also believes that more establishments on land could upgrade their protection against outbreaks of Legionnaires' disease by thinking along similar lines.

Scientific publications

Together with her SINTEF colleague Marianne Aas, Professor Ole Jan Iversen and senior engineer Anne Nor of NTNU, and the Royal Norwegian Navy project group, Ahlén has published her findings in the Journal of the Norwegian Medical Association.

"We have every reason to believe that amoebae play a key role. These bacteria must have a host organism in which they can hide, enabling them to survive high doses of chlorine and/or heat treatment."

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Ole-Jan Iversen, Jan Knudtzon Sommerfelt-Pettersen, Trine Sørbø, Hjalmar Johansen, Per Inge Wetteland, Anne Nor, Marianne Aas, Catrine Ahlén. Legionella pneumophila på Sjøforsvarets fartøyer. Tidsskrift for Den norske legeforening, 2013; 133 (14): 1445 DOI: 10.4045/tidsskr.12.1459

http://www.bbc.co.uk/news/health-24770207

Blood test could detect serious skin cancer spread

A simple blood test could be used to identify patients whose skin cancer has spread, according to a presentation at the National Cancer Research Institute conference.

Melanoma is particularly difficult to detect and treat once it spreads. Dundee University researchers say that measuring levels of a gene called TFP12 in DNA in the blood could be key. Cancer Research UK said the findings could lead to faster diagnoses and new treatments.

Dr Tim Crook, study author and consultant medical oncologist at the University of Dundee, said detecting if melanoma, the most serious form of skin cancer, had started to spread was challenging.

'Landscape of our DNA'

"By using a blood test, we have the basis of a simple and accurate way of discovering how advanced the disease is, as well as an early warning sign of whether it has started to spread.

"This would give doctors and patients important information much sooner than is possible at the moment.

"There's increasing evidence that the latest treatments are more effective in these early stages and, if we can identify patients whose cancer has only just started to spread, this would significantly improve the chances of beating the disease," Dr Crook said.

Prof Charlotte Proby, a dermatologist based at the University of Dundee, said: "Using blood tests to assess the landscape of our DNA is a simple way to learn more about what's going on under the skin. "The switching on and off of certain genes seems to affect when, where and why the melanoma spreads." Prof Proby said the next step was to develop a panel of similar biomarkers that would help to detect those patients needing extra treatment to fight their melanoma.

New treatments

More than eight in 10 people now survive melanoma for at least 10 years, but experts say there is still more to be done for patients whose cancer has spread to other organs.

Dr Harpal Kumar, chief executive of Cancer Research UK and chair of the NCRI, said the research, revealed at the conference in Liverpool, could be important. "This work could lead to quicker diagnosis and potentially new treatments, giving patients and doctors an even better chance of beating the disease," he said.

The same research team identified another potential biomarker, called NT5E, which appears to be linked to spread of aggressive melanoma.

The researchers say it could be a possible target for developing new treatments to tackle melanoma, particularly for cancers that have spread to the brain, lungs and other organs.

http://www.eurekalert.org/pub_releases/2013-11/aafc-odo103013.php

1 dose of HPV vaccine may be enough to prevent cervical cancer

Women vaccinated with one dose of (HPV) vaccine had antibodies against the viruses that remained stable in their blood for four years and may be sufficient to generate long-term immune responses

PHILADELPHIA — Women vaccinated with one dose of a human papillomavirus (HPV) vaccine had antibodies against the viruses that remained stable in their blood for four years, suggesting that a single dose of vaccine may be sufficient to generate long-term immune responses and protection against new HPV infections, and ultimately cervical cancer, according to a study published in Cancer Prevention Research, a journal of the American Association for Cancer Research.

"The latest Morbidity and Mortality Weekly Report from the Centers for Disease Control and Prevention on vaccination coverage indicates that in 2012, only 53.8 percent of girls between 13 and 17 years old initiated HPV vaccination, and only 33.4 percent of them received all three doses," said Mahboobeh Safaeian, Ph.D., an investigator in the Division of Cancer Epidemiology and Genetics at the National Cancer Institute (NCI) in Bethesda, Md.

"We wanted to evaluate whether two doses, or even one dose, of the HPV 16/18 L1 VLP vaccine [Cervarix] could induce a robust and sustainable response by the immune system," she added. "We found that both HPV 16 and HPV 18 antibody levels in women who received one dose remained stable four years after vaccination. Our findings challenge previous dogma that protein subunit vaccines require multiple doses to generate long-lived responses."

Data for this study are from the NCI-funded phase III clinical trial to test the efficacy of Cervarix in women from Costa Rica. About 20 percent of the women in the study received fewer than three doses of the vaccine, not by design.

The researchers looked for the presence of an immune response to the vaccine (measured by antibody levels) in blood samples drawn from 78, 192, and 120 women who received one, two, and three doses of the vaccine,

respectively, and compared the results with data from 113 women who did not receive vaccination but had antibodies against the viruses in their blood because they were infected with HPV in the past.
They found that 100 percent of the women in all three groups had antibodies against HPV 16 and 18 in their blood for up to four years. Antibody levels were comparable for women receiving two doses six months apart and those receiving the full three doses.
The researchers also found that while antibody levels among women who received one dose were lower than among those who received the full three doses, the levels appeared stable, suggesting that these are lasting responses. In addition, the levels of antibodies in women from the one- and two-dose groups were five to 24 times higher than the levels of antibodies in women who did not receive vaccination, but had prior HPV infection.
"Our findings suggest promise for simplified vaccine administration schedules that might be cheaper, simpler, and more likely to be implemented around the world," said Safaeian. "Vaccination with two doses, or even one dose, could simplify the logistics and reduce the cost of vaccination, which could be especially important in the developing world, where more than 85 percent of cervical cancers occur, and where cervical cancer is one of the most common causes of cancer-related deaths."
In some parts of the world, including Chile and British Columbia, two doses of HPV vaccine is now the recommended vaccination program, according to Safaeian. But for a single HPV dose, "while our findings are quite intriguing and show promise, additional data are needed before policy guidelines can be changed," she clarified. "For instance, it is important to note that persistence of antibody responses after a single dose has not been evaluated for Gardasil, the quadrivalent HPV vaccine that is more widely used in the United States and many other countries."
This clinical trial was sponsored by the NCI with support from the National Institutes of Health Office of Research on Women's Health and the Ministry of Health of Costa Rica. The HPV vaccine was provided by GlaxoSmithKline Biologicals. Safaeian declared she has no conflicts of interest.

http://www.medscape.com/viewarticle/813756?src=rss

Pediatricians' Verbal Cues Affect Decision to Vaccinate

Approach used by physician to discuss vaccinations plays a significant role in parental choice to have their child vaccinated at that visit

Troy Brown, RN

The approach a physician uses to discuss vaccinations plays a significant role in whether or not parents choose to have their child vaccinated at that visit, according to a cross-sectional observational study in which 111 provider–parent vaccine discussions during health supervision visits were recorded and analyzed.
Douglas J. Opel, MD, MPH, an assistant professor in the Division of Bioethics and the Division of General Pediatrics, Department of Pediatrics, University of Washington School of Medicine, Seattle, and at the Treuman Katz Center for Pediatric Bioethics at Seattle Childrens Hospital, Seattle Children's Research Institute, Washington, and colleagues report their findings in an article published online November 4 in Pediatrics.
"Although the linguistic format of how a topic is introduced has received attention in other medical settings, it has not yet been explored in the context of vaccine discussions," the authors write.
The study included parents of children aged 1 to 19 months who were screened with the Parent Attitudes About Childhood Vaccines survey. Vaccine-hesitant parents (VHPs) were defined as those having a score of 50 or higher. The researchers developed a coding scheme of 15 communication practices and applied it to all patient encounters.
A provider was using a presumptive format when he or she presumed that the parent would be willing to have the child vaccinated that day (eg, "Well, we have to do some shots"). Providers who used a participatory linguistic format (eg, "What do you want to do about shots?" "Are we going to do shots today?") gave the parent more decision-making latitude.
In multivariate logistic regression analyses, the researchers controlled for parental hesitancy status and demographic and visit characteristics.
A total of 111 vaccine discussions took place between 16 providers from 9 practices, half of which included VHPs. Three fourths (74%) of providers began vaccine recommendations with presumptive vs participatory formats.
Among those who were resistant on provider initiation (41%), a significantly higher number were VHPs than non-VHPs. Parents were significantly more likely to resist vaccine recommendations if the provider used a participatory instead of a presumptive initiation format (adjusted odds ratio, 17.5; 95% confidence interval, 1.2 - 253.5).

Half of the providers handled parental resistance by repeating their original recommendations (eg, "He really needs these shots"), and when that happened, almost half (47%) of parents who were initially resistant then accepted those recommendations.
Longitudinal studies will need to be conducted with a more diverse population of parents and healthcare providers, the researchers note. "How providers initiate their vaccine recommendations at health supervision visits appears to be an important determinant of parent resistance to that recommendation," the authors write. "[I]f providers continue to pursue their original recommendation after encountering parental resistance, many parents eventually agree to it," they conclude.
The authors have disclosed no relevant financial relationships.

http://phys.org/news/2013-11-india-vies-elite-role-space.html

India vies for elite role in space with Mars trip

India is aiming to join the world's deep-space pioneers with a journey to Mars that it hopes will showcase its technological ability to travel our solar system while seeking solutions for everyday problems on Earth

India is aiming to join the world's deep-space pioneers with a journey to Mars that it hopes will showcase its technological ability to explore the solar system while seeking solutions for everyday problems on Earth.
With a Tuesday launch planned for Mangalyaan, which means "Mars craft" in Hindi, India will attempt to become only the fourth country or group of countries to reach the Red Planet, after the Soviet Union, United States and Europe.
"We have a lot to understand about the universe, the solar system where we live in, and it has been humankind's quest from the beginning," said K. Radhakrishnan, chairman of the Indian Space and Research Organization.
India sees its Martian mission primarily as a "technology demonstration," Radhakrishnan said. "We want to use the first opportunity to put a spacecraft and orbit it around Mars and, once it is there safely, then conduct a few meaningful experiments and energize the scientific community."
Radhakrishnan admits the aim is high. This is India's first Mars mission, and no country has been fully successful on its first try. More than half the world's attempts to reach Mars—23 out of 40 missions—have failed, including missions by Japan in 1999 and China in 2011. If India can pull it off, it will demonstrate a highly capable space program that belongs within an elite club of governments exploring the universe.
Mangalyaan is scheduled to blast off Tuesday from the Indian space center on the southeastern island of Shriharikota, the start of a 300-day, 780 million-kilometer (485 million-mile) journey to orbit Mars and survey its geology and atmosphere.
Five solar-powered instruments aboard Mangalyaan will gather data to help determine how Martian weather systems work and what happened to the water that is believed to have once existed on Mars in large quantities. It also will search Mars for methane, a key chemical in life processes on Earth that could also come from geological processes. None of the instruments will send back enough data to answer these questions definitively, but experts say the data are key to better understanding how planet's develop geologically, what conditions might make life possible and where else in the universe it might exist.
Some of the data will complement research expected to be conducted with a probe NASA will launch later this month, the Mars Atmosphere and Volatile Evolution mission, nicknamed MAVEN. "We're pulling for India," said Bruce Jakosky, project leader for the U.S. spacecraft. "The more players we have in space exploration the better."
Radhakrishnan said that although sending a spacecraft to Mars would bring India immense prestige, "we are doing this for ourselves. The main thrust of space science in India has always been people-centric, to benefit the common man and society."
India, as well known for its endemic poverty and hunger as for its technological prowess, has used research in space and elsewhere to help solve problems at home, from gauging water levels in underground aquifers to predicting cataclysmic storms and floods.
India's $1 billion-a-year space program has helped develop satellite, communication and remote sensing technologies that are being used to measure coastal soil erosion, assess the extent of remote flooding and manage forest cover for wildlife sanctuaries. They are giving fishermen real-time data on where to find fish and helping to predict natural disasters such as a cyclone that barreled into India's eastern coast last month. Early warning information allowed Indian officials to evacuate nearly a million people from the massive storm's path.
Indian scientists also have led at least 30 research missions to Antarctica, despite being nearly 12,000 kilometers (7,500 miles) from the icy continent. They are working to expand mineral mining in the deep sea, designating that as a priority area for scientific research. And in 2008-09 the Indian Space and Research Organization successfully launched a lunar orbiter, Chandrayaan-1, which discovered evidence of water on the Moon. Its advances have helped raise the international profile of the world's largest democracy of 1.2 billion

people. India is lobbying for a permanent seat on the U.N. Security Council, a move it says would better reflect new realities in a fast-changing world needing more technological solutions.
Mangalyaan was developed from technology tested during the recent lunar orbiter mission. An evolved version of India's domestically developed Polar Satellite Launch Vehicle, with extended rockets, will take Mangalyaan into an elliptical arc around the Earth. The satellite's thrusters will then begin a series of six small fuel burns, moving it into higher orbit before it slingshots toward the Red Planet. The 1,350-kilogram orbiter is expected to reach its designated orbit Sept. 24, 2014, and will be joined above Mars by MAVEN.
"I know I'm an absolute wreck with ours coming up in two weeks," Jakosky said. "... There are 10,000 things that need to go right in order for it to succeed, and it can take only one thing going wrong for it to fail."
Mangalyaan is expected to have at least six months to investigate the planet's landscape and atmosphere. At its closest point it will be 365 kilometers (227 miles) from the planet's surface, and at its furthest—80,000 kilometers (49,700 miles).
India's space enthusiasts say the $73 million Martian mission will be a step toward understanding the natural world, inspiring children to go into research science and advancing science and technology in ways that help common people cope with a changing environment. Learning more about alien weather systems, for example, might reveal more about our own. Finding evidence for life on other planets might help scientists discover new life forms in places on Earth previously thought inhospitable.
"To visit another planet is a fantastic thing, the biggest thing," said space scientist Yash Pal, a former chairman of the country's University Grants Commission who was not involved in developing the Mars mission. "If you can afford airplanes and war machines you can certainly spend something to fulfill the dreams of young people."

http://phys.org/news/2013-11-justice-denied.html

Justice delayed is justice denied

The Australian Centre for Justice Innovation (ACJI) at Monash University has released a new background report on the issue of timeliness in the justice system.

The aim of this work is to support the development of a framework for measuring, understanding and improving timeliness in the Australian justice system.
Director of ACJI, Professor Tania Sourdin, said the justice system was broad and what happens before people access the courts is important in terms of understanding delay.
"Often there is no systemic approach or understanding of delay," Professor Sourdin said.
There are some six to eight million complaints made in Australia each year, ranging from family, workplace and financial services to accident compensation matters.
While more than 600,000 dispute matters are dealt with outside the court system, the remainder are brought forward in court.
Professor Sourdin said delay in the system is the result of cultural factors as well as other reasons, including complexity.
"There have been many attempts to reduce the time taken to resolve disputes. However, some disputes can take months or years to resolve," Professor Sourdin said.
"The financial, social and emotional costs of resolving disputes escalate the longer they run. For many, justice delayed is justice denied."
The report develops a broad framework within which to examine timeliness across the entire justice system. It explores definitions and measures of timeliness in the justice system and examines the strategies and innovations that have been used both in Australia and internationally to improve timeliness.
"Time is a relative concept. We need a new approach in Australia to allow us to answer the key question of how long is too long for a dispute to be resolved," Professor Sourdin.
"We also need to make sure we make improvements using a solid evidence base and ensuring that people across the system receive quality outcomes in a reasonable timeframe."
More information: www.law.monash.edu.au/centres/acji/projects/timeliness/