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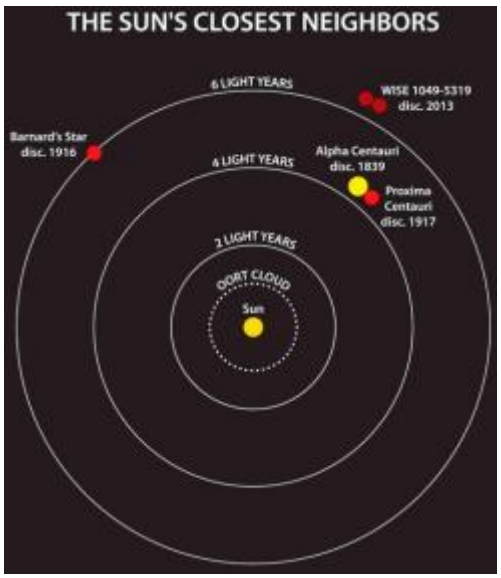
The closest star system found in a century

A pair of newly discovered stars is the third-closest star system to the Sun, according to a paper that will be published in Astrophysical Journal Letters.



This diagram illustrates the locations of the star systems that are closest to the Sun. The year when each star was discovered to be a neighbor of the Sun is indicated. The binary system WISE J104915.57-531906 is the third nearest system to the Sun, and the closest one found in a century. **Credit: Janella Williams, Penn State University.**

The duo is the closest star system discovered since 1916. The discovery was made by Kevin Luhman, an associate professor of astronomy and astrophysics at Penn State University and a researcher in Penn State's Center for Exoplanets and Habitable Worlds. Both stars in the new binary system are "brown dwarfs," which are stars that are too small in mass to ever become hot enough to ignite hydrogen fusion. As a result, they are very cool and dim, resembling a giant planet like Jupiter more than a bright star like the Sun.

"The distance to this brown dwarf pair is 6.5 light years -- so close that Earth's television transmissions from 2006 are now arriving there," Luhman said. "It will be an excellent hunting ground for planets because it is very close to Earth, which makes it a lot easier to see any planets orbiting either of the brown dwarfs." Since it is the third-closest star system, in the distant future it might be one of the first destinations for manned expeditions outside our solar system, Luhman said.

The star system is named "WISE J104915.57-531906" because it was discovered in a map of the entire sky obtained by the NASA-funded Wide-field Infrared Survey Explorer (WISE) satellite. It is only slightly farther away than the second-closest star, Barnard's star, which was discovered 6.0 light years from the Sun in 1916. The closest star system consists of Alpha Centauri, found to be a neighbor of the Sun in 1839 at 4.4 light years, and the fainter Proxima Centauri, discovered in 1917 at 4.2 light years.

Edward (Ned) Wright, the principal investigator for the WISE satellite, said "One major goal when proposing WISE was to find the closest stars to the Sun. WISE 1049-5319 is by far the closest star found to date using the WISE data, and the close-up views of this binary system we can get with big telescopes like Gemini and the future James Webb Space Telescope will tell us a lot about the low mass stars known as brown dwarfs." Wright is the David Saxon Presidential Chair in Physics and a professor of physics and astronomy at UCLA.

Astronomers have long speculated about the possible presence of a distant, dim object orbiting the Sun, which is sometimes called Nemesis. However, Luhman has concluded, "we can rule out that the new brown dwarf system is such an object because it is moving across the sky much too fast to be in orbit around the Sun."

To discover the new star system, Luhman studied the images of the sky that the WISE satellite had obtained during a 13-month period ending in 2011. During its mission, WISE observed each point in the sky 2 to 3 times. "In these time-lapse images, I was able to tell that this system was moving very quickly across the sky -- which was a big clue that it was probably very close to our solar system," Luhman said.

After noticing its rapid motion in the WISE images, Luhman went hunting for detections of the suspected nearby star in older sky surveys. He found that it indeed was detected in images spanning from 1978 to 1999 from the Digitized Sky Survey, the Two Micron All-Sky Survey, and the Deep Near Infrared Survey of the Southern Sky. "Based on how this star system was moving in the images from the WISE survey, I was able to extrapolate back in time to predict where it should have been located in the older surveys and, sure enough, it was there," Luhman said.

By combining the detections of the star system from the various surveys, Luhman was able to measure its distance via parallax, which is the apparent shift of a star in the sky due to the Earth's orbit around the Sun. He then used the Gemini South telescope on Cerro Pachón in Chile to obtain a spectrum of it, which demonstrated that it had a very cool temperature, and hence was a brown dwarf. "As an unexpected bonus, the sharp images from Gemini also revealed that the object actually was not just one but a pair of brown dwarfs orbiting each other," Luhman said.

"It was a lot of detective work," Luhman said. "There are billions of infrared points of light across the sky, and the mystery is which one -- if any of them -- could be a star that is very close to our solar system."

This research received financial support with a grant from the NASA Astrophysics Data Analysis Program (#NNX12AI47G). The Center for Exoplanets and Habitable Worlds is supported by Penn State University, the Penn State Eberly College of Science, and the Pennsylvania Space Grant Consortium.

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Hope for threatened Tasmanian devils

Research paves way for the development of a vaccine for the contagious cancer which is driving Tasmanian devils to the brink of extinction

New research paves the way for the development of a vaccine for the Tasmanian devil, currently on the brink of extinction because of a contagious cancer.

It has been less than two decades since scientists discovered the contagious cancer devil facial tumour disease (DFTD) which causes 100 per cent mortality in the endangered marsupials. The facial cancer, which spreads when the devils bite each other's faces during fighting, kills its victims in a matter of months. As it has already wiped out the majority of the population with sightings of devils reduced by 85 per cent, scientists are desperate to find out more about the mysterious cancer which somehow manages to evade the devils' immune system.

Until now, scientists have believed that the tumours were able to avoid detection by the immune system because the Tasmanian devils have very little genetic diversity (preventing the immune system from recognising the tumour as foreign). However, a University of Cambridge led collaboration with the Universities of Tasmania, Sydney and South Denmark has discovered that the explanation is more complex.

On the surface of nearly every mammalian cell are major histocompatibility complex (MHC) molecules. These molecules enable the immune system to determine if a cell is friend or foe, triggering an immune response if the cell is foreign and a potential threat. The new research, published today, 11 March, in the journal PNAS, reveals that DFTD cancer cells lack these critical molecules, thereby avoiding detection by the devils' immune system.

Professor Jim Kaufman, from the University of Cambridge's Department of Pathology, said: "Once it was found that the cancer was escaping from the devils' immune system, scientists needed to figure out how."

The researchers found that the DFTD cells have lost the expression of MHC molecules, but that the genes that code for these molecules are still intact. This means that these genes could potentially be turned back on. Indeed, the scientists showed that by introducing signalling molecules such as interferon-gamma, a protein which triggers the immune response, the DFTD cells can be forced to express MHC molecules.

Dr Hannah Siddle, lead author of the paper from the University of Cambridge, said: "Developing a vaccine based on our research could tip the balance in the favour of the devil and give them a fighting chance."

"However, we still face some hurdles. The tumour is evolving over time and any vaccine programme would have to take this into consideration. Also, because of the difficulties of vaccinating a wild population, it may be more efficient to use a vaccine in the context of returning captive devils to the wild."

Although the only other contagious cancer has been found in dogs (canine transmissible venereal cancer), the rapid development of DFTD highlights how quickly they can emerge.

Professor Kaufman added: "Our study has implications beyond the Tasmanian devil. Sooner or later a human strain of contagious cancer will develop, and this work gives us insight into how these diseases emerge and evolve."

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Digital records could expose intimate details and personality traits of millions

Surprisingly accurate estimates of Facebook users' personal details can be inferred from automated analysis of only their Facebook Likes

New research, published today in the journal PNAS, shows that surprisingly accurate estimates of Facebook users' race, age, IQ, sexuality, personality, substance use and political views can be inferred from automated analysis of only their Facebook Likes - information currently publicly available by default.

In the study, researchers describe Facebook Likes as a "generic class" of digital record - similar to web search queries and browsing histories - and suggest that such techniques could be used to extract sensitive information for almost anyone regularly online.

Researchers at Cambridge's Psychometrics Centre, in collaboration with Microsoft Research Cambridge, analysed a dataset of over 58,000 US Facebook users, who volunteered their Likes, demographic profiles and psychometric testing results through the myPersonality application. Users opted in to provide data and gave consent to have profile information recorded for analysis.

Facebook Likes were fed into algorithms and corroborated with information from profiles and personality tests. Researchers created statistical models able to predict personal details using Facebook Likes alone.

Models proved 88% accurate for determining male sexuality, 95% accurate distinguishing African-American from Caucasian American and 85% accurate differentiating Republican from Democrat. Christians and Muslims were correctly classified in 82% of cases, and good prediction accuracy was achieved for relationship status and substance abuse – between 65 and 73%.
But few users clicked Likes explicitly revealing these attributes. For example, less that 5% of gay users clicked obvious Likes such as Gay Marriage. Accurate predictions relied on 'inference' - aggregating huge amounts of less informative but more popular Likes such as music and TV shows to produce incisive personal profiles.
Even seemingly opaque personal details such as whether users' parents separated before the user reached the age of 21 were accurate to 60%, enough to make the information "worthwhile for advertisers", suggest the researchers.
While they highlight the potential for personalised marketing to improve online services using predictive models, the researchers also warn of the threats posed to users' privacy. They argue that many online consumers might feel such levels of digital exposure exceed acceptable limits - as corporations, governments, and even individuals could use predictive software to accurately infer highly sensitive information from Facebook Likes and other digital 'traces'.
The researchers also tested for personality traits including intelligence, emotional stability, openness and extraversion. While such latent traits are far more difficult to gauge, the accuracy of the analysis was striking. Study of the openness trait – the spectrum of those who dislike change to those who welcome it – revealed that observation of Likes alone is roughly as informative as using an individual's actual personality test score.
Some Likes had a strong but seemingly incongruous or random link with a personal attribute, such as Curly Fries with high IQ, or That Spider is More Scared Than U Are with non-smokers.
When taken as a whole, researchers believe that the varying estimations of personal attributes and personality traits gleaned from Facebook Like analysis alone can form surprisingly accurate personal portraits of potentially millions of users worldwide.
They say the results suggest a possible revolution in psychological assessment which – based on this research – could be carried out at an unprecedented scale without costly assessment centres and questionnaires.
"We believe that our results, while based on Facebook Likes, apply to a wider range of online behaviours." said Michal Kosinski, Operations Director at the Psychometric Centre, who conducted the research with his Cambridge colleague David Stillwell and Thore Graepel from Microsoft Research.
"Similar predictions could be made from all manner of digital data, with this kind of secondary 'inference' made with remarkable accuracy - statistically predicting sensitive information people might not want revealed. Given the variety of digital traces people leave behind, it's becoming increasingly difficult for individuals to control.
"I am a great fan and active user of new amazing technologies, including Facebook. I appreciate automated book recommendations, or Facebook selecting the most relevant stories for my newsfeed," said Kosinski.
"However, I can imagine situations in which the same data and technology is used to predict political views or sexual orientation, posing threats to freedom or even life." "Just the possibility of this happening could deter people from using digital technologies and diminish trust between individuals and institutions – hampering technological and economic progress. Users need to be provided with transparency and control over their information."
Thore Graepel from Microsoft Research said he hoped the research would contribute to the on-going discussions about user privacy:
"Consumers rightly expect strong privacy protection to be built into the products and services they use and this research may well serve as a reminder for consumers to take a careful approach to sharing information online, utilising privacy controls and never sharing content with unfamiliar parties."
David Stillwell from Cambridge University added: "I have used Facebook since 2005, and I will continue to do so. But I might be more careful to use the privacy settings that Facebook provides."

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University of Maryland School of Medicine discovers adaptations to explain strategies for survival on Mars

Scientists found differences in core proteins from a microorganism that lives in a salty lake in Antarctica

Research from the University of Maryland School of Medicine has revealed key features in proteins needed for life to function on Mars and other extreme environments. The researchers, funded by NASA, studied organisms that survive in the extreme environment of Antarctica. They found subtle but significant differences between the core proteins in ordinary organisms and Haloarchaea, organisms that can tolerate severe conditions such as

high salinity, desiccation, and extreme temperatures. The research gives scientists a window into how life could possibly adapt to exist on Mars.

The study, published online in the journal PLoS One on March 11, was led by Shiladitya DasSarma, Ph.D., Professor in the Department of Microbiology and Immunology at the University of Maryland School of Medicine and a research scientist at the Institute of Marine and Environmental Technology.

Researchers found that Haloarchaeal microbes contain proteins that are acidic, with their surface covered with negatively charged residues. Most ordinary organisms contain proteins that are neutral on average. The negative charges found in the unusual organisms keep proteins in solution and help to hold on tightly to water, reversing the effects of high salinity and desiccation.

In the current study, the scientists identified additional subtle changes in the proteins of one Haloarchaeal species named Halorubrum lacusprofundi. These microbes were isolated from Deep Lake, a very salty lake in Antarctica. The changes found in proteins from these organisms allow them to work in both cold and salty conditions, when temperatures may be well below the freezing point of pure water. Water stays in the liquid state under these conditions much like snow and ice melt on roads that have been salted in winter.

"In such cold temperatures, the packing of atoms in proteins must be loosened slightly, allowing them to be more flexible and functional when ordinary proteins would be locked into inactive conformations" says Dr. DasSarma. "The surface of these proteins also have modifications that loosen the binding of the surrounding water molecules."

"These kinds of adaptations are likely to allow microorganisms like Halorubrum lacusprofundi to survive not only in Antarctica, but elsewhere in the universe," says Dr. DasSarma. "For example, there have been recent reports of seasonal flows down the steep sides of craters on Mars suggesting the presence of underground brine pools. Whether microorganisms actually exist in such environments is not yet known, but expeditions like NASA's Curiosity rover are currently looking for signs of life on Mars."

"Dr. DasSarma and his colleagues are unraveling the basic building blocks of life," says E. Albert Reece, M.D., Ph.D., M.B.A., Vice President for Medical Affairs at the University of Maryland and John Z. and Akiko K. Bowers Distinguished Professor and Dean of the University of Maryland School of Medicine. "Their research into the fundamentals of microbiology are enhancing our understanding of life throughout the universe, and I look forward to seeing further groundbreaking discoveries from their laboratory."

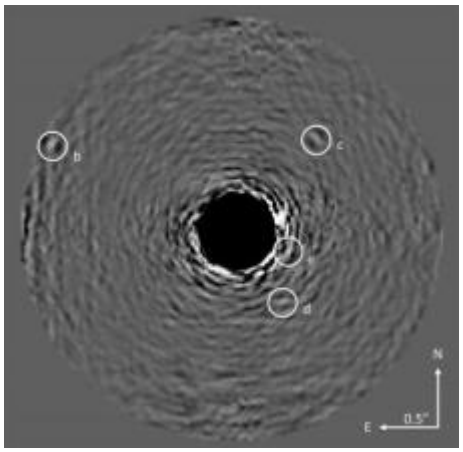
Dr. DasSarma and his colleagues are conducting further studies of individual proteins from Halorubrum lacusprofundi, funded by NASA. The adaptations of these proteins could be used to engineer and develop novel enzymes and catalysts. For example, the researchers are examining one model protein, β-galactosidase, that can break down polymerized substances, such as milk sugars, and with the help of other enzymes, even larger polymers. This work may have practical uses such as improving methods for breaking down biological polymers and producing useful materials (see Karan et al. BMC Biotechnology 2013 13:3 http://www.biomedcentral.com/1472-6750/13/3).

http://www.eurekalert.org/pub_releases/2013-03/amon-acf031113.php

Astronomers conduct first remote reconnaissance of another solar system

Project 1640 reveals chemical composition of four red expplanets 128 light years away

Researchers have conducted a remote reconnaissance of a distant solar system with a new telescope imaging system that sifts through the blinding light of stars. Using a suite of high-tech instrumentation and software called Project 1640, the scientists collected the first chemical fingerprints, or spectra, of this system's four red exoplanets, which orbit a star 128 light years away from Earth. A detailed description of the planets - showing how drastically different they are from the known worlds in the universe - was accepted Friday for publication in The Astrophysical Journal.



"An image is worth a thousand words, but a spectrum is worth a million," said lead author Ben R. Oppenheimer, associate curator and chair of the Astrophysics Department at the American Museum of Natural History. Oppenheimer is the principal investigator for Project 1640, which uses the Hale telescope at the Palomar Observatory in California. The project involves researchers from the California Institute of Technology, NASA's Jet Propulsion Laboratory, Cambridge University, New York University, and the Space Telescope Science Institute, in addition to Oppenheimer's team at the Museum.

This image of the HR 8799 planets was taken with starlight optically suppressed and data processing conducted to remove residual starlight. The star is at the center of the blackened circle in the image. The four spots indicated with the letters b through e are the planets. This is a composite image using 30 wavelengths of light and was obtained over a period of 1.25 hours on June 14 and 15, 2012. **Credit: Courtesy of Project 1640**

The planets surrounding the star of this study, HR 8799, have been imaged in the past. But except for a partial measurement of the outermost planet in the system, the star's bright light overwhelmed previous attempts to study the planets with spectroscopy, a technique that splits the light from an object into its component colors - as a prism spreads sunlight into a rainbow. Because every chemical, such as carbon dioxide, methane, or water, has a unique light signature in the spectrum, this technique is able to reveal the chemical composition of a planet's atmosphere.

"In the 19th century it was thought impossible to know the composition of stars, but the invention of astronomical spectroscopy has revealed detailed information about nearby stars and distant galaxies," said Charles Beichman, executive director of the NASA Exoplanet Science Institute at the California Institute of Technology. "Now, with Project 1640, we are beginning to turn this tool to the investigation of neighboring exoplanets to learn about the composition, temperature, and other characteristics of their atmospheres."

With this system, the researchers are the first to determine the spectra of all four planets surrounding HR 8799. "It's fantastic to nab the spectra of four planets in a single observation," said co-author Gautam Vasisht, an astronomer at the Jet Propulsion Laboratory.

The results are "quite strange," Oppenheimer said. "These warm, red planets are unlike any other known object in our universe. All four planets have different spectra, and all four are peculiar. The theorists have a lot of work to do now."

One of the most striking abnormalities is an apparent chemical imbalance. Basic chemistry predicts that ammonia and methane should naturally coexist in varying quantities unless they are in extremely cold or hot environments. Yet the spectra of the HR 8799 planets, all of which have "lukewarm" temperatures of about 1000 Kelvin (1340 degrees Fahrenheit), either have methane or ammonia, with little or no signs of their chemical partners. Other chemicals such as acetylene, previously undiscovered on any exoplanet, and carbon dioxide may be present as well.

The planets also are "redder," meaning that they emit longer wavelengths of light, than celestial objects with similar temperatures. This could be explained by significant but patchy cloud cover on the planets, the authors say.

With 1.6 times the mass and five times the brightness, HR 8799 itself is very different from our Sun. The brightness of the star can vary by as much as 8 percent over a period of two days and produces about 1,000 times more ultraviolet light than the Sun. All of these factors could impact the spectral fingerprints of the planets, possibly inducing complex weather and sooty hazes that could be revealed by periodic changes in the spectra. More data is needed to further explore this solar system's unusual characteristics.

"The spectra of these four worlds clearly show that they are far too toxic and hot to sustain life as we know it," said co-author Ian Parry, a senior lecturer at the Institute of Astronomy, Cambridge University. "But the really exciting thing is that one day, the techniques we've developed will give us our first secure evidence of the existence of life on a planet outside our solar system."

In addition to revealing unique planets, the research debuts a new capability to observe and rapidly characterize exoplanetary systems in a routine manner, something that has eluded astronomers until now because the light that stars emit is tens of millions to billions of times brighter than the light given off by planets. This makes directly imaging and analyzing exoplanets extremely difficult: as Oppenheimer says, "It's like taking a single picture of the Empire State Building from an airplane that reveals the height of the building as well as taking a picture of a bump on the sidewalk next to it that is as high as a couple of bacteria."

Project 1640 helps scientists clear this hurdle by sharpening and darkening a star's light. This technical advance involves the coordinated operation of four major instruments: the world's most advanced adaptive optics system, which can make millions of tiny adjustments to the device's two 6-inch mirrors every second; a coronagraph that optically dims the star but not other celestial objects in the field of view; an imaging spectrograph that records 30 images in a rainbow of colors simultaneously; and a specialized wave front sensor that distinguishes between residual starlight that sneaks through the coronagraph and the light from planets, allowing scientists to filter out background starlight more effectively.

Altogether, the project has produced images of celestial objects 1 million to 10 million times fainter than the star at the center of the image, with only an hour of observations. It is also capable of measuring orbital motion of objects.

"Astronomers are now able to monitor cloudy skies on extrasolar planets, and for the first time, they have made such observations for four planets at once," said Maria Womack, program director for the Division of Astronomical Sciences at the National Science Foundation. "This new ability enables astronomers to now make comparisons as they track the atmospheres, and maybe even weather patterns, on the planets."

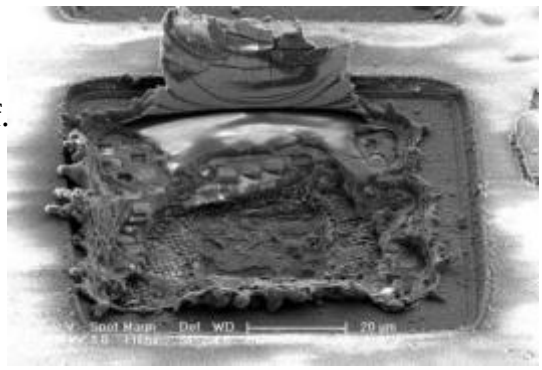
Researchers are already collecting more data on this system to look for changes in the planets over time, as well as surveying other young stars. During its three-year survey at Palomar, which started in June 2012, Project 1640 aims to survey 200 stars within about 150 light years of our solar system.
"The variation in the spectra of the four planets is really intriguing," said Didier Saumon, an astronomer at Los Alamos National Laboratory who was not involved in this study. "Perhaps this shouldn't be too surprising, given that the four gaseous planets of the solar system are all different. The hundreds of known exoplanets have forced us to broaden our thinking, and this new data keeps pushing that envelope."
This work is supported by the National Science Foundation (grant numbers AST-0215793, 0334916, 0520822, 0619922, 0804417, 1039790, and 1245018), NASA Origins of the Solar System Grant (number NMO7100830/102190), and the Plymouth Hill foundation. Additional funding sources for Project 1640 are listed here.

http://www.eurekalert.org/pub_releases/2013-03/ciot-cis031113.php

Creating indestructible self-healing circuits

Caltech engineers build electronic chips that repair themselves

PASADENA, Calif. - Imagine that the chips in your smart phone or computer could repair and defend themselves on the fly, recovering in microseconds from problems ranging from less-than-ideal battery power to total transistor failure. It might sound like the stuff of science fiction, but a team of engineers at the California Institute of Technology (Caltech), for the first time ever, has developed just such self-healing integrated chips.
The team, made up of members of the High-Speed Integrated Circuits laboratory in Caltech's Division of Engineering and Applied Science, has demonstrated this self-healing capability in tiny power amplifiers. The amplifiers are so small, in fact, that 76 of the chips - including everything they need to self-heal - could fit on a single penny. In perhaps the most dramatic of their experiments, the team destroyed various parts of their chips by zapping them multiple times with a high-power laser, and then observed as the chips automatically developed a work-around in less than a second.



"It was incredible the first time the system kicked in and healed itself. It felt like we were witnessing the next step in the evolution of integrated circuits," says Ali Hajimiri, the Thomas G. Myers Professor of Electrical Engineering at Caltech. "We had literally just blasted half the amplifier and vaporized many of its components, such as transistors, and it was able to recover to nearly its ideal performance." The team's results appear in the March issue of IEEE Transactions on Microwave Theory and Techniques.

Some of the damage Caltech engineers intentionally inflicted on their self-healing power amplifier using a high-power laser. The chip was able to recover from complete transistor destruction. This image was captured with a scanning electron microscope. **Credit: Jeff Chang and Kaushik Dasgupta/Caltech**

Until now, even a single fault has often rendered an integrated-circuit chip completely useless. The Caltech engineers wanted to give integrated-circuit chips a healing ability akin to that of our own immune system - something capable of detecting and quickly responding to any number of possible assaults in order to keep the larger system working optimally. The power amplifier they devised employs a multitude of robust, on-chip sensors that monitor temperature, current, voltage, and power. The information from those sensors feeds into a custom-made application-specific integrated-circuit (ASIC) unit on the same chip, a central processor that acts as the "brain" of the system. The brain analyzes the amplifier's overall performance and determines if it needs to adjust any of the system's actuators - the changeable parts of the chip.
Interestingly, the chip's brain does not operate based on algorithms that know how to respond to every possible scenario. Instead, it draws conclusions based on the aggregate response of the sensors. "You tell the chip the results you want and let it figure out how to produce those results," says Steven Bowers, a graduate student in Hajimiri's lab and lead author of the new paper. "The challenge is that there are more than 100,000 transistors on each chip. We don't know all of the different things that might go wrong, and we don't need to. We have designed the system in a general enough way that it finds the optimum state for all of the actuators in any situation without external intervention."
Looking at 20 different chips, the team found that the amplifiers with the self-healing capability consumed about half as much power as those without, and their overall performance was much more predictable and reproducible. "We have shown that self-healing addresses four very different classes of problems," says Kaushik Dasgupta, another graduate student also working on the project. The classes of problems include static variation that is a product of variation across components; long-term aging problems that arise gradually as repeated use changes the internal properties of the system; and short-term variations that are induced by

environmental conditions such as changes in load, temperature, and differences in the supply voltage; and, finally, accidental or deliberate catastrophic destruction of parts of the circuits.
The Caltech team chose to demonstrate this self-healing capability first in a power amplifier for millimeter-wave frequencies. Such high-frequency integrated chips are at the cutting edge of research and are useful for next-generation communications, imaging, sensing, and radar applications. By showing that the self-healing capability works well in such an advanced system, the researchers hope to show that the self-healing approach can be extended to virtually any other electronic system.
"Bringing this type of electronic immune system to integrated-circuit chips opens up a world of possibilities," says Hajimiri. "It is truly a shift in the way we view circuits and their ability to operate independently. They can now both diagnose and fix their own problems without any human intervention, moving one step closer to indestructible circuits."
Along with Hajimiri, Bowers, and Dasgupta, former Caltech postdoctoral scholar Kaushik Sengupta (PhD '12), who is now an assistant professor at Princeton University, is also a coauthor on the paper, "Integrated Self-Healing for mm-Wave Power Amplifiers." A preliminary report of this work won the best paper award at the 2012 IEEE Radio Frequency Integrated Circuits Symposium. The work was funded by the Defense Advanced Research Projects Agency and the Air Force Research Laboratory.

http://www.bbc.co.uk/news/health-21702647

Analysis: Antibiotic apocalypse

A terrible future could be on the horizon, a future which rips one of the greatest tools of medicine out of the hands of doctors.

By James Gallagher Health and science reporter, BBC News

A simple cut to your finger could leave you fighting for your life. Luck will play a bigger role in your future than any doctor could. The most basic operations - getting an appendix removed or a hip replacement - could become deadly. Cancer treatments and organ transplants could kill you. Childbirth could once again become a deadly moment in a woman's life. It's a future without antibiotics.
This might read like the plot of science fiction novel - but there is genuine fear that the world is heading into a post-antibiotic era. The World Health Organization has warned that "many common infections will no longer have a cure and, once again, could kill unabated". The US Centers of Disease Control has pointed to the emergence of "nightmare bacteria". And the chief medical officer for England Prof Dame Sally Davies has evoked parallels with the "apocalypse".
Antibiotics kill bacteria, but the bugs are incredibly wily foes. Once you start treating them with a new drug, they find ways of surviving. New drugs are needed, which they then find ways to survive.

Warning from the father of antibiotics

Sir Alexander Fleming made one of the single greatest contributions to medicine when he discovered antibiotics. He noticed that mould growing on his culture dishes had created a ring free of bacteria, he'd found penicillin. It was the stuff of Nobel Prizes, but in 1945 the spectre of resistance was already there.
In his winner's lecture he said: "It is not difficult to make microbes resistant to penicillin in the laboratory by exposing them to concentrations not sufficient to kill them, and the same thing has occasionally happened in the body. "The time may come when penicillin can be bought by anyone in the shops. "Then there is the danger that the ignorant man may easily underdose himself and by exposing his microbes to non-lethal quantities of the drug make them resistant."

Deadly

As long as new drugs keep coming, resistance is not a problem. But there has not been a new class of antibiotics discovered since the 1980s. This is now a war, and one we are in severe danger of losing.
Antibiotics are more widely used than you might think and a world without antibiotics would be far more dangerous. They made deadly infections such as tuberculosis treatable, but their role in healthcare is far wider than that.
Surgery that involves cutting open the body poses massive risks of infection. Courses of antibiotics before and after surgery have enabled doctors to perform operations that would have been deadly before.
Cancer treatments such as chemotherapy and radiotherapy can damage the immune system. A course of antibiotics is prescribed to provide a much-needed boost alongside your body's own defences.
Anyone with an organ transplant faces a lifetime of drugs to suppress the immune system, otherwise it attacks the transplant, so antibiotics are used to protect the body.
"It's a pretty grim future, I think a lot of major surgery would be seriously threatened," said Prof Richard James from the University of Nottingham. "I used to show

students pictures of people being treated for tuberculosis in London - it was just a row of beds outside a hospital, you lived or you died - the only treatment was fresh air." And this, he says, is what running out of drugs for tuberculosis would look like in the future. But this is all in the future isn't it?
"My lab is seeing an increasing number of resistant strains year on year," said Prof Neil Woodford, from the Health Protection Agency's antimicrobial resistance unit.

Down to luck

He said most cases were resistant to some drugs, known as multi-drug resistant strains, but there were a few cases of pan-drug resistant strains which no antibiotic can touch. Prof Woodford said the worst case scenario would "be like the world in the 1920s and 30s". "You could be gardening and prick your finger on a rose bush, get a bacterial infection and go into hospital and doctors can't do anything to save your life. You live or die based on chance. "But for many infections that wouldn't happen."
Opportunistic infections - those that often hit the elderly when they are already ill and vulnerable in hospital - are one of the main concerns. Prof Woodford says the greatest threat in the UK is Enterobacteriaceae - opportunistic bugs that live in the gut such as E. coli and Klebsiella. They are now the most common form of hospital acquired infection and they show rising levels of resistance.
The number of tests coming back with resistance to carbapenems, one of the most powerful groups of antibiotics, has soared from a handful of cases in 2003 to more than 300 cases by 2010.
It has also raised concerns about the sexually transmitted disease gonorrhoea which is becoming increasingly difficult to treat. Around the world, multi-drug resistant and extremely-drug resistant tuberculosis - meaning only a couple of drugs still work - is a growing problem.

Global problem

Relatively speaking the UK is doing well. "A world without antibiotics has happened in some countries," says Prof Timothy Walsh, from Cardiff University.
He was part of the team that identified one of the new emerging threats in south Asia - NDM-1. This gene gives resistance to carbapenems and has been found in E. coli and Klebsiella. "Antibiotic resistance in some parts of the world is like a slow tsunami, we've known it's coming for years and we're going to get wet," he said.
New Dehli Metallo-beta-lactamase-1 (NDM-1) is thought to have emerged in India where poor sanitation and antibiotic use have helped resistance spread. But due to international travel, cases have been detected around the world including in the UK.
This highlights one of the great problems with attempting to prevent an antibiotic catastrophe - how much can one country do? There are wide differences in how readily antibiotics are used around the world. They are prescription-only drugs in some countries and available over the counter in others.

Economic impact

There are still question about doctors giving antibiotics to patients with viral infections like the common cold - antibiotics do nothing against viruses. Europe has banned the use of antibiotics to boost the growth of livestock as it can contribute to resistance. But the practice is common in many parts of the world and there is a similar issue with fish farms. Prof Laura Piddock, from Birmingham University and the group Antibiotic Action, said: "These are valuable drugs and we need to use them carefully."
Some people have even suggested that antibiotics need to be far more expensive - something more like the price of new cancer drugs - in order for them to be used appropriately.
The doomsday scenario is on the horizon, but that does not mean it will come to pass. A renewed focus on developing new antibiotics and using the ones that still work effectively would change the picture dramatically. But if it does happen, the impact on society will be significant.
Prof Piddock said: "Every time we can't treat an infection, a patient spends longer in hospital and there is the economic impact of not being in education or work. "The consequences are absolutely massive, that's actually something people have not quite grasped."

http://www.sciencedaily.com/releases/2013/03/130311101649.htm

Coffee and Tea During Pregnancy Affect Fetal Growth

Drinking just two cups of coffee a day is associated with the risk of low birth weight.

Researchers at Sahlgrenska Academy, University of Gothenburg, Sweden, have conducted a study on 59,000 women in collaboration with the Norwegian Institute of Public Health.
Expectant mothers who consume caffeine, usually by drinking coffee, are more likely to have babies with lower birth weight than anticipated, given their gestational age. Researchers at Sahlgrenska Academy, University of Gothenburg, conducted a study on 59,000 pregnant Norwegian women in collaboration with the Norwegian Institute of Public Health.

"The correlation between intake of caffeine and fetal growth was established even among women who followed the official recommendation that they limit caffeine consumption to 200 milligrams a day (two cups of coffee)," researcher Verena Sengpiel says. The medical term used in this connection is "small for gestational age" (SGA), which is associated with an elevated risk of morbidity and death.
The new results are consistent with previous international studies but are based on a considerably larger cohort. The participants were healthy and had uncomplicated pregnancies until delivery, while the results were adjusted for age, smoking, body mass index, nicotine consumption, alcohol use and other variables that affect fetal growth.
"We need to stress that our study did not examine whether caffeine is the specific mechanism substance by which responsible for the fetus is being at greater risk of low birth weight," Ms. Sengpiel says. "Nor did we look at whether these babies actually had special health problems during the neonatal period. Additional research is needed before we can say for sure what our finding actually means for pregnant women and their babies."
The other purpose of the study, which is being published in BMC Medicine, was to determine whether women who consumed caffeine during pregnancy were more likely to give birth prematurely. Such a correlation could not be established. The research team is hoping to conduct more in-depth studies about the cause-effect relationship between caffeine use and SGA, as well as any correlation between SGA and neonatal morbidity and death.

http://www.wired.com/wiredscience/2013/03/fireproof-dna/

Can't Burn This: DNA Shows Surprising Flame-Retardant Properties

In addition to building organisms and storing Shakespeare's sonnets, DNA could also keep your favorite nerd-shirt from going up in flames.

By Nadia Drake

Normally, cotton fabrics are highly flammable. But when scientists tried to set fire to cotton coated with herring sperm DNA, the fabric refused to burn, the team reported in Journal of Materials Chemistry A.
"DNA can be considered as a natural flame retardant and suppressant," said materials scientist Giulio Malucelli, whose lab at Italy's Politecnico di Torino, Alessandria branch, tested the fire-retardant properties of DNA. "It could work also on other synthetic fabrics, or thin or thick plastic films."
Malucelli's lab tested whether the macromolecule could stop fires by using DNA extracted from herring sperm. The team dissolved the DNA in water, coated cotton fabrics with it, let them dry, and tried to light them up. The coating behaved similarly to ammonium polyphosphate, a flame retardant commonly used on polymeric materials such as polyurethanes (found in foams and Spandex) and polyolefins (found in flexible foams and electrical insulation).
DNA's chemical structure makes it ideal for the flame-stopping job. When heated, its phosphate-containing backbone produces phosphoric acid, which chemically removes water from cotton fibers while leaving behind a flame-resistant, carbon-rich residue. The nitrogen-containing bases release ammonia - which dilutes flammable gases and inhibits combustion reactions - and can act as "blowing agents," which help turn the carbon-rich deposits into a slow-burning protective layer. Ultimately, these ingredients stop combustion by forming either a carbon-rich foam, or a protective, glassy carbon coating called char.
"I was surprised, and then as I looked at the chemical structure of DNA, it started to become obvious why DNA works as a fire retardant," said Alexander Morgan, a flame retardant materials scientist at the University of Dayton Research Institute. "You probably get a mix of the glassy carbon and carbon foam forming during burning of DNA on the fabric."
As a naturally occurring compound, DNA could conceivably be a good green alternative to conventional flame retardants, with a few modifications. First, the cost needs to come down, Morgan says, since it's between three and five times more expensive than current chemicals. And the toxicological profile needs to be determined. Though it's a natural substance, Morgan notes the possibility that other organisms - including the wearer of DNA-coated attire - could pick up foreign fragments as the DNA breaks down.
Malucelli thinks that's unlikely. "To the best of our knowledge, DNA is not toxic at all," Malucelli said. "Its application as flame retardant should not be harmful."
Perhaps most problematically, for the time being, you can't wash a DNA-coated nerd-shirt. The coating is not yet water resistant and will rinse off in the wash. So far, scientists haven't yet worked out how to make the treatment more permanent. But Malucelli and his colleagues are investigating a chemical cross-linking strategy, which would bind individual DNA strands to the fabric and to each other, creating a giant, insoluble matrix.
"This is a key open issue that has to be solved," he said.

Citation: J. Alongi, R.A. Carletto, A. Di Blasio, F. Carosio, F. Bosco and G. Malucelli. DNA: A novel, green, natura flame retardant and suppressant for cotton. Journal of Materials Chemistry A. doi: 1.1039/c3ta00107e

http://www.sciencedaily.com/releases/2013/03/130311173347.htm

Sleep Discovery Could Lead to Therapies That Improve Memory

Researchers have confirmed mechanism enabling brain to consolidate memory and found a commonly prescribed sleep aid enhances the process

A team of sleep researchers led by UC Riverside psychologist Sara C. Mednick has confirmed the mechanism that enables the brain to consolidate memory and found that a commonly prescribed sleep aid enhances the process. Those discoveries could lead to new sleep therapies that will improve memory for aging adults and those with dementia, Alzheimer's and schizophrenia.

The groundbreaking research appears in a paper, "The Critical Role of Sleep Spindles in Hippocampal-Dependent Memory: A Pharmacology Study," published in the Journal of Neuroscience.

Earlier research found a correlation between sleep spindles -- bursts of brain activity that last for a second or less during a specific stage of sleep -- and consolidation of memories that depend on the hippocampus. The hippocampus, part of the cerebral cortex, is important in the consolidation of information from short-term to long-term memory, and spatial navigation. The hippocampus is one of the first regions of the brain damaged by Alzheimer's disease.

Mednick and her research team demonstrated, for the first time, the critical role that sleep spindles play in consolidating memory in the hippocampus, and they showed that pharmaceuticals could significantly improve that process, far more than sleep alone.

In addition to Mednick the research team includes: Elizabeth A. McDevitt, UC San Diego; James K. Walsh, VA San Diego Healthcare System, La Jolla, Calif; Erin Wamsley, St. Luke's Hospital, St. Louis, Mo.; Martin Paulus, Stanford University; Jennifer C. Kanady, Harvard Medical School; and Sean P.A. Drummond, UC Berkeley.

"We found that a very common sleep drug can be used to increase verbal memory," said Mednick, the lead author of the paper that outlines results of two studies conducted over five years with a $651,999 research grant from the National Institutes of Health. "This is the first study to show you can manipulate sleep to improve memory. It suggests sleep drugs could be a powerful tool to tailor sleep to particular memory disorders."

A total of 49 men and women between the ages of 18 and 39 who were normal sleepers were given varying doses of zolpidem (Ambien) or sodium oxybate (Xyrem), and a placebo, allowing several days between doses to allow the pharmaceuticals to leave their bodies. Researchers monitored their sleep, measured sleepiness and mood after napping, and used several tests to evaluate their memory.

The researchers found that zolpidem significantly increased the density of sleep spindles and improved verbal memory consolidation.

"(P)harmacologically enhancing sleep spindles in healthy adults produces exceptional memory performance beyond that seen with sleep alone or sleep with the comparison drug (sodium oxybate)," the sleep researchers wrote. "… The results set the stage for targeted treatment of memory impairments as well as the possibility of exceptional memory improvement above that of a normal sleep period."

Mednick said one of the next steps in this line of research is to determine which component of the physical response to Ambien -- the amnesia associated with the drug, or something related to a specific aspect of sleep -- is responsible for increasing the density of sleep spindles and the resulting consolidation of memory. She also hopes to study the impact of zolpidem on older adults, who experience poor declarative memory and also decreased sleep spindles. Individuals with Alzheimer's, dementia and schizophrenia also experience decreases in sleep spindles.

"Could we find a dose response, for example, the more Ambien, the more benefit?" she asked.

Sleep is a very new field of research and its importance is generally not taught in medical schools, Mednick said.

"We know very little about it," said Mednick, who began studying sleep in the early 2000s with research into how naps benefit perceptual learning. "We do know that it affects behavior, and we know that sleep is integral to a lot of disorders with memory problems. We need to integrate sleep into medical diagnoses and treatment strategies. This research opens up a lot of possibilities."

S. C. Mednick, E. A. McDevitt, J. K. Walsh, E. Wamsley, M. Paulus, J. C. Kanady, S. P. A. Drummond. The Critical Role of Sleep Spindles in Hippocampal-Dependent Memory: A Pharmacology Study. Journal of Neuroscience, 2013; 33 (10): 4494 DOI: 10.1523/JNEUROSCI.3127-12.2013

Psychiatrists, Instead of Being Embarrassed by Placebo Effect, Should Embrace It, Author Says

Author provokes a furor among his colleagues by proposing that psychiatrists prescribe placebo pills for mildly and moderately depressed patients

By John Horgan | March 12, 2013

Walter Brown, a professor of psychiatry at Brown and Tufts, first caught my attention in the mid-1990s when I was researching my December 1996 *Scientific American* article "Why Freud Isn't Dead," on lack of progress in psychiatry. My research persuaded me that the placebo effect (which I have written about here and here) accounts for most if not all of the benefits of psychotherapy and drug treatments for depression. Brown provoked a furor among his colleagues by proposing that psychiatrists prescribe placebo pills for mildly and moderately depressed patients, a topic that he revisited in a 1998 article for *Scientific American*. He has delved even further into the implications of the placebo effect on psychiatry and other fields of medicine in his incisive new book *The Placebo Effect in Clinical Practice* (Oxford University Press), which I highly recommend. I recently interviewed Brown:

Horgan: What have we learned about the placebo effect since Henry Beecher's landmark 1955 work *The Powerful Placebo*?

Brown: Beecher's paper put the placebo effect on the map, and his general proposition that the placebo effect is ubiquitous has withstood the test of time. He also proposed, among other things, that there is a constant placebo response across conditions. 35.2 % improve with placebo was the figure he came up with. But since then, thanks to thousands of placebo-controlled clinical trials, we have learned that some conditions are far more placebo responsive than others. Even among pain syndromes, which for the most part show robust placebo effects, there are differences: for example, post operative pain appears more placebo responsive then migraine headaches. About 40% of mildly to moderately depressed patients improve with placebo as opposed to only 10-20% of those with obsessive compulsive disorder. Irritable bowel syndrome is highly placebo responsive–about 40% improve with placebo–whereas only about 20% of people with chronic fatigue syndrome get better with placebo. (I cover these issues in my book's chapter on variations).

Since Beecher, laboratory based and clinical studies have identified some of the mechanisms behind the placebo effect. Expectation is the most widely studied. Both rigorously designed and controlled laboratory studies and clinical studies as well show that what one anticipates from a treatment has a profound impact on what one does experience. In the past decade a number of studies have shown that when people get placebo but believe that they're receiving a medication they undergo some of the same brain changes that occur with the active medicine. (I go into the details in the chapter on expectation). The effect of expectation on response to placebo and other treatments seems to rest on a fundamental psychobiologic process (whatever that means). In the past 60 years we've also learned about the role of conditioning in the placebo effect and–a special interest of mine–the role of certain elements of the treatment situation and doctor-patient relationship in bringing about placebo effects.

Horgan: Haven't clinical trials eliminated concerns that many modern medical treatments, when they work, are harnessing the placebo effect?

Brown: Although drugs need to demonstrate efficacy in controlled clinical trials in order to get FDA approval, many widely used treatments are not subjected to clinical trials, including psychotherapies, surgical procedures and all the alternative treatments. And once a drug gets FDA approval it can be used in a so-called "off-label" manner for any condition including those not studied in the clinical trials that led to approval. Most drugs are frequently used "off-label" for conditions in which their efficacy has not been carefully studied or studied at all. Even placebo-controlled trials are no guarantee that a drug that looks good is not deriving its benefit from the placebo effect; double blind clinical trials are not truly double blind. Even though they are designed to eliminate the bias that comes from knowledge about whether drug or placebo is on offer, almost invariably the investigators conducting the trial know, because of side effects, who's getting what.

Placebo effects continue to be mistaken for treatment effects with troubling frequency. As just one example, vertebroplasty–injecting cement into a fractured vertebra–was widely used as a treatment for vertebral fracture from the early 1990s through the first decade of this century until a controlled trial showed that a sham (placebo) procedure (nothing injected) was equally effective in reducing pain and disability. (I discuss this particular study in the first chapter)

Horgan: Do you worry that raising the awareness of patients about the placebo will undermine patients' trust in modern medicine?

Brown: It may cause people to wonder if their improvement is "just" a placebo effect and if the treatment they're getting is not "really" working. But I believe that most folks trust their own doctors–if not doctors in general–and will believe what their doctors tell them about a treatment's inherent effectiveness.
Horgan: Why do you focus in your book so much on psychiatry?
Brown: My original concept for the book was to look at the placebo effect in mental health alone. But as I started to do the research and write it I decided to look at the placebo effect more generally and go beyond psychiatric illness to medicine in general. Some of the focus on psychiatry derives from the original impetus for the book. I also focus on psychiatry because my own research on the placebo effect has been in depressive illness, and the condition in which the placebo effect has been most studied is probably depression. A good bit of what we have learned about the placebo effect in depression sheds light on the placebo effect in other conditions. It's also the case that a number of psychiatric conditions are highly placebo-responsive. Also psychotherapy has a lot in common with placebo treatment; the relationship between the two is a matter of controversy and I wanted to tackle that issue. And finally, although I believe that the placebo effect is pertinent to all illnesses and treatments, as a psychiatrist my expertise and interests lie primarily in psychiatry.
Horgan: What are the implications of the placebo effect for psychiatry? Given the side effects of many psychiatric drugs, should psychiatrists prescribe placebo treatments more often for mental disorders?
Brown: Given the high rates of improvement with placebo–close to the rates with drugs–in some psychiatric conditions such as mild to moderate depression and panic disorder–and the side effects and expense of drugs, I think it does make sense for psychiatrists to prescribe placebo treatments in some circumstances. The placebo could be a pure placebo - i.e., a sugar pill–or a nontoxic alternative therapy given to promote a placebo effect. I go into the details of how to go about this and the ethical and clinical implications in the last chapter. Of equal importance, psychiatrists like all health professionals should apply what is known about mobilizing the placebo to enhance the benefit of all treatments.
Horgan: Do you agree with Jerome Frank [a prominent investigator of the efficacy of psychotherapy] that psychotherapists, like shamans and faith healers, are just harnessing the placebo effect?
Brown: I wouldn't say "just"; the placebo effect can be pretty powerful and harnessing it is not a trivial intervention. But I do agree with Jerome Frank that psychotherapists, shamans and faith healers accomplish what they do by providing the common factors of treatment–the presence of a healing authority, a healing ritual, expectation of recovery, etc.–that are also found with placebo treatment, that promote a placebo effect, and that are probably the active ingredients of all the psychotherapies.
Horgan: Have your writings about the placebo effect in psychiatry gotten you in trouble with other psychiatrists?
Brown: In 1994 the journal *Neuropsychopharmacology* published a paper in which I proposed that in some circumstances depression should be treated with placebo. The paper was followed by invited commentaries from three psychiatrists, two psychologists and one internist. All but the internist freaked out over the idea–it was irresponsible, unethical, dangerous, etc. I would guess that some psychiatrists will object to what I say about the commonalities between psychotherapy and placebo, and others will object to and have objected to my position on the similarity in outcome between placebo and drugs for mild to moderate depression. Oh well.

http://www.bbc.co.uk/news/business-21757035

Interpol deal to combat fake drugs

***The International Police Agency, Interpol, has announced a deal with the pharmaceutical industry to* crack down on fake drugs.**

Twenty nine of the world's biggest drug companies will provide 4.5m euros ($5.9m; £3.9m) in the next three years to help the response to the problem. "A global effort is needed to combat this threat," Interpol said.
The agency added that the lives of millions of people were put at risk every day because of it.
Christopher Viehbacher, the chief executive of French drugmaker Sanofi, said: "In the case of drug counterfeiting, it can mean the difference between life and death for a patient. "It is estimated that 10% of medicines are fake and these figures can go up to 50%, particularly in some poorer countries."
The money will go towards creating a new programme to improve Interpol's fight against the counterfeit industry. Part of it will be about raising public awareness of the dangers of fake drugs - particularly online.
The World Health Organisation estimates that in more than 50% of cases, medicines bought over the internet, where the physical address is concealed, have been found to be fake.
The head of Interpol's Pharmaceutical Crime Programme, Aline Plancon, told the BBC that the funds would be used to support countries with crime detection and help them to follow up investigations.

The programme will also be tasked with rooting out and dismantling organised crime networks that sell fake brands of drugs.
Sometimes, these drugs can have fatal consequences. Last year, in Pakistan, more than a hundred heart patients died after taking counterfeit medicines.

http://phys.org/news/2013-03-beneficial-tea-tree-oil-all-clear.html

Beneficial tea tree oil given all-clear

International study finds no evidence to support that exposing bacteria to tea tree oil may contribute to antibiotic resistance

After two recent reports suggesting that exposing bacteria to tea tree oil may contribute to antibiotic resistance in humans, an international study - led by researchers at The University of Western Australia - has found no evidence that this is the case.
UWA's Dr Christine Carson and her colleagues from UWA, PathWest and a university in The Netherlands exposed golden staph (Staphylococcus aureus) and other bacteria to tea tree oil. They found there was no difference in resistance to antibiotics compared to bacteria not exposed.
Their study was published in the International Journal of Antimicrobial Agents this week.
"The need for new antimicrobial agents is particularly pressing owing to the continued occurrence and spread of resistance to existing agents," the authors write. "Agents from different chemical classes that have diverse mechanisms of action would be most welcome. One possibility is tea tree oil."
"It has broad-spectrum in vitro activity against bacteria, including antimicrobial-resistant and multiresistant organisms, and its use for the decolonisation of methicillin-resistant golden staph has attracted particular attention."
Dr Carson and her group argue the weight of evidence now shows that tea tree oil does not contribute to antibiotic resistance. "It is low-level exposure to tea tree oil that is alleged to promote resistance to it and other antimicrobial agents. But we found that tea tree oil does not in fact induce resistance."
Researchers at UWA have been studying the antimicrobial properties of tea tree oil since the early 1990s and its anti-cancer effects since 2007. Tea tree oil is a natural, renewable resource from Melaleuca alternifolia, a tree native to New South Wales. Its earliest reported use was by the Bundjalung Indigenous people of northern NSW who treated their coughs, colds and wounds with crushed leaves.

http://www.eurekalert.org/pub_releases/2013-03/jhm-uft030813.php

Using fat to fight brain cancer

Johns Hopkins researchers use a type of stem cells from human adipose tissue to chase migrating cancer cells

In laboratory studies, Johns Hopkins researchers say they have found that stem cells from a patient's own fat may have the potential to deliver new treatments directly into the brain after the surgical removal of a glioblastoma, the most common and aggressive form of brain tumor.
The investigators say so-called mesenchymal stem cells (MSCs) have an unexplained ability to seek out damaged cells, such as those involved in cancer, and may provide clinicians a new tool for accessing difficult-to-reach parts of the brain where cancer cells can hide and proliferate anew. The researchers say harvesting MSCs from fat is less invasive and less expensive than getting them from bone marrow, a more commonly studied method.
Results of the Johns Hopkins proof-of-principle study are described online in the journal PLOS ONE.
"The biggest challenge in brain cancer is the migration of cancer cells. Even when we remove the tumor, some of the cells have already slipped away and are causing damage somewhere else," says study leader Alfredo Quinones-Hinojosa, M.D., a professor of neurosurgery, oncology and neuroscience at the Johns Hopkins University School of Medicine. "Building off our findings, we may be able to find a way to arm a patient's own healthy cells with the treatment needed to chase down those cancer cells and destroy them. It's truly personalized medicine."
For their test-tube experiments, Quinones-Hinojosa and his colleagues bought human MSCs derived from both fat and bone marrow, and also isolated and grew their own stem cell lines from fat removed from two patients. Comparing the three cell lines, they discovered that all proliferated, migrated, stayed alive and kept their potential as stem cells equally well.
This was an important finding, Quinones-Hinojosa says, because it suggests that a patient's own fat cells might work as well as any to create cancer-fighting cells. The MSCs, with their ability to home in on cancer cells, might be able to act as a delivery mechanism, bringing drugs, nanoparticles or some other treatment directly to

the cells. Quinones-Hinojosa cautions that while further studies are under way, it will be years before human trials of MSC delivery systems can begin.
Ideally, he says, if MSCs work, a patient with a glioblastoma would have some adipose tissue (fat) removed - from any number of locations in the body - a short time before surgery. The MSCs in the fat would be drawn out and manipulated in the lab to carry drugs or other treatments. Then, after surgeons removed the brain tumor, they could deposit these treatment-armed cells into the brain in the hopes that they would seek out and destroy the cancer cells.
Currently, standard treatments for glioblastoma are chemotherapy, radiation and surgery, but even a combination of all three rarely leads to more than 18 months of survival after diagnosis. Glioblastoma tumor cells are particularly nimble, migrating across the entire brain and establishing new tumors. This migratory capability is thought to be a key reason for the low cure rate of this tumor type.
"Essentially these MSCs are like a 'smart' device that can track cancer cells," Quinones-Hinojosa says.
Quinones-Hinojosa says it's unclear why MSCs are attracted to glioblastoma cells, but they appear to have a natural affinity for sites of damage in the body, such as a wound. MSCs, whether derived from bone marrow or fat, have been studied in animal models to treat trauma, Parkinson's disease, ALS and other diseases.
This research was supported by the National Institutes of Health's National Institute of Neurological Disorders and Stroke (R01-NS070024), the Maryland Stem Cell Research Fund and the Howard Hughes Medical Institute.
Other Johns Hopkins researchers involved in the study include Courtney Pendleton, M.D.; Qian Li, Ph.D.; David A Chesler, M.D., Ph.D.; Kristy Yuan, M.D.; and Hugo Guerrero-Cazares, M.D., Ph.D. ***For more information:***
http://www.hopkinsmedicine.org/neurology_neurosurgery/experts/profiles/team_member_profile/36A35BDE9B71CB08318C8F419FD7ACB4/Alfredo_Quinones-Hinojosa

http://bit.ly/13PjGdK

Craig Venter close to creating synthetic life

For the first time we are close to creating artificial life from scratch.

Updated 10:50 13 March 2013 by Andy Coghlan

So says Craig Venter, founder of the J. Craig Venter Institute in Rockville, Maryland, and famed for creating the first cell with a synthetic genome. "We think we're close, but we've not submitted a paper yet," he said at the Global Grand Challenges summit in London this week.
Venter announced in 2010 that he had brought to life an almost completely synthetic version of the bacterium Mycoplasma mycoides, by transplanting it into the vacant shell of another bacterium. Venter's latest creation, which he has dubbed the Hail Mary Genome, will be made from scratch with genes he and his institute colleagues, Clyde Hutchison and Hamilton Smith, consider indispensable for life.
The team is using computer simulations to better understand what is needed to create a simple, self-replicating cell. "Once we have a minimal chassis, we can add anything else to it," he says.
Venter's quest to engineer algae to produce more oil than usual is also going well. "We've been able to increase photosynthesis threefold, meaning that we get three times as much energy per photon [of sunlight] as from natural algae," he says. He also announced that his programme to scour the oceans for novel microscopic life has so far turned up 80 million genes new to biology.

http://www.sciencedaily.com/releases/2013/03/130312131746.htm

NASA Rover Finds Conditions Once Suited for Ancient Life On Mars

An analysis of a rock sample collected by NASA's Curiosity rover shows ancient Mars could have supported living microbes.

Scientists identified sulfur, nitrogen, hydrogen, oxygen, phosphorus and carbon -- some of the key chemical ingredients for life -- in the powder Curiosity drilled out of a sedimentary rock near an ancient stream bed in Gale Crater on the Red Planet last month. "A fundamental question for this mission is whether Mars could have supported a habitable environment," said Michael Meyer, lead scientist for NASA's Mars Exploration Program at the agency's headquarters in Washington. "From what we know now, the answer is yes."
Clues to this habitable environment come from data returned by the rover's Sample Analysis at Mars (SAM) and Chemistry and Mineralogy (CheMin) instruments. The data indicate the Yellowknife Bay area the rover is exploring was the end of an ancient river system or an intermittently wet lake bed that could have provided chemical energy and other favorable conditions for microbes. The rock is made up of a fine-grained mudstone containing clay minerals, sulfate minerals and other chemicals. This ancient wet environment, unlike some others on Mars, was not harshly oxidizing, acidic or extremely salty.
The patch of bedrock where Curiosity drilled for its first sample lies in an ancient network of stream channels descending from the rim of Gale Crater. The bedrock also is fine-grained mudstone and shows evidence of multiple periods of wet conditions, including nodules and veins.

Curiosity's drill collected the sample at a site just a few hundred yards away from where the rover earlier found an ancient streambed in September 2012.
"Clay minerals make up at least 20 percent of the composition of this sample," said David Blake, principal investigator for the CheMin instrument at NASA's Ames Research Center in Moffett Field, Calif.
These clay minerals are a product of the reaction of relatively fresh water with igneous minerals, such as olivine, also present in the sediment. The reaction could have taken place within the sedimentary deposit, during transport of the sediment, or in the source region of the sediment. The presence of calcium sulfate along with the clay suggests the soil is neutral or mildly alkaline.
Scientists were surprised to find a mixture of oxidized, less-oxidized, and even non-oxidized chemicals, providing an energy gradient of the sort many microbes on Earth exploit to live. This partial oxidation was first hinted at when the drill cuttings were revealed to be gray rather than red.
"The range of chemical ingredients we have identified in the sample is impressive, and it suggests pairings such as sulfates and sulfides that indicate a possible chemical energy source for micro-organisms," said Paul Mahaffy, principal investigator of the SAM suite of instruments at NASA's Goddard Space Flight Center in Greenbelt, Md. An additional drilled sample will be used to help confirm these results for several of the trace gases analyzed by the SAM instrument.
"We have characterized a very ancient, but strangely new 'gray Mars' where conditions once were favorable for life," said John Grotzinger, Mars Science Laboratory project scientist at the California Institute of Technology in Pasadena, Calif. "Curiosity is on a mission of discovery and exploration, and as a team we feel there are many more exciting discoveries ahead of us in the months and years to come."
Scientists plan to work with Curiosity in the "Yellowknife Bay" area for many more weeks before beginning a long drive to Gale Crater's central mound, Mount Sharp. Investigating the stack of layers exposed on Mount Sharp, where clay minerals and sulfate minerals have been identified from orbit, may add information about the duration and diversity of habitable conditions.
NASA's Mars Science Laboratory Project has been using Curiosity to investigate whether an area within Mars' Gale Crater ever has offered an environment favorable for microbial life. Curiosity, carrying 10 science instruments, landed seven months ago to begin its two-year prime mission. NASA's Jet Propulsion Laboratory in Pasadena, Calif., manages the project for NASA's Science Mission Directorate in Washington.
For more about the mission, visit: http://www.jpl.nasa.gov/msl , http://mars.jpl.nasa.gov/msl/ and http://www.nasa.gov/msl . You can follow the mission on Facebook and Twitter at: http://www.facebook.com/marscuriosity and http://www.twitter.com/marscuriosity

http://www.sciencedaily.com/releases/2013/03/130312134920.htm

Bitter Melon Juice Prevents Pancreatic Cancer in Mouse Models

Bitter melon juice restricts ability of pancreatic cancer cells to metabolize glucose, eventually killing them

A University of Colorado Cancer study published this week in the journal Carcinogenesis shows that bitter melon juice restricts the ability of pancreatic cancer cells to metabolize glucose, thus cutting the cells' energy source and eventually killing them.
"Three years ago researchers showed the effect of bitter melon extract on breast cancer cells only in a Petri dish. This study goes much, much farther. We used the juice -- people especially in Asian countries are already consuming it in quantity. We show that it affects the glucose metabolism pathway to restrict energy and kill pancreatic cancer cells," says Rajesh Agarwal, PhD, co-program leader of Cancer Prevention and Control at the CU Cancer Center and professor at the Skaggs School of Pharmacy and Pharmaceutical Sciences.
Agarwal's interest came from connecting the dots of existing research in a novel way. Diabetes tends to presage pancreatic cancer and bitter melon has been shown to effect type-II diabetes, and has been used for centuries against diabetes in the folk medicines of China and India. Following this line of thinking, Agarwal and colleagues wondered what would happen if they closed out the middle man of diabetes and directly explored the link between bitter melon and pancreatic cancer.
The result, Agarwal says, is, "Alteration in metabolic events in pancreatic cancer cells and an activation of the AMP-activated protein kinase, an enzyme that indicates low energy levels in the cells."
Perhaps not coincidentally, bitter melon also regulates insulin secretion by pancreatic beta cells. After studies in cell cultures, the group showed that mouse models of pancreatic cancer that were fed bitter melon juice were 60 percent less likely to develop the disease than controls. "It's a very exciting finding," Agarwal says. "Many researchers are engineering new drugs to target cancer cells' ability to supply themselves with energy, and here we have a naturally-occurring compound that may do just that."

The Agarwal Lab is now applying for grants that will allow them to move the study of bitter melon into further chemoprevention trials in mouse models of pancreatic cancer.

M. Kaur, G. Deep, A. K. Jain, K. Raina, C. Agarwal, M. Wempe, R. Agarwal. Bitter melon juice activates cellular energy sensor AMP-activated protein kinase causing apoptotic death of human pancreatic carcinoma cells. Carcinogenesis, 2013; DOI: 10.1093/carcin/bgt081

http://www.sciencedaily.com/releases/2013/03/130312171612.htm

Preventing HIV Infection With Anti-HIV Drugs in People at Risk Is Cost-Effective

HIV prevention strategy in which at-risk people take antiretroviral drugs (PrEP), may be a cost-effective method of preventing HIV

An HIV prevention strategy in which people at risk of becoming exposed to HIV take antiretroviral drugs to reduce their chance of becoming infected (often referred to as pre-exposure prophylaxis or PrEP), may be a cost-effective method of preventing HIV in some settings, according to a study by international researchers published in this week's PLOS Medicine.

In an analysis of 13 modelling studies led by Gabriela Gomez from the Department of Global Health, Academic Medical Centre, University of Amsterdam/AIGHD in The Netherlands, the authors evaluated the impact of pre-exposure prophylaxis in different populations (heterosexual couples, men who have sex with men, and people who inject drugs) in different regions and countries, such as southern Africa, Ukraine, the US, and Peru.

They found that in every setting, the cost of antiretroviral drugs was an important factor influencing the affordability of effective prevention programmes but delivery of pre-exposure prophylaxis to populations at higher risk of HIV exposure appeared to be the most cost-effective strategy. The authors also found that both behavioural changes and adherence to the pre-exposure prophylaxis drug regimens affected programme effectiveness. The authors say: "Our findings show that pre-exposure prophylaxis has the potential to be a cost-effective addition to HIV prevention programmes in some settings."

They continue: "However, the cost-effectiveness of pre-exposure prophylaxis is likely to depend on considerations such as cost, the epidemic context, pre-exposure prophylaxis programme coverage and prioritisation strategies, as well as individual adherence levels and pre-exposure prophylaxis efficacy estimates."

The authors add: "Given that our review shows that both the setting and which population is prioritised for pre-exposure prophylaxis are critical drivers of cost-effectiveness, the next step is to conduct context-specific demonstration studies, including comprehensive cost analyses, of different prioritisation and adherence promotion strategies to ensure that the maximum benefit from the introduction of pre-exposure prophylaxis is realised within combination HIV prevention programmes."

Gabriela B. Gomez, Annick Borquez, Kelsey K. Case, Ana Wheelock, Anna Vassall, Catherine Hankins. The Cost and Impact of Scaling Up Pre-exposure Prophylaxis for HIV Prevention: A Systematic Review of Cost-Effectiveness Modelling Studies. PLoS Medicine, 2013; 10 (3): e1001401 DOI: 10.1371/journal.pmed.1001401

http://www.bbc.co.uk/news/science-environment-21759233

Neanderthals' large eyes 'caused their demise'

A study of Neanderthal skulls suggests that they became extinct because they had larger eyes than our species.

By Pallab Ghosh Science correspondent, BBC News

As a result, more of their brains were devoted to seeing in the long, dark nights in Europe, at the expense of high-level processing. This ability enabled our species, Homo sapiens, to fashion warmer clothes and develop larger social networks, helping us to survive the ice age in Europe. The study is published in Proceedings of the Royal Society B.

Neanderthals are a closely related species of human that lived in Europe from around 250,000 years ago. They coexisted and interacted briefly with our species until they went extinct about 28,000 years ago, in part due to an ice age.

Neanderthals are a closely related species of human that lived in Europe from around 250,000 years ago.

The research team explored the idea that the ancestor of Neanderthals left Africa and had to adapt to the longer, darker nights and murkier days of Europe. The result was that Neanderthals evolved larger eyes and a much larger visual processing area at the backs of their brains. The humans that stayed in Africa, on the other hand,

continued to enjoy bright and beautiful days and so had no need for such an adaption. Instead, these people, our ancestors, evolved their frontal lobes, associated with higher-level thinking, before they spread across the globe. Eiluned Pearce of Oxford University decided to check this theory. She compared the skulls of 32 Homo sapiens and 13 Neanderthals.

Social networks

Ms Pearce found that Neanderthals had significantly larger eye sockets - by an average of 6mm from top to bottom. Although this seems like a small amount, she said that it was enough for Neanderthals to use significantly more of their brains to process visual information. "Since Neanderthals evolved at higher latitudes, more of the Neanderthal brain would have been dedicated to vision and body control, leaving less brain to deal with other functions like social networking," she told BBC News.

This is a view backed by Prof Chris Stringer, who was also involved in the research and is an expert in human origins at the Natural History Museum in London. "We infer that Neanderthals had a smaller cognitive part of the brain and this would have limited them, including their ability to form larger groups. If you live in a larger group, you need a larger brain in order to process all those extra relationships," he explained.

The Neanderthals' more visually-focused brain structure might also have affected their ability to innovate and to adapt to the ice age that was thought to have contributed to their demise.

Neanderthal wraps

There is archaeological evidence, for example, that the Homo sapiens that coexisted with Neanderthals had needles that they used to make tailored clothing. This would have kept them much warmer than the wraps thought to have been worn by Neanderthals.

Prof Stringer said that all these factors together might have given our species a crucial advantage that enabled us to survive. "Even if you had a small percent better ability to react quickly, to rely on your neighbours to help you survive and to pass on information - all these things together gave the edge to Homo sapiens over Neanderthals, and that may have made a difference to survival."

The finding runs counter to the idea that Neanderthals were not the stupid, brutish creatures portrayed in Hollywood films; they may well have been as intelligent as our species.

Oxford University's Prof Robin Dunbar, who supervised the study, said that the team wanted to avoid restoring the stereotypical image of Neanderthals. "They were very, very smart, but not quite in the same league as Homo sapiens," he told BBC News. "That difference might have been enough to tip the balance when things were beginning to get tough at the end of the last ice age," he said.

Up until now, researchers' knowledge of Neanderthals' brains has been based on casts of skulls. This has given an indication of brain size and structure, but has not given any real indication of how the Neanderthal brain functioned differently from ours. The latest study is an imaginative approach in trying to address this issue.

Previous research by Ms Pearce has shown that modern humans living at higher latitudes evolved bigger vision areas in the brain to cope with lower light levels. There is no suggestion though that their higher cognitive abilities suffered as a consequence.

Studies on primates have shown that eye size is proportional to the amount of brain space devoted to visual processing. So the researchers made the assumption that this would be true of Neanderthals.

http://www.eurekalert.org/pub_releases/2013-03/uoa-cpv031313.php

Chicken pox vaccine saving children's lives

The widespread introduction of a chicken pox vaccine in Australia in 2006 has prevented thousands of children from being hospitalized with severe chicken pox and saved lives, according to new research.

In a national study of chicken pox admissions at four participating Australian children's hospitals, researchers found the number of children hospitalized with chicken pox or shingles had dropped by 68% since 2006.

The research was led by Associate Professor Helen Marshall from the University of Adelaide and Women's and Children's Hospital, and researchers of the Paediatric Active Enhanced Disease Surveillance (PAEDS) project.

Prior to the chicken pox (or varicella) vaccine being available, each year Australia had an estimated 240,000 chicken pox cases, with 1500 hospitalizations and between 1-16 deaths.

The results of the study, now published online in the Pediatric Infectious Disease Journal, show that there were no deaths identified in the participating hospitals in Australia during 2007-2010 following the widespread introduction of varicella vaccine. The study also shows that of children needing hospitalization for severe chicken pox, 80% had not been immunized.

"These results are a very strong endorsement of the impact of chicken pox vaccine being available for children through the national childhood immunization program, and of the need to immunize all children against chicken pox," says lead author Associate Professor Helen Marshall, from the University of Adelaide's Robinson

Institute and Director of the Vaccinology and Immunology Research Trials Unit at the Women's and Children's Hospital, Adelaide. "A higher level of immunization would have spared most children from severe chicken pox, which in a few cases required intensive care treatment. Based on the results of our studies, this is now mostly preventable," Associate Professor Marshall says.
Chicken pox is a highly contagious infection spread by airborne transmission or from direct contact with the fluid from skin lesions caused by the disease. In its most serious form, chicken pox can cause severe and multiple complications, including neurological conditions, and even death. "At least one dose of varicella vaccine in eligible children and in other members of their household has the potential to prevent almost all severe cases of chicken pox in Australia," Associate Professor Marshall says. "Not only does this have the potential to save lives, it also saves millions of dollars in hospital admission costs each year."

http://www.eurekalert.org/pub_releases/2013-03/ki-lio031213.php

Lower incidence of genital warts in young girls

The incidence of genital warts, or condylomata, declined by 93 per cent in girls given the HPV vaccine before the age of 14, according to a Swedish national registry study.

The study was carried out by researchers at Karolinska Institutet in Sweden, and published in Journal of the National Cancer Institute.
Using a selection of population-based registries, the researchers at Karolinska Institutet studied 124,000 girls and women in Sweden between 10 and 44 years old who had received the HPV vaccine against condyloma and cervical cancer at some time between 2006 and 2010. The researchers examined their registry data over an average of 4.4 years in order to study the effect of the vaccine and who chose to receive it.
The research team has not yet studied the results of cervical cancer, which takes longer to develop. The effect on condyloma was, however, clear: subjects who were vaccinated before the age of 14 showed a 93 per cent decrease in condyloma. It is already known that the vaccine has to be taken before an infection with HPV (human papillomavirus) for it to work, and the researchers noted a level of protection below 50 per cent for those who vaccinated themselves after the age of 20.
The researchers also found that it was 15 times more common for daughters of academically educated parents to vaccinate themselves than for the daughters of less-educated parents. The educational level of the mother had most impact; it was eight times more common for a girl to be vaccinated if her mother was academically educated, as opposed to four times more common if her father was.
Opportunistic HPV vaccination was introduced in 2007 in Sweden offering girls between 13 and 17 (only) the possibility to vaccinate at a reduced price. Since 2012, the vaccine is part of the general vaccination programme and is thus offered free of charge to all girls between 10 and 12 along with a catch-up vaccination for girls and young women between 13 and 18.
"Our study supports the notion that the vaccine should be given at young age," says Dr Lisen Arnheim-Dahlström, Research Associate at the Department of Medical Epidemiology and Statistics at Karolinska Institutet. "When the vaccine was offered at a reduced price, the distribution was very unequal. Now that the vaccine is free and offered through the schools, it will be more evenly distributed in the population."
The study was made possible with funding from pharmaceutical company Merck, Sharp & Dohme, which sells the vaccine in question, and grants awarded to Dr Lisen Arnheim-Dahlström and Professor Joakim Dillner. Another member of the team, Dr Cecilia Young, is medical director of Sanofi Pasteur MSD, a drug company co-owned by Sanofi Pasteur and MSD exclusively devoted to the manufacture and sale of vaccines. The companies have not influenced the interpretation of the results.
Publication: 'Quadrivalent HPV-Vaccine Effectiveness: A Swedish National Cohort Study', Amy Leval, Eva Herweijer, Alexander Ploner, Sandra Eloranta, Julia Fridman Simard, Joakim Dillner, Cecilia Young, Eva Netterlid, Pär Sparén, Lisen Arnheim-Dahlström, Journal of the National Cancer Institute (JNCI) online 13 March 2013. Embargoed until March 13th 2013 at 4 PM US ET / 20:00 UK time / 21:00 CET

http://www.eurekalert.org/pub_releases/2013-03/uot-bsw031113.php

Burgess Shale worm provides crucial missing link

Discovery pushes fossil record back 200 million years

Canada's 505 million year-old Burgess Shale fossil beds, located in Yoho National Park, have yielded yet another major scientific discovery – this time with the unearthing of a strange phallus-shaped creature.
A study to be published online in the journal Nature on March 13 confirms Spartobranchus tenuis is a member of the acorn worms group which are seldom-seen animals that thrive today in the fine sands and mud of shallow and deeper waters. Acorn worms are themselves part of the hemichordates, a group of marine animals closely related to today's sea stars and sea urchins.
"Unlike animals with teeth and bones, these spaghetti-shaped creatures were soft-bodied, so the fossil record for them is extremely scarce," said lead author Dr. Jean-Bernard Caron, associate professor of earth sciences and

ecology & evolutionary biology at the University of Toronto and curator of invertebrate palaeontology at the Royal Ontario Museum. "Our analysis of Spartobranchus tenuis, a creature previously unknown to science, pushes the fossil record of the enteropneusts back by 200 million years and fundamentally changes our understanding of evolution from this period."

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<td>Spartobranchus tenuis from the Burgess Shale (ROM 62123). Proboscis, centre bottom. Photo: JB Caron</td>
<td>Spartobranchus tenuis (Walcott) from the Burgess Shale. Top -- individual specimens within and outside their tubes. Bottom -- Close-up of a specimen within its tube. Illustration: Marianne Collins</td>
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Since their discovery in the 19th-century, some of the biggest questions in hemichordate evolution have focused on the group's origins and the relationship between its two main branches: the enteropneusts and pterobranchs. Enteropneusts and pterobranchs look very different, yet share many genetic and developmental characteristics that reveal an otherwise unexpected close relationship.

"Spartobranchus tenuis represents a crucial missing link that serves not only to connect the two main hemichordate groups but helps to explain how an important evolutionary transformation was achieved," added Caron. "Our study suggests that primitive enteropneusts developed a tubular structure – the smoking gun – which has been retained over time in modern pterobranchs."

Hemichordates also share many of the same characteristics as chordates – a group of animals that includes humans – with the name hemichordate roughly translating to 'half a chordate.'

Spartobranchus tenuis probably fed on small particles of matter at the bottom of the oceans. "There are literally thousands of specimens at the Walcott Quarry in Yoho National Park, so it's possible Spartobranchus tenuis may have played an important role in recycling organic matter in the early Burgess Shale environment, similar to the ecological service provided by earth worms today on land," said Caron.

Detailed analysis suggests Spartobranchus tenuis had a flexible body consisting of a short proboscis, collar and narrow elongate trunk terminating in a bulbous structure, which may have served as an anchor. The largest complete specimens examined were 10 centimetres long with the proboscis accounting for about half a centimetre. A large proportion of these worms was preserved in tubes, of which some were branched, suggesting the tubes were used as a dwelling structure.

Other members of the Spartobranchus tenuis research team are Simon Conway Morris of the University of Cambridge and Christopher B. Cameron of the Université de Montréal. Last year Conway Morris and Caron published a well-publicized study on Pikaia, believed to be one of the planet's first human relatives.

The Burgess Shale is found in Yoho National Park, part of the Canadian Rocky Mountain Parks World Heritage Site, and is one of the most important fossil deposits for understanding the origin and early evolution of animals that took place during the Cambrian Explosion starting about 542 million years ago. To learn more about the Burgess Shale visit: http://www.burgess-shale.rom.on.ca

The study, entitled Tubicolous enteropneusts from the Cambrian period, is available at http://www.nature.com as of March 13 at 2 pm.

http://www.eurekalert.org/pub_releases/2013-03/au-eft030813.php

Energy from the interior of the Earth supports life in a global ecosystem

First direct evidence of life in the deeply buried oceanic crust

The core drill slides through a drill pipe, extending from the drill ship at the sea surface, through a water depth of 2.5 km and hundreds of metres of sediment, into the oceanic crust off the west coast of North America. Microbiologist Mark Lever is on board the Integrated Ocean Drilling Program's research vessel JOIDES

Resolution to examine rock samples from the depths. The results of the studies he and his colleagues carried out are published today in the journal Science.
"We're providing the first direct evidence of life in the deeply buried oceanic crust. Our findings suggest that this spatially vast ecosystem is largely supported by chemosynthesis," says Dr Lever, at the time a PhD student at the University of North Carolina at Chapel Hill, USA, and now a scientist at the Center for Geomicrobiology at Aarhus University, Denmark.

Energy from reduced iron

We have learned that sunlight is a prerequisite for life on Earth. Photosynthetic organisms use sunlight to convert carbon dioxide into organic material that makes up the foundation of Earth's food chains. Life in the porous rock material in the oceanic crust is fundamentally different. Energy – and therefore life's driving force – derives from geochemical processes.
"There are small veins in the basaltic oceanic crust and water runs through them. The water probably reacts with reduced iron compounds, such as olivine, in the basalt and releases hydrogen. Microorganisms use the hydrogen as a source of energy to convert carbon dioxide into organic material," explains Dr Lever. "So far, evidence for life deep within oceanic crust was based on chemical and textural signatures in rocks, but direct proof was lacking", adds Dr Olivier Rouxel of the French IFREMER institute.

Our biosphere is extended

The oceanic crust covers 60 per cent of the Earth's surface. Taking the volume into consideration, this makes it the largest ecosystem on Earth. Since the 1970s, researchers have found local ecosystems, such as hot springs, which are sustained by chemical energy.
"The hot springs are mainly found along the edges of the continental plates, where the newly formed oceanic crust meets seawater. However, the bulk of oceanic crust is deeply buried under layers of mud and hundreds to thousands of kilometres away from the geologically active areas on the edges of continental plates. Until now, we've had no proof that there is life down there," says Dr Lever.
Even though this enormous ecosystem is probably mainly based on hydrogen, several different forms of life are found here. The hydrogen-oxidising microorganisms create organic material that forms the basis for other microorganisms in the basalt. Some organisms get their energy by producing methane or by reducing sulphate, while others get energy by breaking down organic carbon by means of fermentation.

Basalt is their home

Mark Lever is a specialist in sulphur-reducing and methane-producing organisms, and these were the organisms he also chose to examine among the samples taken from the oceanic crust. These organisms are able to use hydrogen as a source of energy, and are typically not found in seawater. Dr Lever had to make sure that no microorganisms had been introduced as contaminants during the drilling process, or transported from bottom seawater entering the basaltic veins.
"We collected rock samples 55 kilometres from the nearest outcrop where seawater is entering the basalt. Here the water in the basaltic veins has a chemical composition that differs fundamentally from seawater, for instance, it is devoid of oxygen produced by photosynthesis. The microorganisms we found are native to basalt," explains Dr Lever.

Active life or dead relics?

Dr Lever's basalt is 3.5 million years old, but laboratory cultures show that the DNA belonging to these organisms is not fossil. "It all began when I extracted DNA from the rock samples we had brought up. To my great surprise, I identified genes that are found in methane-producing microorganisms. We subsequently analysed the chemical signatures in the rock material, and our work with carbon isotopes provided clear evidence that the organic material did not derive from dead plankton introduced by seawater, but was formed within the oceanic crust. In addition, sulphur isotopes showed us that microbial cycling of sulphur had taken place in the same rocks. These could all have been fossil signatures of life, but we cultured microorganisms from basalt rocks in the laboratory and were able to measure microbial methane production," explains Dr Lever.
Dr Jeff Alt of the University of Michigan at Ann Arbor adds that "Our work proves that microbes play an important role in basalt chemistry, and thereby influence ocean chemistry".

Chemosynthetic life plays a role

Mark Lever and his colleagues developed new sampling methods to avoid sampling microbial contaminants from seawater, which is often a major problem in explorations of the oceanic crust. The researchers work in an area of the world that is extremely hard to reach. As Dr Andreas Teske of the University of North Carolina at Chapel Hill expresses "this study would not have been possible without the close collaboration of microbiologists, geochemists and geologists from the US, Denmark, France, Germany, the UK and Japan –

each team member going to the limits of what was technically possible. Such strong proof for life in the deep ocean crust has eluded scientists for a long time".
Exploring the oceanic crust is still a young science. However, the prospects are great.
"Life in the deeply buried oceanic crust is supported by energy-sources that are fundamentally different from the ones that support life in both the mud layers in the sea bed and the oceanic water column. It is possible that life based on chemosynthesis is found on other planets, where the chemical environment permits. Our continued studies will hopefully reveal whether this is the case, and also what role life in the oceanic crust plays in the overall carbon cycle on our own planet," says Dr Lever.
'Evidence for Microbial Carbon and Sulfur Cycling in Deeply Buried Ridge Flank Basalt' by Mark A. Lever, Olivier Rouxel, Jeffrey C. Alt, Nobumichi Shimizu, Shuhei Ono, Rosalind M. Coggon, Wayne C. Shanks, III, Laura Lapham, Marcus Elvert, Xavier Prieto-Mollar, Kai-Uwe Hinrichs, Fumio Inagaki, and Andreas Teske in Science, 15 March 2013.

http://www.scientificamerican.com/article.cfm?id=painkillers-could-prove-helpful-in-stem-cell-transplants

Painkillers Could Prove Helpful in Stem-Cell Transplants

Bone marrow might be easier to extract with the help of aspirin-like drugs

By Thea Cunningham and Nature magazine | Wednesday, March 13, 2013

Inhibition of a prostaglandin with non-steroidal anti-inflammatory drugs (NSAIDS, such as ibuprofen, acetaminophen and naproxen) has been found to cause stem cells to leave marrow, where they could be harvested for patients with blood disorders
Aspirin-like drugs could improve the success of stem-cell transplants for patients with blood or bone-marrow disorders, a study suggests. The compounds coax stem cells from bone marrow into the bloodstream where they can be harvested for use in transplantation - and they do so with fewer side effects than drugs now in use.
For patients with blood disorders such as leukemia, multiple myeloma or non-Hodgkin's lymphoma, transplantation of haematopoietic stem cells - precursor cells that reside in the bone marrow and give rise to all types of blood cell - can be an effective treatment.
Previous work has shown that prostaglandin E2, or PGE2, a lipid known to regulate multiple bodily reactions including pain, fever and inflammation, also has a role in keeping stem cells in the bone marrow. In the latest study, researchers show that in mice, humans and baboons, inhibition of PGE2 with non-steroidal anti-inflammatory drugs (NSAIDs) causes stem cells to leave the bone marrow.
Releasing the stem cells
The team gave baboons and humans an NSAID called meloxicam. They saw a subsequent increase in the numbers of haematopoietic stem cells in the bloodstream.
The researchers think that the departure of stem cells is caused by the disturbance of a group of bone-forming cells called osteoblasts. These cells secrete a protein called osteopontin that hooks the stem cells to the bone marrow. Inhibiting PGE2 would disrupt the production of osteopontin.
At present, doctors use a drug called filgrastim to mobilize haematopoietic stem cells in donors or in patients undergoing autotransplantation (in which they receive their own stem cells).
In patients with multiple myeloma or non-Hodgkin's lymphoma, however, and in some donors, stem cells don't mobilize well with filgrastim and other drugs in its class. Using NSAIDs such as meloxicam could enhance filgrastim's efficacy, says lead author Louis Pelus of the Indiana University School of Medicine in Indianapolis. The study appears in Nature.
Meloxicam also has comparatively few side effects, says Pelus. He and his colleagues found that other NSAIDs, including aspirin and ibuprofen, can also mobilize haematopoietic stem cells, but these drugs can cause gastrointestinal upset in patients.
"PGE2 controls the secretion of hydrochloric acid in the stomach, and when you block that you've reduced your ability to control acid secretion. Meloxicam doesn't do that as badly as many of the other [drugs] do," he says.
For Charles Craddock, director of the blood and marrow transplant unit at the Queen Elizabeth Hospital in Birmingham, UK, the results might also hold clues about how to mediate the tricky process of getting cells back to the bone marrow once transplanted. "If you're beginning to understand what mediates cells moving out, you might be able to understand what mediates cells moving in. If you can make bone marrow more 'sticky', when you put cells back, you might be able to keep them in."
The researchers are now planning to test filgrastim and meloxicam in combination in a clinical trial at Indiana University. Because both drugs are already approved by the US Food and Drug Administration, "it's just a matter of running the trial", Pelus says.

http://www.sciencedaily.com/releases/2013/03/130313214013.htm

Fluid Given to Treat Shock Can Kill

Clinical Trial Shows How 'Standard' Procedure Results in Children's Deaths

Results from the Fluid Expansion as Supportive Therapy (FEAST) trial in East Africa show that children who are given fluid to treat shock have an increased risk of death due to cardiovascular collapse at 48 hours. These findings in BioMed Central's open access journal BMC Medicine challenge the generally held idea that early and rapid reversal of shock by fluid resuscitation translates into longer-term survival benefits.

The FEAST trial was conducted in six African hospitals across Kenya, Tanzania and Uganda without intensive care facilities. It included 3000 children with shock caused by conditions including sepsis and malaria but excluded children with gastroenteritis, burns, who had undergone surgery or had severe malnutrition. All the children in the trial received standard treatments, depending on their illness including antibiotics, antimalarials, anticonvulsants, glucose or whole blood if anemic, but were randomly assigned to receiving fluid resuscitation or to a control group without fluid resuscitation.

Prof Kathryn Maitland, from the Wellcome Trust Centre for Clinical Tropical Medicine at Imperial College London, who led this study explained, "The children who were given this treatment (boluses) initially responded well compared to the control group. However, this did not translate into a better recovery at 48 hours -- more children died in the group receiving boluses. The main cause of death, rather than fluid overload, was cardiovascular collapse."

This is surprising given that this treatment is standard practice elsewhere. The research team involved in this trial believe that in settings where there is a lack of intensive care facilities 'standard' procedures, such as fluid resuscitation, should not necessarily be used, especially when they have not been properly tested in clinical trials.

Commenting on this study Prof John Myburgh, from the University of New South Wales and The George Institute for Global Health, takes this one stage further and recommends that fluid resuscitation should be used with the same care as any potentially lethal drug, "Studies are beginning to show cracks in fluid resuscitation therapy and that careful monitoring is needed as well as a better understanding of dose and the way the therapy is given. The compelling results of this study from Africa question the wisdom of fluid bolus as therapy not only in pediatric patients but also in all critically ill patients."

This article marks the launch of an article collection on Medicine for Global Health in BMC Medicine. The collection will focus on public health initiatives, the development of health care policies, management of infectious and non-communicable diseases, cost-effectiveness studies and evidence-based guidelines which are needed to address the global burden of disease.

Kathryn Maitland, Elizabeth C George, Jennifer A Evans, Sarah Kiguli, Peter Olupot-Olupot, Samuel O Akech, Robert O Opoka, Charles Engoru, Richard Nyeko, George Mtove, Hugh Reyburn, Bernadette Brent, Julius Nteziyaremye, Ayub Mpoya, Natalie Prevatt, Cornelius M Dambisya, Daniel Semakula, Ahmed Dungu, Vincent Okunny, Ronald Wokulira, Molline Timbwa, Benedict Otii, Michael Levin, Jane Crawley, Abdel G Babiker, Diana M Gibb and FEAST trial group. Exploring mechanisms of excess mortality with early fluid resuscitation: insights from the FEAST trial. BMC Medicine, 2013 DOI: 10.1186/1741-7015-11-68

http://www.eurekalert.org/pub_releases/2013-03/aha-gtc031113.php

Green tea, coffee may help lower stroke risk

Green tea and coffee may help lower your risk of having a stroke, especially when both are a regular part of your diet, according to research published in Stroke: Journal of the American Heart Association.

"This is the first large-scale study to examine the combined effects of both green tea and coffee on stroke risks," said Yoshihiro Kokubo, M.D., Ph.D., F.A.H.A., F.A.C.C., F.E.S.C., lead author of the study at Japan's National Cerebral and Cardiovascular Center. "You may make a small but positive lifestyle change to help lower the risk of stroke by adding daily green tea to your diet."

Researchers asked 83,269 Japanese adults about their green tea and coffee drinking habits, following them for an average 13 years. They found that the more green tea or coffee people drink, the lower their stroke risks.

People who drank at least one cup of coffee daily had about a 20 percent lower risk of stroke compared to those who rarely drank it.

People who drank two to three cups of green tea daily had a 14 percent lower risk of stroke and those who had at least four cups had a 20 percent lower risk, compared to those who rarely drank it.

People who drank at least one cup of coffee or two cups of green tea daily had a 32 percent lower risk of intracerebral hemorrhage, compared to those who rarely drank either beverage. (Intracerebral hemorrhage happens when a blood vessel bursts and bleeds inside the brain. About 13 percent of strokes are hemorrhagic.)

Participants in the study were 45 to 74 years old, almost evenly divided in gender, and were free from cancer and cardiovascular disease.

During the 13-years of follow-up, researchers reviewed participants' hospital medical records and death certificates, collecting data about heart disease, strokes and causes of death. They adjusted their findings to account for age, sex and lifestyle factors like smoking, alcohol, weight, diet and exercise.
Green tea drinkers in the study were more likely to exercise compared to non-drinkers.
Previous limited research has shown green tea's link to lower death risks from heart disease, but has only touched on its association with lower stroke risks. Other studies have shown inconsistent connections between coffee and stroke risks.
Initial study results showed that drinking more than two cups of coffee daily was linked to increasing coronary heart disease rates in age- and sex-adjusted analysis. But researchers didn't find the association after factoring in the effects of cigarette smoking - underscoring smoking's negative health impact on heart and stroke health.
A typical cup of coffee or tea in Japan was approximately six ounces. "However, our self-reported data may be reasonably accurate, because nationwide annual health screenings produced similar results, and our validation study showed relatively high validity." Kokubo said. "The regular action of drinking tea, coffee, largely benefits cardiovascular health because it partly keeps blood clots from forming." Tea and coffee are the most popular drinks in the world after water, suggesting that these results may apply in America and other countries.
It's unclear how green tea affects stroke risks. A compound group known as catechins may provide some protection. Catechins have an antioxidant anti-inflammatory effect, increasing plasma antioxidant capacity and anti-thrombogenic effects. Some chemicals in coffee include chlorogenic acid, thus cutting stroke risks by lowering the chances of developing type 2 diabetes. Further research could clarify how the interaction between coffee and green tea might help further lower stroke risks, Kokubo said.
Co-authors are: Isao Saito, M.D., Ph.D.; Kazumasa Yamagishi, M.D., Ph.D.; Hiroshi Yatsuya, M.D., Ph.D.; Junko Ishihara, Ph.D.; Manami Inoue, M.D., Ph.D.; and Shoichiro Tsugane, M.D., Ph.D.
The study was supported by Grants-in-Aid for Cancer Research and the Third-Term Comprehensive Ten-Year Strategy for Cancer Control from the Ministry of Health, Labour and Welfare of Japan.

http://www.scientificamerican.com/article.cfm?id=could-life-have-evolved-on

Could Life Have Evolved on Mars Before Earth?

New observations by NASA's Curiosity rover suggest that microbial life could have survived on Mars in the distant past

By Mike Wall and SPACE.com

The discovery that ancient Mars could have supported microbes raises the tantalizing possibility that life may have evolved on the Red Planet before it took root on Earth.
New observations by NASA's Curiosity rover suggest that microbial life could have survived on Mars in the distant past, when the Red Planet was a warmer and wetter place, scientists announced Tuesday (March 12).
It's unclear exactly how long ago Mars' habitability window opened up, researchers said. But the timing may be comparable to that of Earth, where life first appeared around 3.8 billion years ago.
"We're talking about older than 3 billion years ago, and we're probably looking at a situation where, plus or minus a couple hundred million years, it's about the time that we start seeing the first record of life preserved on Earth," Curiosity chief scientist John Grotzinger, of Caltech in Pasadena, said during a press conference Tuesday. [The Search for Life on Mars (Photo Timeline)]
The Curiosity team's conclusions are based on the rover's study of material collected from the interior of a Martian rock. Last month, Curiosity used its hammering drill to bore 2.5 inches (6.4 centimeters) into part of a Red Planet outcrop dubbed "John Klein" - deeper than any Mars robot had ever gone before.
Curiosity's analyses show that the John Klein area was once a benign aqueous environment, such as a neutral-pH lake, researchers said. Further, the rover's instruments detected many of the chemical ingredients necessary for life as we know it, including sulfur, nitrogen, hydrogen, oxygen, phosphorus and carbon.
Mission scientists aren't claiming that life has ever existed on the Red Planet. They have found no signs of Martian microbes, which is no surprise since the car-size Curiosity rover carries no life-detection instruments among its scientific gear.
But the advanced age of the John Klein deposits does open the door to some interesting speculation. If life ever flourished on Mars - a very big if - did it predate life on Earth? And if so, could Earth life trace its lineage back to Mars?
Some microbes are incredibly hardy, after all, and may be able to survive an interplanetary journey after being blasted off their home world by an asteroid impact. And orbital dynamics show that it's much easier for rocks to travel from Mars to Earth than the other way around.

These are questions scientists and laypeople alike will undoubtedly ask if a future mission ever does find conclusive evidence of life on Mars. But for now, Curiosity will continue rolling through its Gale Crater landing site, helping scientists learn more about the Red Planet and its history.
"Mars has written its autobiography in the rocks of Gale Crater, and we've just started deciphering that story," said Michael Meyer, lead scientist for NASA's Mars Exploration Program at the agency's headquarters in Washington.

http://www.eurekalert.org/pub_releases/2013-03/tum-oom031413.php

Olive oil makes you feel full

How oils and fats regulate feeling of satiety

Work groups at Technische Universität München (TUM) under Prof. Peter Schieberle and at the University of Vienna under Prof. Veronika Somoza studied four different edible fats and oils: Lard, butterfat, rapeseed oil and olive oil. Over a period of three months, the study participants ate 500 grams of low-fat yoghurt enriched with one of the four fats or oils every day – as a supplement to their normal diet.
"Olive oil had the biggest satiety effect," reports Prof. Peter Schieberle, Head of the TUM Chair of Food Chemistry and Director of the German Research Center for Food Chemistry. "The olive oil group showed a higher concentration of the satiety hormone serotonin in their blood. Subjectively speaking, these participants also reported that they found the olive oil yoghurt very filling." During the study period, no member of this group recorded an increase in their body fat percentage or their weight.
Aroma is the key
"The findings surprised us," admits Schieberle, "because rapeseed oil and olive oil contain similar fatty acids." The researchers decided to turn their attention to a completely different type of substance – the aroma compounds in olive oil. In the second part of the study, one group was given yoghurt with olive oil aroma extracts and a control group was given plain yoghurt.
The results were conclusive: The olive oil group's calorie intake remained the same, but the control group had been consuming an extra 176 kilocalories per day. Schieberle explains: "The aroma group adapted their eating habits – but the control group participants were obviously not able to do likewise. We also found that in comparison to the other group, the control group had less of the satiety hormone serotonin in their blood."
Direct impact on blood sugar level
How long the feeling of satiety lasts after eating depends on a number of factors, but blood sugar level is particularly significant. The faster it falls, that is to say, the faster the somatic cells absorb glucose from the blood, the sooner the person will start to feel hungry again. In the next part of their study, the researchers investigated which of the aroma substances present in the oil are most effective at inhibiting glucose absorption. The researchers used olive oils from Spain, Greece, Italy and Australia for their study. The research team managed to identify two substances that reduce the absorption of glucose from the blood in liver cells: Hexanal and E2-Hexenal. They also discovered that Italian olive oil contained larger amounts of the two aroma compounds.
"Our findings show that aroma is capable of regulating satiety," concludes Schieberle. "We hope that this work will pave the way for the development of more effective reduced-fat food products that are nonetheless satiating."
P. Schieberle, V. Somoza, M. Rubach, L. Scholl, M. Balzer; Identifying substances that regulate satiety in oils and fats and improving low-fat foodstuffs by adding lipid compounds with a high satiety effect; Key findings of the DFG/AiF cluster project "Perception of fat content and regulating satiety: an approach to developing low-fat foodstuffs", 2009-2012.
University of Vienna, Department of Nutritional and Physiological Chemistry, Christian Doppler Laboratory for Bioactive Aroma Compounds: http://npc.univie.ac.at/home/cdl-fuer-bioaktive-aromastoffe/

http://www.eurekalert.org/pub_releases/2013-03/ksu-rbs031413.php

Researchers building stronger, greener concrete with biofuel byproducts

Kansas State University civil engineers are developing the right mix to reduce concrete's carbon footprint and make it stronger. Their innovative ingredient: biofuel byproducts.

MANHATTAN, KAN. - "The idea is to use bioethanol production byproducts to produce a material to use in concrete as a partial replacement of cement," said Feraidon Ataie, doctoral student in civil engineering, Kabul, Afghanistan. "By using these materials we can reduce the carbon footprint of concrete materials."
Concrete is made from three major components: portland cement, water and aggregate. The world uses nearly 7 billion cubic meters of concrete a year, making concrete the most-used industrial material after water, said Kyle Riding, assistant professor of civil engineering and Ataie's faculty mentor.

"Even though making concrete is less energy intensive than making steel or other building materials, we use so much of it that concrete production accounts for between 3 to 8 percent of global carbon dioxide emissions," Riding said.
To reduce carbon dioxide emissions from concrete production, the researchers are studying environmentally friendly materials that can replace part of the portland cement used in concrete. They are finding success using the byproducts of biofuels made from corn stover, wheat straw and rice straw.
"It is predicted that bioethanol production will increase in the future because of sustainability," Ataie said. "As bioethanol production increases, the amount of the byproduct produced also increases. This byproduct can be used in concrete."
The researchers are specifically looking at byproducts from production of cellulosic ethanol, which is biofuel produced from inedible material such as wood chips, wheat straw or other agricultural residue. Cellulosic ethanol is different from traditional bioethanol, which uses corn and grain to make biofuel. Corn ethanol's byproduct -- called distiller's dried grains -- can be used as cattle feed, but cellulosic ethanol's byproduct -- called high-lignin residue -- is often perceived as less valuable.
"With the cellulosic ethanol process, you have leftover material that has lignin and some cellulose in it, but it's not really a feed material anymore," Riding said. "Your choices of how to use it are a lot lower. The most common choices would be to either burn it for electricity or dispose of the ash."
When the researchers added the high-lignin ash byproduct to cement, the ash reacted chemically with the cement to make it stronger. The researchers tested the finished concrete material and found that replacing 20 percent of the cement with cellulosic material after burning increased the strength of the concrete by 32 percent.
"We have been working on applying viable biofuel pretreatments to materials to see if we can improve the behavior and use of ash and concrete," Riding said. "This has the potential to make biofuel manufacture more cost effective by better using all of the resources that are being wasted and getting value from otherwise wasteful material and leftover materials. It has the potential to improve the strength and durability of concrete. It benefits both industries."
The research could greatly affect Kansas and other agricultural states that produce crops such as wheat and corn. After harvesting these crops, the leftover wheat straw and corn stover can be used for making cellulosic ethanol. Cellulosic ethanol byproducts then can be added to cement to strengthen concrete.
"The utilization of this byproduct is important in both concrete materials and biofuel production," Ataie said. "If you use this in concrete to increase strength and quality, then you add value to this byproduct rather than just landfilling it. If you add value to this byproduct, then it is a positive factor for the industry. It can help to reduce the cost of bioethanol production."
The researchers have published some of their work in the American Society of Civil Engineer's Journal of Materials in Civil Engineering and are preparing several other publications. Ataie also was one of two Kansas State University graduate students named a winner at the 2013 Capitol Graduate Research Summit in Topeka. His poster was titled "Utilization of high lignin residue ash (HLRA) in concrete materials."
The research at Kansas State University was funded by more than $210,000 from the National Science Foundation. The researchers collaborated with the University of Texas, North Carolina State University and the National Renewable Energy Laboratory in Golden, Colo. The research also involved Antoine Borden, senior in civil engineering, Colorado Springs, Colo.

http://bit.ly/ZEQyi6

Are breast milk stem cells the real deal for medicine?

Evidence is piling up that both breast milk and breast tissue contain embryonic-like stem cells.

14 March 2013 by Douglas Heaven

PROTEINS, carbohydrates and vitamins are all on the menu for a breastfed baby. Now it seems you can add stem cells to that list. Evidence is piling up that both breast milk and breast tissue contain embryonic-like stem cells. That might mean we will soon have access to a source of stem cells without destroying embryos. This would be a boon as stem cells can turn into any type of human tissue, making them useful for treating degenerative diseases like Alzheimer's or for regrowing damaged heart muscle.
In 2011 Foteini Hassiotou at the University of Western Australia in Crawley and colleagues found stem cells in lactating breast tissue and breast milk. When they grew the breast milk cells they turned into the three types of cells from which all tissues and organs develop – just like human embryonic stem cells (hESCs) do.
Hassiotou has since found this "pluripotency" in many more breast milk samples and thinks that breast milk stem cells could one day replace those from embryos. In one study, her team looked at fresh breast milk from more than 70 healthy breastfeeding women. They found that BMSCs expressed several genes that are also found in hESCs and help them replicate. Cultured samples also grew into different tissues including bone, neuron, heart and pancreatic cells (Human Lactation, DOI: 10.1177/0890334413477242).

In some cases, the team found that 30 per cent of all cells in breast milk were stem cells. In studies with monkeys and mice the cells were shown to pass into the bloodstream. "One can speculate wildly about what they do in the baby," says Hassiotou. But she thinks that breastfed infants could be getting a developmental head start, with stem cells from the mother contributing to organ development in the newborn.
However, BMSCs fail one widely accepted test for embryonic cells: when injected into mice, they don't form a type of tumour called a teratoma. For many this failure is a deal-breaker.
But BMSCs are not alone. Mari Dezawa at Tohuku University in Sendai, Japan, and colleagues have found pluripotent cells called MUSE cells in bone marrow and connective tissue that do not form teratomas.
"The best stem cells might not make tumours," says Hassiotou. Dezawa agrees, and says that MUSE and BMSCs could be superior if they turn into a wide variety of cells without the risk of forming tumours.
Thea Tlsty at the University of California in San Francisco says she can imagine that there are pluripotent cells that do not make tumours. Her team recently identified pluripotent stem cells in breast tissue from non-lactating women and men (PNAS, doi.org/krn). Although her cells do form tumours, she agrees that the standard test needs revisiting.
Tlsty is not convinced that BMSCs are truly pluripotent, since they have yet to be shown to differentiate fully into living tissue. Nevertheless, she is open-minded. It used to be thought that these cells were restricted to the testes or ovaries, "now we're finding them all over the body".

http://www.eurekalert.org/pub_releases/2013-03/uop-prs031413.php

Penn research shows that suppressing the brain's 'filter' can improve performance in creative tasks

The brain's prefrontal cortex is thought to be the seat of cognitive control, working as a kind of filter that keeps irrelevant thoughts, perceptions and memories from interfering with a task at hand.

Now, researchers at the University of Pennsylvania have shown that inhibiting this filter can boost performance for tasks in which unfiltered, creative thoughts present an advantage.
The research was conducted by Sharon Thompson-Schill, the Christopher H. Browne Distinguished Professor of Psychology and director of the Center for Cognitive Neuroscience, and Evangelia Chrysikou, a member of her lab who is now an assistant professor at the University of Kansas. They collaborated with Roy Hamilton and H. Branch Coslett of the Department of Neurology at Penn's Perelman School of Medicine and Abhishek Datta and Marom Bikson of the Department of Biomedical Engineering at the City College of New York.
Their work was published in the journal Cognitive Neuroscience.
Previous studies have shown that the prefrontal cortex - in particular, the left prefrontal cortex - is one important area of the brain that supports cognitive control. As a test of whether reduced cognitive control might be advantageous in some circumstances, Thompson-Schill's team designed an experiment that involved inhibiting the activity of the left prefrontal cortex in adults while they completed a creative task.
In this task, participants are shown pictures of everyday objects and are asked to quickly come up with uses for them that are out of the ordinary, such as using a baseball bat as a rolling pin. Participants see a sequence of 60 objects, one every nine seconds, and the researchers measure how long it takes for them to come up with a valid response, or if they are unable to do so before the next picture appears.
The researchers hypothesized that high levels of cognitive control would be a detriment to coming up with these kinds of uncommon uses.
"When we use objects in daily life, our cognitive control helps us focus on what the object is typically used for and 'filters out' irrelevant properties," Chrysikou said. "However, to come up with the idea of using a baseball bat as a rolling pin, you have to consider things like its shape and the material it's made of."
"The real takeaway," Thompson-Schill said, "is that when you give people a task for which they do not know the goal - such as showing them an object and asking, 'What else can you do with this thing' - anything that they would normally do to filter out irrelevant information about the object will hurt their ability to do the task."
Experiments to test such hypotheses have been aided by new ways of non-invasively manipulating neurons in specific areas of the brain, inducing a variety of temporary changes in perception and performance.
The method Thompson-Schill's team used, called transcranial direct current stimulation, or tDCS, involves passing a weak electrical charge through the brain, aiming the charge's path so it intersects with areas thought to be associated with an ability or behavior. This charge can influence the electrical activity that constitutes cell-to-cell communication in those areas.
"TDCS is believed to induce incremental shifts in the electrical potential of neuronal membranes, making it more or less likely that neurons will reach their threshold for firing," Hamilton said. "In this instance, we

employed stimulation in a way that would make it harder for neurons to fire, thereby diminishing behaviorally relevant activity in that part of the brain."
Participants were first split into groups corresponding to three experimental conditions: one would receive tDCS to their left prefrontal cortex for the duration of the task, another would receive it to their right prefrontal cortex and a third would receive what amounted to a placebo. TDCS produces a slight tingling sensation on the scalp when it is first applied, so those in the third group received only a brief period of stimulation before the task began, rather than throughout.
As additional controls, each of these three groups was also split in half, with one set completing the uncommon-use task and the other simply stating what the object is normally used for. And all participants also completed a task that involved remembering strings of numbers, a common exercise in psychological experiments that has been shown not to require the prefrontal cortex.
"We wouldn't want to think that the stimulation affected everything," Thompson-Schill said. "So if we found an effect when participants were remembering numbers, we'd be worried about our interpretation of the data."
As expected, none of the experimental conditions affected participants' performance when asked to recall the sequences of numbers, or when they were asked to say the common uses of the objects they saw. But there was a marked difference between those who received tDCS to their left prefrontal cortex and those who didn't when completing the uncommon-use task.
The right prefrontal cortex and placebo groups couldn't come up with uncommon uses for an average of 15 out of 60 objects, whereas those whose left prefrontal cortices were being inhibited only missed an average of eight. The latter group was also able to provide correct responses an average of a second faster than the former two.
"A second faster difference is huge in psychology research. We're used to seeing differences measured in milliseconds," Thompson-Schill said. This is probably the biggest effect I've seen over my 20 years in research."
These results lend credence to the idea that high levels of cognitive control may be a disadvantage in some circumstances, such as in early development.
"We differ from non-human primates in having a long period of immaturity in our prefrontal cortex," Thompson-Schill said, "so we started considering whether this might not be an unfortunate accident of nature but rather a feature of our species' developmental path.
The slow development of the prefrontal cortex is one reason children fail at many attention-based tasks but excel at imaginative ones. It may also aid children in rapidly acquiring new knowledge.
"There are things that are important to not filter, in particular when you are learning," Thompson-Schill said. "If you throw out information about your environment as being irrelevant, you miss opportunities to learn about those things."
The research was supported by the National Institutes of Health and the Robert Wood Johnson Foundation.

http://www.eurekalert.org/pub_releases/2013-03/osu-ssh031413.php

Study shows how vitamin E can help prevent cancer

Researchers have identified an elusive anti-cancer property of vitamin E that has long been presumed to exist, but difficult to find.

COLUMBUS, Ohio –Many animal studies have suggested that vitamin E could prevent cancer, but human clinical trials following up on those findings have not shown the same benefits.
In this new work, researchers showed in prostate cancer cells that one form of vitamin E inhibits the activation of an enzyme that is essential for cancer cell survival. The loss of the enzyme, called Akt, led to tumor cell death. The vitamin had no negative effect on normal cells.
"This is the first demonstration of a unique mechanism of how vitamin E can have some benefit in terms of cancer prevention and treatment," said lead author Ching-Shih Chen, professor of medicinal chemistry and pharmacognosy at The Ohio State University and an investigator in Ohio State's Comprehensive Cancer Center.
The study appears in the March 19, 2013, issue of the journal Science Signaling.
Chen cautioned that taking a typical vitamin E supplement won't offer this benefit for at least two reasons: The most affordable supplements are synthetic and based predominantly on a form of the vitamin that did not fight cancer as effectively in this study, and the human body can't absorb the high doses that appear to be required to achieve the anti-cancer effect.
"Our goal is to develop a safe pill at the right dose that people could take every day for cancer prevention. It takes time to optimize the formulation and the dose," he said.
Chen has filed an invention disclosure with the university, and Ohio State has filed a patent application for the agent.

Vitamin E occurs in numerous forms based on their chemical structure, and the most commonly known form belongs to a variety called tocopherols. In this study, researchers showed that, of the tocopherols tested, the gamma form of tocopherol was the most potent anti-cancer form of the vitamin.
The scientists manipulated the structure of that vitamin E molecule and found that the effectiveness of this new agent they created was 20-fold higher than the vitamin itself in cells. In experiments in mice, this agent reduced the size of prostate cancer tumors.
These findings suggest that an agent based on the chemical structure of one form of vitamin E could help prevent and treat numerous types of cancer – particularly those associated with a mutation in the PTEN gene, a fairly common cancer-related genetic defect that keeps Akt active.
The researchers began the work with both alpha and gamma forms of the vitamin E molecule. Both inhibited the enzyme called Akt in very targeted ways, but the gamma structure emerged as the more powerful form of the vitamin.
In effect, the vitamin halted Akt activation by attracting Akt and another protein, called PHLPP1, to the same region of a cell where the vitamin was absorbed: the fat-rich cell membrane. PHLPP1, a tumor suppressor, then launched a chemical reaction that inactivated Akt, rendering it unable to keep cancer cells alive.
"This is a new finding. We have been taking vitamin E for years but nobody really knew about this particular anti-cancer mechanism," Chen said.
The gamma form was most effective because its chemical shape allowed it to attach to Akt in the most precise way to shut off the enzyme.
Because of how the various molecules interacted on the cell membrane, the scientists predicted that shortening a string of chemical groups dangling from the main body, or head group, of the gamma-tocopherol molecule would make those relationships even stronger. They lopped off about 60 percent of this side chain and tested the effects of the new agent in the prostate cancer cells.
"By reducing two-thirds of the chain, the molecule had a 20 times more potent anti-tumor effect, while retaining the integrity of vitamin E's head group," Chen said. This manipulation enhanced the anti-tumor potency of the molecule by changing its interaction with the cell membrane, so that the head group was more accessible to Akt and PHLPP1.
When mice with tumors created by these two prostate cancer cell lines were injected with the agent, the treatment suppressed tumor growth when compared to a placebo, which had no effect on tumor size. Chemical analysis of the treated tumors showed that the Akt enzyme signal was suppressed, confirming the effects were the same in animals as they had been in cell cultures.
The animal study also suggested the experimental agent was not toxic. Chen's lab is continuing to work on improvements to the molecule. *This work was supported by the National Institutes of Health.*
Co-authors include Po-Hsien Huang, Hsiao-Ching Chuang, Chih-Chien Chou, Huiling Wang, Su-Lin Lee, Hsiao-Ching Yang, Hao-Chieh Chiu, Naval Kapuriya, Dasheng Wang and Samuel Kulp of the Division of Medicinal Chemistry and Pharmacognosy at Ohio State. Huang and Chen also are affiliated with National Cheng-Kung University, Yang with Fu-Jen Catholic University, and Chiu with National Taiwan University, all in Taiwan; and Kapuriya with Saurashtra University in Gujarat, India.

http://txchnologist.com/post/45262921791/been-thinking-of-somebody-brain-researchers-know-who

Been Thinking of Somebody? Brain Researchers Know Who

FMRI scans of volunteers' media prefrontal cortexes revealed unique brain activity patterns associated with individual characters or personalities as subjects thought about them

March 13th, 2013 | by Charles Q. Choi

Scientists scanning the human brain can now tell whom a person is thinking of, the first time researchers have been able to identify what people are imagining from imaging technologies.
Work to visualize thought is starting to pile up successes. Recently, scientists have used brain scans to decode imagery directly from the brain, such as what number people have just seen and what memory a person is recalling. They can now even reconstruct videos of what a person has watched based on their brain activity alone. Cornell University cognitive neuroscientist Nathan Spreng and his colleagues wanted to carry this research one step further by seeing if they could deduce the mental pictures of people that subjects conjure up in their heads.
“We are trying to understand the physical mechanisms that allow us to have an inner world, and a part of that is how we represent other people in our mind,” Spreng says.

Imagining others

His team first gave 19 volunteers descriptions of four imaginary people they were told were real. Each of these characters had different personalities. Half the personalities were agreeable, described as liking to cooperate

with others; the other half were less agreeable, depicted as cold and aloof or having similar traits. In addition, half these characters were described as outgoing and sociable extroverts, while the others were less so, depicted as sometimes shy and inhibited. The scientists matched the genders of these characters to each volunteer and gave them popular names like Mike, Chris, Dave or Nick, or Ashley, Sarah, Nicole or Jenny.
The researchers then scanned volunteers' brains using functional magnetic resonance imaging (fMRI), which measures brain activity by detecting changes in blood flow. During the scans, the investigators asked participants to predict how each of the four fictitious people might behave in a variety of scenarios - for instance, if they were at a bar and someone else spilled a drink, or if they saw a homeless veteran asking for change.
"Humans are social creatures, and the social world is a complex place," Spreng says. "A key aspect to navigating the social world is how we represent others."
The scientists discovered that each of the four personalities were linked to unique patterns of brain activity in a part of the organ known as the medial prefrontal cortex. In other words, researchers could tell whom their volunteers were thinking about.
"This is the first study to show that we can decode what people are imagining," Spreng says.

Unlocking brain's personality models

The medial prefrontal cortex helps people deduce traits about others. These findings suggest this region is also where personality models are encoded, assembled and updated, helping people understand and predict the likely behavior of others and prepare for the future.
"The scope of this is incredible when you think of all the people you meet over the course of your life and are able to remember. Each one probably has its own unique representation in the brain," Spreng says. "This representation can be modified as we share experiences and learn more about each other, and plays into how we imagine future events with others unfolding."
The anterior medial prefrontal cortex is also linked to autism and other disorders were people have problems with social interactions. These findings suggest people with such disorders may suffer from an inability to build accurate personality models of others. Further research could not only help diagnose these diseases, but also help treat such disorders, researchers say.
The scientists detailed their findings online March 5 in the journal Cerebral Cortex.

http://www.sciencedaily.com/releases/2013/03/130314111853.htm

International Gender Difference in Math and Reading Scores Persists Regardless of Gender Equality

Even in countries with high gender equality, sex differences in math and reading scores persist in 75 nations

Malala Yousafzai, the teenaged advocate for Pakistani girls' education, was released from the hospital earlier this month. Most of the world's girls don't have to fight as hard as Yousafzai for their education.
However, even in countries with high gender equality, sex differences in math and reading scores persisted in the 75 nations examined by a University of Missouri and University of Leeds study. Girls consistently scored higher in reading, while boys got higher scores in math, but these gaps are linked and vary with overall social and economic conditions of the nation. A better understanding of these gaps and how they are related could help educators design curricula to help students of both genders apply their talents and deal with their weaknesses.
"Educational systems could be improved by acknowledging that, in general, boys and girls are different," said David Geary, MU professor of psychological science. "For example, in trying to close the sex gap in math scores, the reading gap was left behind. Now, our study has found that the difference between girls' and boys' reading scores was three times larger than the sex difference in math scores. Girls' higher scores in reading could lead to advantages in admissions to certain university programs, such as marketing, journalism or literature, and subsequently careers in those fields. Boys lower reading scores could correlate to problems in any career, since reading is essential in most jobs."
Generally, when conditions are good, the math gap increases and the reading gap decreases and when conditions are bad the math gap decreases and the reading gap increases. This pattern remained consistent within nations as well as among them, according to the study by Geary and Gijsbert Stoet of the University of Leeds that included testing performance data from 1.5 million 15-year-olds in 75 nations. The top five percent of scores within nations generally showed girls to be lower in math and boys to be lower in reading. That pattern continued in lower scoring groups until reaching the lowest scoring students, where the math achievement of boys and girls evened out but the reading gap increased, according to Geary.

"The consistent pattern within nations suggests the sex differences are not simply related to socio-economic factors," said Geary. Socio-economic and cultural factors are important in that they influence the performance of all students, but boys, as a group, respond more strongly than girls, perhaps due to a biological difference in sensitivity to wider conditions." For example, in nations with impoverished or violent conditions, boys' scores tended to fall faster and further than girls. On the other hand, in wealthier, socially stable nations boys' scores benefitted more than girls. This resulted in boys reducing the reading gap and widening the math gap.
"This finding has important implications for how we interpret the math gap of other countries," said co-author Gijsbert Stoet of the University of Leeds. "For example, policy makers often take Sweden as an example of being particularly good for reducing the gender gap in science, technology, engineering and math, but they do not realize that Swedish boys fall behind in reading more so than in most other highly developed nations. This is a good example of the inverse relation between the math and reading gaps. This phenomenon urgently needs more attention."
"In adult life, there are more male CEOs, but also more homeless men," said Geary. "Boys' prospects in life seem to react more intensely to positive and negative social conditions, hence we see more variation in boys' testing scores, especially when conditions are bad."
Gijsbert Stoet, David C. Geary. Sex Differences in Mathematics and Reading Achievement Are Inversely Related: Within- and Across-Nation Assessment of 10 Years of PISA Data. PLoS ONE, 2013; 8 (3): e57988 DOI: 10.1371/journal.pone.0057988

http://www.nature.com/news/super-dense-celestial-bodies-could-be-a-new-kind-of-planet-1.12599

Super-dense celestial bodies could be a new kind of planet

Space telescope's discoveries may be the remains of wandering ice giants.

Davide Castelvecchi

Mysterious dense bodies outside the Solar System could be the remnants of ice giants similar to Neptune that wandered too close to their suns, according to results presented this week at a meeting on exoplanets at the Royal Society in London.
Among the most puzzling finds of NASA's Kepler space mission to find exoplanets, which launched in 2009, are bodies too heavy for their size. In some of the rare cases in which astronomers can estimate both the mass and the size of distant planets discovered by the probe, the objects have radiuses similar to that of Earth but are denser than pure iron.
No conventional theories about planet formation can account for such densities in planets of this size. "There is no way to explain that in the Solar System," says Olivier Grasset, a geophysicist at the University of Nantes in France.

Fossil worlds

Grasset and his collaborators now say that the strange bodies could be the "fossil cores" of planets that were once much larger, an idea that was first proposed by researchers in 20111. These planets would have been ice giants that formed in the outer parts of a star system and then migrated inwards - as their orbits were affected by interactions with surrounding gas and dust - perhaps getting as close to their suns as Mercury is to ours. The hotter temperatures closer to the stars, Grasset explains, would evaporate the outer layers of the planets, which are made mainly of volatile components such as hydrogen, helium and water. The leftover cores would consist of rock and metal, just like the bulk of Earth, and could weigh up to several times as much as our planet, making them what scientists call super-Earths.
But these cores formed under the weight of their planets' outer layers, under pressures of around 500 gigapascals - 5 million times atmospheric pressure on Earth - and typical temperatures of about 6,000 kelvin. As a result, the materials in these cores should be more compacted, and denser, than Earth.

Quick change

Together with his colleagues Antoine Mocquet, a planetary scientist also at Nantes, and Christophe Sotin, a planetary geologist at NASA's Jet Propulsion Laboratory in Pasadena, California, Grasset created a computer simulation to test the idea.
The team found that if the outer layers of an ice giant are removed over billions of years, the materials would 'relax', expanding back to more ordinary densities. But if the stripping occurred over a geologically short time, the sudden cooling would keep the core locked into its dense state essentially forever. "If the process is short, you end up with a very compressed super-Earth," says Grasset.
Lars Stixrude, a geologist at University College London, calls the idea "fascinating" - although he warns that science's understanding of the behaviour of materials under the extreme temperatures and pressures of an ice-giant core is still incomplete. Grasset agrees that there are large uncertainties in his team's calculations, especially in the rate of relaxation of the naked cores. But, he adds, he and his colleagues made conservative assumptions.

William Borucki, a space scientist at NASA's Ames Research Center in Moffett Field, California, and leader of the Kepler mission, says that the idea is plausible, but that there could be other ways for the outer layers of an ice giant to be ripped away. The process could be the result of a cataclysmic collision with another planet-sized object, for example. Or perhaps the high-density cores could suggest that planets form through exotic processes similar to those of star formation. Whatever the implications, he says, it is exciting that Kepler's findings are upending old assumptions. "This is why we do science." *Nature doi:10.1038/nature.2013.12599*

http://www.scientificamerican.com/article.cfm?id=whiskey-makers-break-tradition-to-make-new-flavors

Barreling Ahead: Whiskey-Makers Break Cherished Traditions to Create New Flavors

Armed with modern analytic tools, distillers are studying the wood in the barrels and experimenting with the aging process. Is nothing sacred?

By Fred Minnick

Master distiller Harlen Wheatley of Buffalo Trace Distillery draws a bourbon whiskey sample out of the barrel and pours it into a brandy snifter glass. Wheatley raises it into the light; the bourbon illuminates with rich colors of caramel, gold, straw yellow and light brown. He tastes the seven-year-old drink known as W. L. Weller and says, "That's really coming along."

As Wheatley moves onto the next barrel, the glass sits in the light, the bourbon shining brightly and illustrating the chemical change wrought by the barrel. After being poured into the barrel, the colorless spirit sat there or "aged" for seven years. The liquid mingled with the wood, giving the bourbon it's color, taste and smell.

A new generation of distillers have begun to break time-honored tradition and tinker with the barrels, relying on science and experimentation to bring new flavors into the spirits. For the bourbon whiskey business, the barrel is everything.

Bourbon barrel science

All bourbon is whiskey, but not all whiskey is bourbon. Congress declared bourbon "America's Spirit" in 1964 and, according to the Federal Alcohol Administration Act, bourbon whiskey must be produced from a fermented mash of at least 51 percent corn, although malted barley, rye or wheat can be added to the mash. Once distilled, the clear spirit must be stored at not more than 125 proof in charred new oak containers. Coopers have long built bourbon barrels out of American white oak, specifically the species Quercus alba, instead of the popular-for-wine French white oak or other common oaks.

American white oak's durability as well as its ability to hold water and oxygenate it make it favorable for bourbon barrels. American oak is denser and harder than French oak, making barrels less prone leakage. Q. alba also yields different flavor profiles appealing to the U.S. whiskey market, says Brad Boswell, whose Independent Stave Company makes the majority of U.S. whiskey barrels.

"American oak has lactone levels certainly not found in French oak," Boswell says. Lactones, a molecule in oak wood that imparts taste, yield a coconut flavor that can be controlled by cooking, toasting and seasoning the wood. Before a barrel is assembled, barrel pieces called staves air dry either indoors or outdoors. This process slowly degrades the wood "because of the microbial activity that grows and feeds off the wood. The rainwater, snow and the natural elements leach the [bitter] tannins out of the wood," Boswell says.

Once air-dried, the staves form a 53-gallon barrel that is later charred to filter out organosulfur compounds that are not eliminated in the distilling process. Distillers pour fresh distillate into the new, charred oak barrel, and the change begins.

Pressed into the wood

At the chemical level, the wood's lactones, sugars, tannins, cellulose, hemicellulose and lignins interact with the esters, aldehydes, butanols and two-methyl butanols to give the whiskey flavors of vanilla, caramel, spice, toast, smoke, coconut, coffee and mocha. Vapor and barometric pressure push the whiskey deep inside the wood, bringing out more intense flavor notes. Wheatley says the higher a barrel is in a several-story warehouse, the more pressure the barrel exerts on the liquid, pushing it deeper inside the wood. "When it's real hot outside with high pressure you hit the side of the barrel and the bung [stopper] will shoot up four or five feet," Wheatley says. "If it's cold outside with low pressure, it's hard to get the barrel bung out. It will just sit there."

Such observations are valuable for Wheatley and others who have dedicated their careers to studying the complexities of bourbon whiskey. For 200 years distillers did not have the science or perhaps the desire to test the limits. They just followed the procedures and practices from distillers before them: Make spirit from fermented mash, age in new charred oak barrel and bottle.

Then, Scotch whisky–makers started experimenting with new ways to enhance whisky in the 1980s, and bourbon distillers followed their lead. "Growing up in the industry you'd hear old-timers say you can't make barrels out of maple or other species," says Chris Morris, master distiller for Woodford Reserve Distillery. "But

with the handcuffs off, due to the experimentations in the Scotch whisky industry, we said 'it's about time to see what we can and can't do.'"

Flavor experiments

To change whiskey, a master distiller has to change one of the whiskey's flavor sources. Most distillers choose to alter the wood during the aging process.

Morris recently launched Woodford Reserve "Four Wood," the seventh release in Woodford Reserve's annual Master's Collection, which sees Morris alter one of the five sources of the whiskey's flavor - grain, water, fermentation, distillation or maturation. Focusing on the time the whiskey spends in the barrel for 2012, Morris put standard six- to seven-year-old Woodford Reserve in a maple wood barrel as well as former sweet wine casks to lend more chocolate, nutty and dark cherry flavors not usually found in bourbon. Much like the original Woodford Reserve mingled with the new charred American oak barrel, the "Four Wood" chemically reacted with its barrel wood to produce a particular set of flavors. The former fortified wine barrels had wine soaked into the wood and are larger than standard whiskey barrels, giving the Woodford Reserve a larger surface-to-whiskey ratio as well as the small-scale fruity flavors that remained from the barrel's former alcohol.

In an effort to create a spicier-finishing whiskey, Maker's Mark added toasted French white oak staves to its existing bourbon barrel for its 2010 Maker's 46. "French oak has a different flavor profile than American oak - it's spicier," Boswell says. "The French oak wood is lighter, a less dense wood. The oxygen interacts with the spirit differently than the American oak barrel."

French white oak packs nine times more tannic acid than American oak, Boswell says. When the Maker's Mark hits the barrel and mingles with the French and American oak, the whiskey takes on both woods' profile characteristics. With the French spice and American sweetness, Maker's 46 delivers a spicy, rich caramel whiskey that leaves its flavor on the tongue longer than traditional Maker's Mark.

Aging has even gone beyond stationary warehouses. For its Ocean-Aged Bourbon, Jefferson's Reserve placed several barrels on a 126-foot ship and let the casks cruise at sea for nearly four years. The increased oceanic air pressure (compared with its warehouse), along with the Panama Canal's extreme heat pushed the whiskey deeper inside the wood, causing the wood sugars to caramelize and add a rumlike black hue. The whiskey breathed a little easier, too, says Trey Zoeller, who co-founded Jefferson's Reserve. "The porous nature of the barrel not only allows for evaporation of bourbon out of the barrel, but also [for] the barrel to breathe in the salt air, giving it a briny taste," Zoeller notes.

But Wheatley's Buffalo Trace Distillery may hold the record for whiskey experimentation. Since 1987 the company has conducted more than 1,500 barrel experiments for its Experimental Whiskey collection. These tests included studying sections of the tree to determine which heartwood should go into which stave and making a French oak barrel three times the size of a standard barrel. In the latest experiment Wheatley charred a regular bourbon barrel for 3.5 minutes instead of the standard 55 seconds. "We could not have gone a second more," Wheatley says. "The barrel nearly fell apart."

As for the whiskey - well, some people liked it, some didn't. And that's the standard reaction to the whiskeys that break tradition. Many whiskey purists despise these new-age whiskeys, saying distillers are trying to fix something that's not broken. "I've developed thick skin over the years," Morris says about the negative reviews. "Everything I do is about making [whiskey] better."

http://bit.ly/XE192t

Wired and Wireless Components of the Brain

Unknown left-sided brain/immune network might influence infections. But why would the left side of the brain affect immunity?

By Jon Lieff | March 14, 2013 |

Traditionally, we have understood the immune system and the nervous system as two distinct and unrelated entities. The former fights disease by responding to pathogens and stimulating inflammation and other responses. The latter directs sensation, movement, cognition and the functions of the internal organs. For some, therefore, the recent discovery that left-sided brain lesions correlate with an increased rate of hospital infections is difficult to understand. However, other recent research into the extremely close relationship between these two systems makes this finding comprehensible.

A study, published in the March 2013 issue of Archives of Physical Medicine and Rehabilitation, looked at more than 2,000 hospital patients with brain lesions from either stroke or traumatic brain injury. They looked at how many of these brain-injured patients contracted infections within 2 to 3 days of admission. Of those patients who developed infections, 60% had left-sided lesions. The authors concluded that an unknown left-sided brain/immune network might influence infections. But why would the left side of the brain affect immunity?

The nervous and immune systems are quite different in their speed and mode of action. The two major immune systems, innate and adaptive, are both wireless - they communicate through cell-to-cell contact, secreted signals, and antigen-antibody reactions. The innate system is the first responder, followed by the slower adaptive response. The nervous system, on the other hand, is wired for much more rapid communication throughout the body. It turns out that the two work surprisingly closely together.

The Brain Helps Immune Function

One example of cooperation between the immune and nervous systems is inflammation. Of the four signs of inflammation - pain, heat, redness, and swelling - it has been thought that only pain is mediated through the nervous system. Recently, however, it has been shown that all aspects of the immune process are in some ways modulated or directly meditated by the nervous system.

Only quite recently was it learned that neurons could directly stimulate the immune mast and dendritic cells into action against pathogens. Also, neuropeptides secreted by neurons often function directly as an antibiotic. A surprising new finding is that pain fibers send signals in the direction opposite to their usual sensory function, and directly alter the immune response by stimulating white blood cells and changing the flow of blood.

Direct links between the two systems have now been found in which neurons also affect the three hallmarks of inflammation other than pain - heat, swelling and redness. The first response to danger comes from nerves in the skin, lining of the lungs, and digestive and urinary tracts. Neuronal signals related to noxious stimuli, trauma, toxins, and microbes use more than a dozen recently discovered neurotransmitters to directly change blood flow, which increases heat, swelling and redness and attracts local immune cells. Another finding consistent with this is that severing a nerve lowers inflammation in patients with arthritis.

Many of the complex feedback loops between immune cells and neurons are just being discovered. For example, lymphocytes, whose behavior is now known to be affected by dopamine, also secrete dopamine. In this elaborate communication circuit, lymphocytes are affected by neuronal secretion of dopamine and then use dopamine to pass signals to other immune cells.

The Immune System Helps the Nervous System

Just as neurons are using their hard-wired, speedy connections to perform functions previously thought to be specific to the immune system, so too are immune cells performing tasks thought to be in the purview of the nervous system.

It is critical to avoid damage in the brain from immune reactions. The brain is the only region of the body where intrusion of ordinary immune cells is rare and can be devastating, causing much of the damage associated with illnesses such as meningitis and encephalitis. Microglia are specialized brain-based immune cells, part of the glia family, that protect against intruders near the blood brain barrier. They also watch for microbes near another less well-known protective barrier in the brain, made up of a dense web of astrocytes, another type of glial cell. When there is an intruder, microglia send warning signals to the neurons and other glia cells, triggering a rapid response. In this response, microglia can identify microbes and toxins, and can provide antigens related to these microbes to immune cells. Immune cells, such as macrophages, dendritic cells, and T cells, are waiting in the blood vessels nearby to help.

But immune cells do much more than just protecting the brain from intruders. In the peripheral nervous system, immune cells help rebuild axons that have been damaged. Immune cells are also critical to the very important synapse-pruning process that occurs on a daily basis to update connections and eliminate unnecessary and unused synapses between neurons. One major way that synapses are pruned is with the help of the complement cascade, a very elaborate component of the immune system that "complements" the use of antibodies to kill pathogens. In fact, when a fetus is being pruned of the 900 billion extra neurons not being maintained through experience, there is a very high amount of complement protein present in the fetus. Finally, molecules involved in the immune antigen reactions, such as immunoglobulin, sit on the surface of neurons as adhesion molecules. These adhesion molecules guide neuron migration, as well as the long voyage of the axon to make a synapse, where one neuron meets another neuron that has on its surface a protein molecule from the complement cascade.

A very surprising recent finding goes even further. It has been discovered that microglia control production of neurons from stem cells as the brain develops. These brain-based immune cells remove healthy neural progenitor cells through phagocytosis to control the over-production of neurons.

Immune System and Behavior

There are very close ties between the immune system and human behavior. One example is the influence of interleukin 6, a very important cytokine signal from immune cells, which has been tied to hunger and the ability to burn fat and lose weight. Another very familiar behavior triggered by the immune system is the "sick feeling" that includes fatigue, pain, and lack of interest. The sick feeling is triggered by microglia in the brain, but through a surprising and complex route. When microbes trigger lymphocytes in the body, the lymphocytes

secrete cytokine signal molecules, such as interleukin 1 or 6. These cytokines activate the vagus nerve to send a signal backwards from the body to the brain, which triggers the microglia to send yet another signal that triggers the sick feeling. The sick feeling modifies our behavior by causing us to slow down and rest, thus providing more energy for the body to fight the infection.

So, we really have one brain with two branches - a wireless branch that can travel to hard-to-reach places and a hard-wired branch that provides very fast communication throughout the body - both constantly working together. Knowing that the brain influences the immune reaction to infection and that some brain functions tend to be lateralized, it is certainly reasonable to consider the possibility that the left side of the brain helps defend against infections. This recent research finding poses new questions and new directions for future medical innovations. Will we be able to help fight infections in the future with medications, procedures, or other techniques that affect the brain?

1. Pasquale G. Frisina, Ann M. Kutlik, Anna M. Barrett. Left-Sided Brain Injury Associated With More Hospital-Acquired Infections During Inpatient Rehabilitation. Archives of Physical Medicine and Rehabilitation, 2013; 94 (3): 516 DOI: 10.1016/j.apmr.2012.10.012

http://ars.to/WLtKly

Ten years after SARS, a novel coronavirus causes global health concerns

A new virus has caused 9 deaths; has SARS left us able to contain it?

by Allie Wilkinson - Mar 15 2013, 3:30am TST

A new virus emerged nearly a year ago in Jordan, predominantly infecting people who live in or have traveled to the Middle East. Two days ago, the World Health Organization confirmed the fifteenth case of infection with the novel coronavirus - a family of viruses that includes both the common cold and SARS - and a fatality that brought the death count to nine. The World Health Organization has been monitoring the situation closely and has been working with agencies in member states, such as the Center for Disease Control, to better understand the public health risk posed by the virus.

Ten years ago, the SARS outbreak spurred efforts by the World Health Organization to improve global responses to health threats and crises. In November 2002, a middle-aged man went to the hospital in Foshan, China with what appeared to be pneumonia. The man recovered and returned home. It would have been an unremarkable event, except for the fact that it was likely to have been the first case of severe acute respiratory syndrome, or SARS.

Others were infected with the mystery virus, but it didn't come to the world's attention until February 21, 2003, when a professor of nephrology from a neighboring municipality traveled to Hong Kong. Shortly after his arrival, he realized he had the same symptoms of the patients he had been treating, so he checked himself into the local hospital. He died 11 days later.

In the wake of his death, others fell ill and took the virus with them on their travels. On March 12, 2003, the World Health Organization issued a global alert. By the beginning of April, Hong Kong reported 685 cases and 16 deaths, and the epidemic was spreading. Eventually the virus spread to Asia, North America, South America, and Europe, infecting more than 8,000 people and killing 774.

The epidemic not only renewed the debate about how countries should cooperate to combat international public health crises, but it also proved to be a success in collaboration across borders. Thirteen laboratories in 10 countries labored to identify and sequence the virus' genome, which was accomplished within a month. The World Health Organization's Global Outbreak Alert and Response Network analyzed case reports from all countries affected by SARS in real time and helped guide management and infection control. Thanks in part to these efforts, the outbreak was declared contained by July 2003.

The rapid spread of SARS was a turning point in the World Health Organization's International Health Regulations. Previously, the regulations had focused on just three infections diseases: cholera, pneumonic plague, and yellow fever. But the outbreaks of SARS in 2002 to 2003, then avian influenza in 2004 to 2005, lead to a revised set of International Health Regulations put in place in 2005. The revisions provided the world with the legal framework to mount a collective defense against global threats to human health. Changes included increased mandatory reporting for a number of illnesses, better surveillance and response, and ensuring that ports of travel between countries have measures in place to prevent the spread of disease.

In a "Perspective" article published today in the journal Science, Isabelle Nuttall and Christopher Dye of the World Health Organization ask if the revisions to the International Health Regulations are adequate. "The critical test comes not from scrutiny of the legislative fine print but from the way the regulations work in practice," they write.

The H1N1 flu pandemic of 2009 has been the biggest test so far. During the outbreak, a report reviewing how well the International Health Regulations are functioning found that the new regulations allowed for better

preparation. Still, the world remained ill-prepared for a pandemic of this magnitude, or any large global, sustained threat to public health. Challenges exist today: national and local capacities called for in the regulations are still not up to standards, national legal arrangements are not always consistent with international laws, and member states still worry about maintaining their reputations when divulging information about outbreaks.

Out of 195 signatories, 119 did not meet last June's deadline to implement core competencies to detect, assesses, inform, and respond to public health threats. Instead, those 119 asked for an extension.

The authors postulate that the novel coronavirus serves as a reminder of the threat posed by SARS a decade ago. While we cannot know what, where, or when, another major international health threat is inevitable - will we be fully prepared? *Science, 2013. DOI: 10.1126/science.1236434 (About DOIs).*

http://www.wired.com/wiredscience/2013/03/bat-eating-spiders/

Bat-Eating Spiders: The Most Terrifying Thing You'll See Today

A bat's enemies: owls, hawks, snakes, the Joker, spiders. Spiders? Yes.

By Nadia Drake

The incidence of spiders eating bats could be more widespread than initially suspected, reports a study published March 13 in PLoS ONE.

To reach this conclusion, the authors spoke with scientists, conducted an extensive scientific literature review, dug through the blogosphere, and looked for pictures of spiders eating bats on Flickr.

The search turned up 52 reports of bat-eating spiders, less than half of which had been published before.

The authors report that bat-munching spiders live on every continent except Antarctica. Most catch bats in webs, like the giant golden silk orb-weavers (Nephilidae). As adults, these spiders' leg spans can be 10-15 centimeters across, and they weave webs more than a meter in diameter. Bats have also been observed in the webs of social spiders, such as Parawixia. But a minority of spiders, like huntsman and tarantulas, forage for prey without a web, and have been spotted munching on bats on forest floors.

***Adult Proboscis Bat (Rhynchonycteris naso) entangled in a web of Argiope savignyi at the La Selva Biological Station, northern Costa Rica* (photo by Mirjam Knörnschild, Ulm, Germany).**

Perhaps most surprisingly, "An attempt by a large fishing spider Dolomedes triton to kill a bat pup has been witnessed below a bridge in Indiana," the authors report. That spider's plot was foiled after it became frightened by photographers.

http://bit.ly/101zUwM

Bat-Eating Spiders Are Everywhere

There's only one place in the world to escape bat-catching spiders: Antarctica. These arachnids ensnare and pounce on bats everywhere else in the world, researchers say.

Mar 16, 2013 11:15 AM ET // by Charles Q. Choi, OurAmazingPlanet

Bats rank among the most successful groups of mammals, with the more than 1,200 species of bats comprising about one-fifth of all mammal species. Other than owls, hawks and snakes, bats have few natural enemies.

Still, invertebrates — creatures without backbones — have been known to dine on bats. For instance, giant centipedes in a cave in Venezuela were seen killing and eating bats, and the arachnids known as whip spiders were spotted feeding on dead bats in caves of the Caribbean. Cockroaches have been observed feeding on bat pups that have fallen to the floor of caves.

***Bat-eating spiders are common and apparently creep around every continent, except Antarctica, devouring various bat species. Here, a dead bat (Rhinolophus cornutus orii) caught in the web of a female Nephila pilipes on Amami-Oshima Island, Japan.* Yasunori Maezono, Kyoto University, Japan Gallery**

Spider-eat-bat world

Accidental deaths of bats in spiderwebs were known as well, but were thought to happen very rarely. Still, spiders are known to occasionally dine on a variety of vertebrates — creatures with backbones. For instance,

fishing spiders capture and devour fish and frogs; some species of wolf spiders, huntsman spiders, tarantulas and related spiders have been seen killing and eating frogs and lizards; and tarantulas and comb-footed spiders have apparently fed on snakes and mice. There are also numerous reports of spiders killing other flying vertebrates, snagging birds with large orb webs.
Recent studies of a web-building spider species (Argiope savignyi) and a tarantula species (Poecilotheria rufilata) both killing small bats led researchers to suggest that bat captures and kills due to spiders might be more frequent than previously thought. So they analyzed 100 years' worth of scientific reports, interviews of bat and spider researchers and the staff of bat hospitals, and scans of image and video sites. The search revealed 52 cases of bat-catching spiders worldwide. ***(See Photos of Bat-Eating Spiders in Action)***

http://bit.ly/10Wq2qV

Lowly aspirin fights deadly skin cancer in women

A PILL sitting in many medicine cabinets may protect women against skin cancer.

Aspirin, a non-steroidal anti-inflammatory drug (NSAID), is known to protect against heart disease and colorectal cancer. Now, data from 59,806 white women in the US supports the idea that it also protects against melanoma, the most dangerous type of skin cancer. Over a 12-year period, incidence of melanoma was 21 per cent lower in women taking high-dose aspirin at least twice a week than in people not taking NSAIDs regularly. In all, 115 of the 15,089 aspirin-takers developed melanoma, compared with 344 of 35,529 people (Cancer, DOI: 10.1002/cncr.27817).
A likely explanation is that aspirin dampens inflammation pathways that aggravate the spread of the cancer, says Jean Tang of the Stanford University School of Medicine in Palo Alto, California, who led the study.
"These findings need to be followed up to find out if there's a real effect," says Hazel Nunn, head of health information at Cancer Research UK. She adds that melanoma is largely preventable by protecting skin from sunburn.

http://bit.ly/YvQSz1

More HIV 'cured': first a baby, now 14 adults

Two weeks after the revelation that a baby has been "cured" of HIV, reports suggest that a similar treatment can cure some adults too. Early treatment seems crucial, but does not guarantee success.

21:00 14 March 2013 by Andy Coghlan

Asier Sáez-Cirión of the Pasteur Institute's unit for regulation of retroviral infections in Paris analysed 70 people with HIV who had been treated with antiretroviral drugs (ARVs) between 35 days and 10 weeks after infection – much sooner than people are normally treated.
All of the participants' drug regimes had been interrupted for one reason or another. For example, some people had made a personal choice to stop taking the drugs, others had been part of a trial of different drug protocols. Most of the 70 people relapsed when their treatment was interrupted, with the virus rebounding rapidly to pre-treatment levels. But 14 of them – four women and 10 men – were able to stay off of ARVs without relapsing, having taken the drugs for an average of three years.
The 14 adults still have traces of HIV in their blood, but at such low levels that their body can naturally keep it in check without drugs.

Drugless years

On average, the 14 adults have been off medication for seven years. One has gone 10-and-a-half years without drugs. "It's not eradication, but they can clearly live without pills for a very long period of time," says Sáez-Cirión.
Last week, a baby was reported to have been "functionally cured" of HIV after receiving a three-drug regime of ARVs almost immediately after birth. Sáez-Cirión warns that rapid treatment doesn't work for everyone, but the new study reinforces the conclusion that early intervention is important.
"There are three benefits to early treatment," says Sáez-Cirión. "It limits the reservoir of HIV that can persist, limits the diversity of the virus and preserves the immune response to the virus that keeps it in check."
Further analysis confirmed that the 14 adults were not "super-controllers" – the 1 per cent of the population that are naturally resistant to HIV – since they lack the necessary protective genes. Also, natural controllers rapidly suppress their infections, whereas these 14 mostly had severe symptoms which led to their early treatment.
"Paradoxically, doing badly helped them do better later," says Sáez-Cirión.

Rapid response

The researchers are trying to identify additional factors that could explain why early intervention only works on some people, hopefully extending the scope for more functional cures.

"This whole area is fascinating, and we've been looking very closely at issues of early initiation of treatment, and the potential for functional cures," says Andrew Ball, senior adviser on HIV/AIDS strategy at the World Health Organization in Geneva.
"The big challenge is identifying people very early in their infection," says Ball, adding that many people resist testing because of the stigma and potential discrimination. "There's a good rationale for being tested early, and the latest results may give some encouragement to do that," he says.
Journal reference: PLoS Pathogens, DOI: 10.1371/journal.ppat.1003211

http://bit.ly/XPVqqv

Donor livers kept alive outside the body for 24 hours

Donated livers can survive for at least a day outside the body thanks to a new device which keeps the organ ticking over as if it hadn't been removed.

17: 00 15 March 2013 by Andy Coghlan

The machine is likely to more than double the availability of livers for transplant. The device was unveiled today in London by its developer Peter Friend, professor of transplantation surgery at the University of Oxford.
In the US and Europe, 2000 livers get discarded each year because they deteriorate in transit, damaged by the ice packs and solutions that, for the past 40 years, have been the usual way to preserve them.
At present, a quarter of the 30,000 people on US and European liver transplant waiting lists die each year before receiving an organ.
The new device can keep a donated liver at body temperature, supplying it with blood, sugar, oxygen and nutrients. Whereas most frozen livers become unusable after about 14 hours of cold storage, the new device keeps them alive and in perfect condition for at least 24 hours. "In animals, we've gone up to 72 hours and see no reason why it shouldn't go even further than that," says Friend.

Buying time

He is hopeful that as well as buying precious time in which to use the organ, the device will enable surgeons to better judge a liver's condition before transplanting it, because in the device, it carries on functioning as normal. "It gives the opportunity to test-drive the organ before transplanting it," says Constantin Coussios, co-developer of the device and founder of OrganOx, the company set up by the University of Oxford to commercialise it.
Video footage shows Friend plumbing a donated liver into the device. Within seconds of connection, the brown-grey organ turns bright red as blood floods into its capillaries.
As in the body, blood and nutrients enter through the hepatic artery and the portal vein, and exit through the inferior vena cava. A fourth connection to the bile duct enables the liver's functioning to be monitored.
The box containing the liver and its plumbing is connected to a master console that monitors and controls the organ's life support.
A pump mimics the heart, an oxygenator mimics the lungs and tubes supply donated blood, explains Stuart Kay of Team Consulting in Cambridge, UK, which miniaturised and optimised the original system developed at Oxford. "The key is that the system 'listens' to the organ to find out how much blood to supply, and at what pressure," says Kay. Sensors for fluid flow and pressure, plus levels of oxygen, carbon dioxide and sugar in the blood, are part of the disposable circuitry, he adds. Also, the device is fully automated so that non-specialist medical staff can use it and load it easily into planes or ambulances.

Clinical pilot

Two people have received livers kept alive using the device. They were both treated at King's College Hospital, London, in February, and are among 20 people taking part in a pilot clinical trial that, if successful, should allow the device to win approval for use in Europe by next year. Further randomised trials are planned to compare the performance of the device with existing preservation methods using freezing. Friend says that animal experiments, mainly in pigs, have already demonstrated that the device outperforms freezing.
It also enables surgeons to transplant fatty livers that would normally be rejected because they do not respond well to the freezing process, he says. Friend says that with modifications, the same technology could be applied to preserve the pancreas, kidneys, small bowel and lungs.

http://www.bbc.co.uk/news/health-21805395

Obese heart patients 'do better'

Obese cardiac patients are less likely to die than their normal weight counterparts, say researchers.

This is despite them reporting worse health and being less likely to follow lifestyle advice, a study of more than 4,400 patients reported. One explanation is that doctors treat the disease more aggressively, the University College London team said. The British Heart Foundation also said that where people stored fat, not just general obesity, was important.

It is not the first time researchers have pointed out this paradox, that being overweight or obese - a risk factor for heart disease in itself - can actually lead to a better prognosis. One theory has been that maybe such patients were fitter, despite their size - taking more exercise for example.
To see if this was the case, researchers from University College London looked at data from patients who took part in the Health Survey for England or Scottish Health Survey.
They found that, as with other studies, patients with cardiovascular disease who were obese or overweight were less likely to die over the next seven years than people of a normal weight who had the condition. In all 31% of patients were obese - that is with a body mass index of 30 or more - they reported in Preventive Medicine.
Those patients tended to be younger but reported worse health and had more heart risk factors such as raised cholesterol and blood pressure, but were less likely to smoke.
The researchers found that those who took part in physical activity at least once a week and did not smoke had a lower risk of death whatever their weight. But obese patients who did not stick to these healthy lifestyle recommendations still had a lower risk of death than normal weight patients who smoked or were inactive.

BMI a 'poor marker'

Study leader Dr Mark Hamer said they were trying to explain why obese heart patients seemed to do better by looking at lifestyle factors, but they found that it was not the case that obese patients were healthier.
"We don't yet understand this paradox and we would clearly not advise patients to put on weight. "One of the more sensible explanations may be that when obese patients present to their doctor, they are given more aggressive treatment because they are seen as very high risk," he explained.
"We do know, for example with cardiac rehabilitation, that the thing that absolutely works is exercise - that dramatically reduces risk even though you don't necessarily lose weight." Other work by the same researchers has shown that a certain proportion of obese patients have very normal health and are not at increased risk of heart disease. "BMI is quite a poor marker of what's going on," Dr Hamer added.
June Davison, a senior cardiac nurse at the British Heart Foundation, said: "It seems contradictory that one of the risk factors for heart disease may improve survival rates. "The reason for this link remains unclear, but it's possible that those with a higher BMI go to their doctor sooner and may be treated more aggressively. "Also, this study only measured BMI. When looking at health risk it's not only BMI that matters, but where fat is stored. "Carrying excess fat around the middle can produce toxic substances which can increase your health risk."

http://nyti.ms/1463XXK

How Beer Gave Us Civilization

Beer's place in the development of civilization deserves at least a raising of the glass

By JEFFREY P. KAHN

Anders Nilsen

HUMAN beings are social animals. But just as important, we are socially constrained as well.
We can probably thank the latter trait for keeping our fledgling species alive at the dawn of man. Five core social instincts, I have argued, gave structure and strength to our primeval herds. They kept us safely codependent with our fellow clan members, assigned us a rank in the pecking order, made sure we all did our chores, discouraged us from offending others, and removed us from this social coil when we became a drag on shared resources.
Thus could our ancient forebears cooperate, prosper, multiply — and pass along their DNA to later generations. But then, these same lifesaving social instincts didn't readily lend themselves to exploration, artistic expression, romance, inventiveness and experimentation — the other human drives that make for a vibrant civilization.
To free up those, we needed something that would suppress the rigid social codes that kept our clans safe and alive. We needed something that, on occasion, would let us break free from our biological herd imperative — or at least let us suppress our angst when we did.
We needed beer.
Luckily, from time to time, our ancestors, like other animals, would run across fermented fruit or grain and sample it. How this accidental discovery evolved into the first keg party, of course, is still unknown. But evolve it did, perhaps as early as 10,000 years ago.
Current theory has it that grain was first domesticated for food. But since the 1950s, many scholars have found circumstantial evidence that supports the idea that some early humans grew and stored grain for beer, even before they cultivated it for bread.

Brian Hayden and colleagues at Simon Fraser University in Canada provide new support for this theory in an article published this month (and online last year) in the Journal of Archeological Method and Theory. Examining potential beer-brewing tools in archaeological remains from the Natufian culture in the Eastern Mediterranean, the team concludes that "brewing of beer was an important aspect of feasting and society in the Late Epipaleolithic" era.

Anthropological studies in Mexico suggest a similar conclusion: there, the ancestral grass of modern maize, teosinte, was well suited for making beer — but was much less so for making corn flour for bread or tortillas. It took generations for Mexican farmers to domesticate this grass into maize, which then became a staple of the local diet.

Once the effects of these early brews were discovered, the value of beer (as well as wine and other fermented potions) must have become immediately apparent. With the help of the new psychopharmacological brew, humans could quell the angst of defying those herd instincts. Conversations around the campfire, no doubt, took on a new dimension: the painfully shy, their angst suddenly quelled, could now speak their minds.

But the alcohol would have had more far-ranging effects, too, reducing the strong herd instincts to maintain a rigid social structure. In time, humans became more expansive in their thinking, as well as more collaborative and creative. A night of modest tippling may have ushered in these feelings of freedom — though, the morning after, instincts to conform and submit would have kicked back in to restore the social order.

Some evidence suggests that these early brews (or wines) were also considered aids in deliberation. In long ago Germany and Persia, collective decisions of state were made after a few warm ones, then double-checked when sober. Elsewhere, they did it the other way around.

Beer was thought to be so important in many bygone civilizations that the Code of Urukagina, often cited as the first legal code, even prescribed it as a central unit of payment and penance.

Part of beer's virtue in ancient times was that its alcohol content would have been sharply limited. As far as the research has shown, distillation of alcohol to higher concentrations began only about 2,000 years ago.

Today, many people drink too much because they have more than average social anxiety or panic anxiety to quell — disorders that may result, in fact, from those primeval herd instincts kicking into overdrive. But getting drunk, unfortunately, only compounds the problem: it can lead to decivilizing behaviors and encounters, and harm the body over time. For those with anxiety and depressive disorders, indeed, there are much safer and more effective drugs than alcohol — and together with psychotherapy, these newfangled improvements on beer can ease the angst.

But beer's place in the development of civilization deserves at least a raising of the glass. As the ever rational Ben Franklin supposedly said, "Beer is living proof that God loves us and wants us to be happy."

Several thousand years before Franklin, I'm guessing, some Neolithic fellow probably made the same toast.

Jeffrey P. Kahn, a clinical associate professor of psychiatry at NewYork-Presbyterian Hospital, is the author of "Angst: Origins of Anxiety and Depression."

http://phys.org/news/2013-03-high-cesium-fish-fukushima.html

High cesium level found in fish by Fukushima plant

The Japanese utility that owns the tsunami-damaged nuclear power plant says it has detected a record 740,000 becquerels per kilogram of radioactive cesium in a fish caught close to the plant.

March 17, 2013 by Malcolm Foster

That's 7,400 times the government limit for safe human consumption. The bottom-dwelling fish called a greenling was found Feb. 21 in a cage set up by Tokyo Electric Power Co. inside the port next to the Fukushima Dai-ichi nuclear power plant, said a utility official who requested anonymity, citing company policy.

The March 11, 2011, earthquake and tsunami damaged the plant, causing meltdowns that spewed radiation into the surrounding soil and water. Some experts speculate that radioactive water may be seeping from the plant into the ocean. Most fish along the Fukushima coast are barred from market.

http://phys.org/news/2013-03-idea-startup-colony-anchored-pacific.html

Idea floated for a startup colony anchored in Pacific Ocean

Even here in the world capital of far-fetched ideas, this one is more outlandish than most.

Two Silicon Valley entrepreneurs, frustrated by the shortage of visas that keep some of the world's brightest science and engineering minds from building companies on dry land, have hatched a plan to build a startup colony in the middle of the Pacific.

Max Marty and Dario Mutabdzija say they plan to park a cruise ship 12 nautical miles off the coast of Northern California in international waters. Foreign-born entrepreneurs would live and work on the ship, building startups within commuting distance of Silicon Valley. They wouldn't need the work visas that are so hard to

come by. They would just need business tourism visas that would let them ferry back and forth to Silicon Valley once or twice a week.
The unusual project, called Blueseed, illustrates the fantastical lengths to which some in Silicon Valley are willing to go in their bid to bring more highly skilled foreign workers and entrepreneurs to its shores.
The high-tech industry has been lobbying lawmakers without success to increase the cap of 65,000 temporary work visas permitted each year. Strict limits on high-tech visas keep foreigners - many of whom were educated in the United States, sometimes at taxpayer expense - on waiting lists for years. That brain drain threatens the continued growth of the high-tech industry and the U.S. economy, said Vivek Wadhwa, author of "The Immigrant Exodus: Why America Is Losing the Global Race to Capture Entrepreneurial Talent."
"We are choking off the supply of immigrants and the lifeblood of Silicon Valley," Wadhwa said.
But the 2012 elections, in which Latino voters played an influential role, have sparked new hope for sweeping immigration reform. And - for the first time - Silicon Valley leaders think they have a real shot at getting more high-tech visas for foreign talent.
Executives have met with President Barack Obama and lawmakers. They are planning a nationwide social media campaign, or "virtual march," to encourage people to use the Internet - email, Facebook, Twitter - to tell lawmakers they want immigration reform - a grass-roots tactic that last year helped Silicon Valley rally opposition to proposed legislation to combat piracy and established the high-tech industry as a political force.
Silicon Valley has also begun to quietly lobby lawmakers in the Republican-controlled House.
Obama, in his State of the Union speech in February, called for "real reform" that would "attract the highly skilled entrepreneurs and engineers that will help create jobs and grow our economy."
Immigration reform for high-tech workers is also gaining momentum on Capitol Hill, where a bipartisan group of eight senators is working on comprehensive legislation.
Still, reform is far from certain. Democrats are insisting on a single bill on immigration, while some Republicans oppose key elements of a broad overhaul. Even the growing number of lawmakers who support reform worry it could harm American workers. The Obama administration has its own immigration bill ready to go if congressional talks break down, but White House senior advisors have not tipped their hand to the high-tech industry on what specifically that would mean for it.
Marty, the son of Cuban immigrants, and Mutabdzija, who came to the United States as a refugee from the war-torn former Yugoslavia, said they grew weary of all the political talk about immigration reform in Washington. In 2011, they hatched the idea for Blueseed. Unlike other countries, the United States offers no specific visa for highly skilled foreigners who want to start a business, Marty said. Eventually many of them return home in frustration or head for countries that entice them with visas and cash.
A recent study from the Kauffman Foundation found that the number of high-tech immigrant-founded startups has stalled for the first time in decades. The proportion of these companies in Silicon Valley declined to 44 percent in 2012 from 52 percent in 2005, according to the study.
Blueseed, which is targeting spring 2014 for its launch, borrows from the concept of "seasteading" - the libertarian idea to create floating cities that was championed by Patri Friedman, a former Google engineer and the grandson of economist Milton Friedman, and backed by venture capitalist and hedge fund manager Peter Thiel. Seasteaders want to build a flotilla of new sovereign nations on oil rig-like platforms anchored in international waters where people could live free from the burdens of taxes and government. Marty and Mutabdzija met while working at the Seasteading Institute.
More than 380 companies from 68 countries have applied for a spot on Blueseed. About a quarter of the applicants hail from the United States, but most are foreigners chasing the elusive Silicon Valley dream.
Andrew Considine, co-founder of mobile startup Willstream Labs, who is based in Ireland, says Blueseed could open up opportunities for his company and its employees, who might not otherwise get the chance to set foot in Silicon Valley. "I think Blueseed is an incredible opportunity for non-U.S. entrepreneurs to work in what is no doubt the most powerful startup environment in the world," Considine said.
No one is sure how U.S. officials would react to Blueseed if it gets off the ground.
"Homeland Security is simply not going to be wild about foreign nationals living on a foreign flag cruise ship coming and going in the U.S. on a regular basis with the obvious goal of avoiding U.S. laws," University of Washington law professor Craig Allen said. U.S. Customs and Border Protection declined to comment.
Marty and Mutabdzija have had to navigate the legal and logistical challenges to develop a permanent on-board community outside the territorial waters of the United States - not to mention plenty of eye-rolling.
Marty, Blueseed's chief executive, says he has heard all the "Atlantis Shrugged" and "Waterworld" jokes. He has patiently answered questions about pirates and tsunamis. Despite widespread skepticism, he insists Blueseed is a serious endeavor, not a publicity stunt.

"We are a very determined couple of founders," Marty said.
Many investors were put off by Blueseed's original proposal of a $50 million Google-like complex equipped with its own helicopter pad, trees and greenery, indoor soccer fields, swimming pools, rock climbing walls, massage therapists and other amenities. Marty and Mutabdzija say they have dramatically downsized that vision.
Blueseed's current plan is to lease - not buy - a cruise ship that could house 1,000 entrepreneurs plus crew. The ship would have cafes, a gym, co-working space, shipwide high-speed Internet access, medical professionals and a private security force. Entrepreneurs could share a cabin for $1,200 a month or get their own for $1,600. They also would hand over a 6 percent equity stake to Blueseed. Entrepreneurs could stay aboard six months to a year.
Blueseed got some much needed cash in December from Silicon Valley angel investor Mike Maples and others. But the $350,000 round of funding was just a drop in the bucket: Blueseed is trying to raise $27 million.
Maples, always on the hunt for big, daring ideas, says he invested in Blueseed to support immigrant entrepreneurs who might one day build the next Apple or Facebook.
"I don't know whether Blueseed will work or not," Maples said. "But here's another opportunity to help people who want to come to this country to build great companies."

http://bit.ly/ZCA63B

Gold seams form in an earthquake-powered flash

Over 80 per cent of the world's commercial gold deposits formed in a flash.

18: 00 17 March 2013 by Jeff Hecht

Using a simple model, geologists have shown that mountain-building earthquakes deep below Earth pull apart rocks so quickly that the high-pressure fluids they contain instantly vaporise. This process leaves behind residues rich in minerals including gold.
Geologists have long known that gold seams must form when mineral-rich water flows through networks of cracks in rocks 5 to 30 kilometres below the ground. But exactly how the gold accumulates in these cracks was unclear. Earthquake-triggered pressure changes have long been suggested as a factor in the process, but as these pressure changes were thought to be relatively small, it was not obvious how they were involved.
Richard Henley of the Australian National University in Canberra and Dion Weatherley of the University of Queensland in Brisbane have studied earthquake dynamics, and found that quake-triggered pressure changes are much larger than first thought. Their model suggests that earthquakes can open cracks in the deep rocks at the speed of sound.

Gold nuggets on display on April 29, 2011 in Jamestown, California. Solid gold can be deposited in Earth's crust "almost instantaneously" during earthquakes, said a study published in the journal Nature Geoscience on Sunday.

Pressure crash

The fluid cannot get from the surrounding rock into the hole fast enough to fill the void, Henley says, so pressure drops from 3000 times atmospheric pressure to pressures almost the same as those at Earth's surface in an instant. The nearby fluid flash-vaporises as a result – and any minerals it contains are deposited as it does. Later, incoming fluid dissolves some of the minerals, but the less-soluble ones, including gold, accumulate as more episodes of quake-driven flash deposition occur. "Large quantities of gold may be deposited in only a few hundred thousand years," says Weatherley – a brief interval by geological standards. "Each event drops a little more gold," adds Henley. "You can see it microscopically, tiny layer after tiny layer. It just builds up."

Gold, you're indestructible

Geologist John Muntean at the University of Nevada in Reno, says the results are "very credible". The link between earthquakes and gold deposits is not new, says Muntean. "But this paper quantifies the amount of pressure drop," he says, "and it ties it into gold solubility and why that pressure drop could drop out all of the gold in the hydrothermal fluid."
Today, gold veins formed deep underground account for about a third of known gold deposits. Much is mined directly, and some that erodes away is collected from streams. "You can't destroy gold. It just keeps getting recycled," says Henley. Another 45 per cent of the world's gold comes from South Africa's Witwatersrand basin, where it collected over 2 billion years ago as erosion wore down gold-rich veins of quartz in ancient mountain belts that probably formed by flash vaporisation. The same process concentrates gold in similar veins as little as 2 kilometres below volcanoes, which stand guard over another 10 per cent or so of the world's gold deposits.
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