http://www.eurekalert.org/pub_releases/2012-09/uow-lbp092112.php

Large bacterial population colonized land 2.75 billion years ago

New research suggests that early microbes might have been widespread on land

There is evidence that some microbial life had migrated from the Earth's oceans to land by 2.75 billion years ago, though many scientists believe such land-based life was limited because the ozone layer that shields against ultraviolet radiation did not form until hundreds of millions years later.

But new research from the University of Washington suggests that early microbes might have been widespread on land, producing oxygen and weathering pyrite, an iron sulfide mineral, which released sulfur and molybdenum into the oceans.

"This shows that life didn't just exist in a few little places on land. It was important on a global scale because it was enhancing the flow of sulfate from land into the ocean," said Eva Stüeken, a UW doctoral student in Earth and space sciences.

In turn, the influx of sulfur probably enhanced the spread of life in the oceans, said Stüeken, who is the lead author of a paper presenting the research published Sunday (Sept. 23) in Nature Geoscience. The work also will be part of her doctoral dissertation.

A drill core from the 2.5 billion-year-old Mount McRae Shale formation in Western Australia, which originally was fine-grained ocean sediment, shows high concentrations of sulfide and molybdenum. That supports the idea that most of the sulfate came from land, likely freed by microbial activity on rocks. Some data for the research came from the Mount McRae formation **Roger Buick/U. of Washington.**

Sulfur could have been released into sea water by other processes, including volcanic activity. But evidence that molybdenum was being released at the same time suggests that both substances were being liberated as bacteria slowly disintegrated continental rocks, she said. If that is the case, it likely means the land-based microbes were producing oxygen well in advance of what geologists refer to as the "Great Oxidation Event" about 2.4 billion years ago that initiated the oxygen-rich atmosphere that fostered life as we know it.

In fact, the added sulfur might have allowed marine microbes to consume methane, which could have set the stage for atmospheric oxygenation. Before that occurred, it is likely large amounts of oxygen were destroyed by reacting with methane that rose from the ocean into the air.

"It supports the theory that oxygen was being produced for several hundred million years before the Great Oxidation Event. It just took time for it to reach higher concentrations in the atmosphere," Stüeken said.

The research examined data on sulfur levels in 1,194 samples from marine sediment formations dating from before the Cambrian period began about 542 million years ago. The processes by which sulfur can be added or removed are understood well enough to detect biological contributions, the researchers said.

The data came from numerous research projects during the last several decades, but in most cases those observations were just a small part of much larger studies. In an effort to provide consistent interpretation, Stüeken combed the research record for data that came from similar types of sedimentary rock and similar environments. "The data has been out there for a long time, but people have ignored it because it is hard to interpret when it is not part of a large database," she said.

Co-authors are David Catling and Roger Buick, UW professors of Earth and space sciences. The work was funded by the National Science Foundation and the Virtual Planet Laboratory in the UW Department of Astronomy.

http://www.bbc.co.uk/news/health-19699677

How threatening is the new coronavirus?

A new respiratory illness similar to the SARS virus that spread globally in 2003 and killed hundreds of people has been identified in a man being treated in Britain. What is this new coronavirus and should we be concerned?

What is this new virus?

The new virus is a type of coronavirus. Coronaviruses are a large family of viruses, which includes the common cold and SARS (severe acute respiratory syndrome). The new virus is not SARS.

It is the first time this particular strain of coronavirus has been identified in the UK and only the second time in the world - in both cases the infection was caught in the Middle East.

The latest infection was identified by the Health Protection Agency's virus reference laboratories at Colindale in London. It is genetically the same as the earlier one, isolated in a laboratory in Saudi Arabia, which was then confirmed and its genetic material sequenced in a laboratory in the Netherlands.

As it has only been recently described, and this is only the second laboratory confirmed case, there is limited information on how much of a threat it may pose to humans.

What does it do?

Coronaviruses cause respiratory infections in humans and animals. The two people infected so far presented with fever, cough and breathing difficulties.

The patient in Saudi Arabia died. The patient in London is being treated in intensive care.

At this point it is not clear whether these cases are typical of infection with this virus or whether it could be circulating more widely and only very rarely causing a severe illness.

How is it spread?

It is likely the virus is spread in droplets when an infected person coughs or sneezes. But experts believe it is not very contagious. If it were, we would have seen more cases in other countries or the people caring for these two cases, the first of which occurred more than three months ago. Coronaviruses are fairly fragile. Outside of the body they can only survive for a day and are easily destroyed by usual detergents and cleaning agents.

Can it be treated?

Doctors do not yet know what the best treatment is, but people with severe symptoms will need intensive medical care to help them breath. There is no vaccine for it.

As with any newly identified virus that may be associated with severe illness, it is better to err on the side of caution. All infection control precautions to prevent the spread of this virus are therefore being taken in the case of the London patient with the confirmed diagnosis. This includes isolation of the patient, barrier nursing and making sure that all staff wear the appropriate protective equipment.

Where did it come from?

Experts do not yet know where the virus originated from. It may have been the result of a new mutation of an existing virus. Or it may be an infection that has been circulating in animals and has now made the jump to humans.

Is there any travel advice?

At the moment the World Health Organization says there is no reason to impose any travel restrictions to the Middle East, where both cases of the infection were caught. Travel advice will be kept under review if additional cases occur or when the patterns of transmission become clearer.

http://arstechnica.com/science/2012/09/cooperation-comes-easily-but-thinking-makes-us-selfish/

Cooperation comes easily but thinking makes us selfish

Stopping to think makes research subjects less generous.

by Kate Shaw - Sept 24 2012, 11:50pm TST

A set of ten studies suggests that intuition promotes cooperation, but rational thought turns us selfish.

Are humans instinctively cooperative or are we naturally selfish? This question has been a topic of inquiry for thousands of years, argued over by philosophers, psychologists, and theologians. Most recently, a group of researchers from Harvard University weighed in on the question in this week's issue of Nature.

The scientists conducted ten studies on cooperation to examine its cognitive basis in humans. The goal of this set of experiments was to determine whether we are predisposed to selfishness but become more generous once we are given time to think about it, or whether people are naturally cooperative, with selfishness only creeping in when we reflect more on our options. Taken together, the set of studies suggest that we are instinctively generous, but rational thought may make us greedier.

For several of their studies, the researchers recruited subjects from around the world using Amazon Mechanical Turk, or AMT. AMT is an online labor market that connects people to employers willing to pay small sums of money for a quick "job." In this set of studies, the jobs consisted of short games or tasks designed to measure the correlation between generosity and response time. Participants recruited in this way are much more diverse than the undergraduates that are often the subjects in these types of experiments.

In the first study, 212 participants were given 40 cents and asked to contribute whatever portion they liked to a communal pool; at the end, whatever had been donated was doubled by the experimenters and divvied up evenly among the participants. The researchers measured the time it took each participant to make a decision about how much to give, and compared it to the amount of money they contributed. The longer people took to decide, the less generous they were.

Then, the researchers conducted a variation of this study, but manipulated the amount of time people had in which to decide how much to donate. One group of subjects had to make their decisions within ten seconds; other subjects had to wait ten seconds before they were allowed to contribute anything, and third group of participants had no time constraints at all.

The researchers found that subjects under time pressure gave significantly more money than either those that had to wait or those that were unconstrained. Participants in the 'time-delay' condition were the least generous,

donating significantly less money than those in the other two groups. In other words, those that were forced to respond instinctively cooperated much more than those that had more time to consider their options.
It appears from these studies that humans are predisposed to cooperation and generosity, and only become selfish when they take time to think about the situation. The effect was robust, occurring both in subjects recruited from AMT and in college students. Furthermore, a meta-analysis of previously published work showed that this effect was observed not only in the donation scenario described above, but also in other social "games" (such as the prisoners' dilemma) that are either played just once or repeated multiple times.
The researchers were even able to manipulate participants into being either selfless or greedy, based on whether they were primed to think about intuition or careful reasoning. Some participants were primed to believe in their intuition by asking them to either write an essay about a time in their life when their intuition was right, or when careful reasoning was wrong. A second group, which had to write about when their intuition led them astray or when careful reasoning proved helpful, was primed to promote rationality. When asked to contribute money, donations were much higher in the first, intuitively-primed group than in the second group, which had been primed for rationality and reflection.
So where do these cooperative instincts come from? The researchers rightly warn that these results don't necessarily mean that generosity is hardwired into our DNA; nurture may play an important role here. Humans are reared in a generally cooperative society where we engage in repeated interactions with people we know, and where our reputations are important. Under these conditions, we likely learn that cooperation is the best way to proceed, and subsequently act this way instinctively.
Only when people are put into a situation where cooperation is not advantageous (such as these experiments) and given time to think about the situation do they become more self-serving. Indeed, the researchers found that the effect disappears after repeated trials; people become less cooperative as they gain greater familiarity with these laboratory tasks.
The particularly intriguing - and somewhat counterintuitive - implications of this body of research are that the traditional ways we try to foster cooperation and generosity may actually be doing the opposite. It is possible when we ask people to consider donating to a cause or to reflect on the benefits of working together, we may actually be promoting greater levels of self-interest. *Nature, 2012. DOI: 10.1038/nature11467 (About DOIs).*

http://www.eurekalert.org/pub_releases/2012-09/pu-prs092412.php

Princeton release: Slow-moving rocks better odds that life crashed to Earth from space

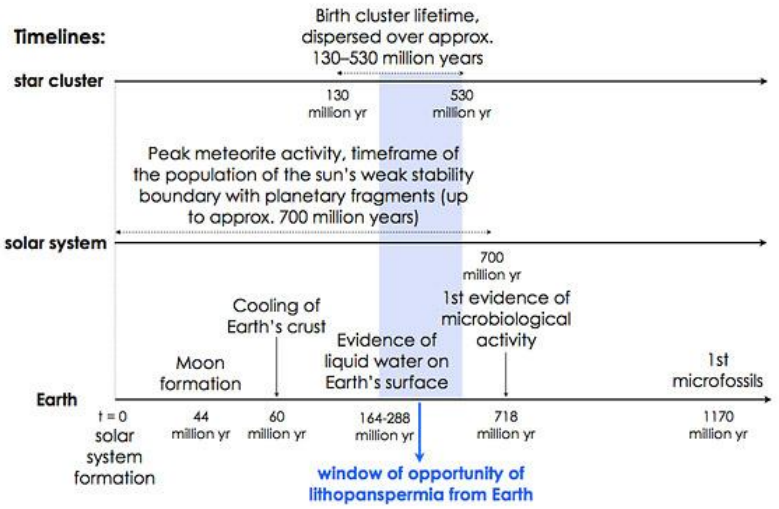
Under certain conditions there is a high probability that life came to Earth - or spread from Earth to other planets - during the solar system's infancy

Microorganisms that crashed to Earth embedded in the fragments of distant planets might have been the sprouts of life on this one, according to new research from Princeton University, the University of Arizona and the Centro de Astrobiología (CAB) in Spain.
The researchers report in the journal Astrobiology that under certain conditions there is a high probability that life came to Earth - or spread from Earth to other planets - during the solar system's infancy when Earth and its planetary neighbors orbiting other stars would have been close enough to each other to exchange lots of solid material. The work will be presented at the 2012 European Planetary Science Congress on Sept. 25.
The findings provide the strongest support yet for "lithopanspermia," the idea that basic life forms are distributed throughout the universe via meteorite-like planetary fragments cast forth by disruptions such as volcanic eruptions and collisions with other matter. Eventually, another planetary system's gravity traps these roaming rocks, which can result in a mingling that transfers any living cargo.
[Images and video can be seen at http://www.princeton.edu/main/news/archive/S34/82/42M30. To obtain high-res images, contact Princeton science writer Morgan Kelly, (609) 258-5729, mgnkelly@princeton.edu]
Previous research on this possible phenomenon suggests that the speed with which solid matter hurtles through the cosmos makes the chances of being snagged by another object highly unlikely.
But the Princeton, Arizona and CAB researchers reconsidered lithopanspermia under a low-velocity process called weak transfer wherein solid materials meander out of the orbit of one large object and happen into the orbit of another. In this case, the researchers factored in velocities 50 times slower than previous estimates, or about 100 meters per second.
Using the star cluster in which our sun was born as a model, the team conducted simulations showing that at these lower speeds the transfer of solid material from one star's planetary system to another could have been far more likely than previously thought, explained first author Edward Belbruno, a mathematician and visiting research collaborator in Princeton's Department of Astrophysical Sciences who developed the principles of weak transfer.

The researchers suggest that of all the boulders cast off from our solar system and its closest neighbor, five to 12 out of 10,000 could have been captured by the other. Earlier simulations had suggested chances as slim as one in a million.

"Our work says the opposite of most previous work," Belbruno said. "It says that lithopanspermia might have been very likely, and it may be the first paper to demonstrate that. If this mechanism is true, it has implications for life in the universe as a whole. This could have happened anywhere."

Co-authors Amaya Moro-Martín, an astronomer at CAB and a Princeton visiting research collaborator in astrophysical sciences, and Renu Malhotra, a professor of planetary sciences at Arizona, noted that low velocities offer very high probabilities for the exchange of solid material via weak transfer, and also found that the timing of such an exchange could be compatible with the actual development of the solar system, as well as with the earliest known emergence of life on Earth. Dmitry Savransky, a Princeton mechanical and aerospace engineering doctoral student, conducted the simulations.



The researchers suggest that ideal conditions for lithopanspermia in the sun's birth cluster, in the solar system and on Earth overlapped for several hundred million years (blue shaded area). Rock evidence suggests that the Earth (bottom line) contained surface water during a period when the relative velocities between the sun and its closest cluster neighbors (top line) were small enough to allow weak transfer to other planetary systems, and when the solar system (middle line) experienced high meteorite activity within the sun's weak gravitational boundary. If life arose on Earth shortly after surface water was available, life could have journeyed from Earth to another habitable world during this time, or vice versa if life had an early start in another planetary system. **Image by Amaya Moro-Martín**

The researchers report that the solar system and its nearest planetary-system neighbor could have swapped rocks at least 100 trillion times well before the sun struck out from its native star cluster. Furthermore, existing rock evidence shows that basic life forms could indeed date from the sun's birth cluster days - and have been hardy enough to survive an interstellar journey and eventual impact.

"The conclusion from our work," Moro-Martín said, "is that the weak transfer mechanism makes lithopanspermia a viable hypothesis because it would have allowed large quantities of solid material to be exchanged between planetary systems, and involves timescales that could potentially allow the survival of microorganisms embedded in large boulders."

All about velocities

The Princeton-Arizona-CAB paper cites two previous studies that present the odds of solid matter from one planetary system being captured by another as being more or less dismal.

The first, a 2003 paper published in Astrobiology by Jay Melosh, a Purdue University earth and atmospheric sciences professor, questioned the probability that meteorites have ever escaped a terrestrial planet in Earth's solar system and wound up on a terrestrial planet in another system. The report concluded that the chances - about one in 10,000, or 0.01 percent - are "overwhelmingly unlikely" considering the speed a meteorite would need to travel (about six kilometers per second) and the roominess of space.

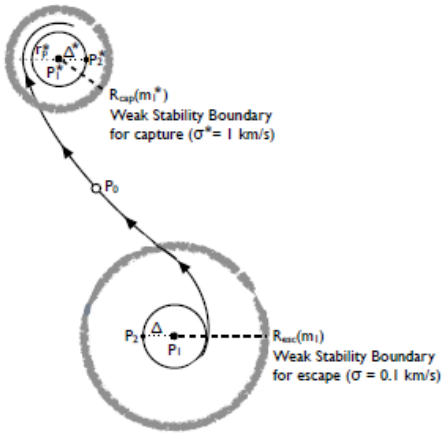
Belbruno and his co-authors calculated that under this scenario of high velocities and dispersed planetary systems, the probability of solid material from any planetary system striking another falls to as little as five in 100,000, or 0.005 percent.

Star birth clusters, which are tightly confined groups of stars and planetary systems, were introduced as a possible setting for lithopanspermia in a 2005 Astrobiology paper by David Spergel, Princeton's Charles A. Young Professor of Astronomy on the Class of 1897 Foundation and chair of astrophysical sciences, and University of Michigan physics professor Fred Adams.

Factoring in velocities of two to five kilometers per second, Spergel and Adams found that the chances of an exchange of life-bearing rocks between star systems clustered in groups of 30 to 1,000 could be as unlikely as one in a million to as good as one in 1,000, or 0.0001 to 0.1 percent, respectively. Spergel and Adams, however, limited their study to binary stars - or planetary systems with two stars - which might elevate star-to-star solid matter exchanges, Moro-Martín said.

Nonetheless, in clusters similar to those considered by Spergel and Adams, weak transfer involves relative velocities of no more than one kilometer per second, which substantially increases the probability of capture by other stars in the cluster. In other words, star clusters provide an ideal setting for weak transfer, Belbruno said.

Chaotic in nature, weak transfer happens when a slow moving object such as a meteorite wanders into the outer edge of the gravitational pull of a larger object with a low relative velocity, such as a star or massive Jupiter-like planet. The smaller object partially orbits the large object, but the larger object has only a loose grip on it. This means the smaller object can escape and be propelled into space, drifting until it is pulled in by another large object.



Belbruno first demonstrated weak transfer with the Japanese lunar probe Hiten in 1991. A mechanical malfunction left the probe with insufficient fuel to enter the moon's orbit the traditional way, which is to approach at a high speed then fire retrorockets to slow down. Instead, Belbruno designed a weak-transfer trajectory that got the probe into orbit around the moon using a minimal amount of fuel.

Researchers based at Princeton University, the University of Arizona and the Centro de Astrobiología in Spain used a low-velocity process called weak transfer to provide the strongest support yet for "lithopanspermia," the idea that the microorganisms that sprout life came to Earth -- or spread from Earth to other developing planets -- via collisions with meteorite-like planetary fragments. Under weak transfer, a slow-moving planetary fragment meanders into the outer edge of the gravitational pull, or weak stability boundary, of a planetary system. The system has only a loose grip on the fragment, meaning the fragment can escape and be propelled into space, drifting until it is pulled in by another planetary system. **Image by Amaya Moro-Martín**

Adams, co-author of the 2005 paper with Spergel, said that the work by Belbruno and his co-authors succeeds at pulling together the various factors of earlier lithopanspermia models and adding a substantial new element - chaos. Adams is familiar with the study but had no role in it.

"This paper takes the type of calculations that have been done before and makes an important generalization of previous work," Adams said. "Their work on chaos in this context also carries the subject forward. They make a careful assessment of a process that is dynamically quite complicated and chaotic in nature.

"They are breaking new ground from the viewpoint of dynamical astrophysics," Adams said. "Regarding the problem of lithopanspermia, this type of weak capture and weak escape is interesting because it allows for the ejection speeds to be small, and these slow speeds allow for higher probabilities of rock capture. To say it another way, chaos, in part, enhances the prospects for lithopanspermia."

To the simulator!

Star birth clusters satisfy two requirements for weak transfer, Moro-Martín said. First, the sending and receiving planetary systems must contain a massive planet that captures the passing solid matter in the weak-gravity boundary between itself and its parent star. Earth's solar system qualifies, and several other stars in the sun's birth cluster would too.

Second, both planetary systems must have low relative velocities. In the sun's stellar cluster, between 1,000 and 10,000 stars were gravitationally bound to one another for hundreds of millions of years, each with a velocity of no more than a sluggish one kilometer per second, Moro-Martín said.

The team simulated 5 million trajectories between single-star planetary systems - in a cluster with 4,300 stars - under three conditions: the solid matter's "source" and "target" stars were both the same mass as the sun; the target star was only half the sun's mass; or the source star was half the sun's mass.

The odds of a star capturing solid matter from another planetary system under these three scenarios are 15 (0.15 percent), five (0.05 percent) and 12 (0.12 percent) in 10,000, respectively, the researchers report - probabilities that exceed those under the conditions proposed by Melosh by a factor of 1 billion.

To estimate the actual amount of solid matter that could have been exchanged between the sun and its nearest star neighbor, the researchers used data and models pertaining to the movement and formation of asteroids, the Kuiper Belt - the solar system's massive outer ring of asteroids - and the Oort Cloud, a hypothesized collection of comets, ice and other matter about one light year from Earth's sun widely believed to be a primary source of comets and meteorites.

The researchers used this data to conclude that during a period of 10 million to 90 million years, anywhere between 100 trillion to 30 quadrillion solid matter objects weighing more than 10 kilograms transferred

between the sun and its nearest cluster neighbor. Of these, some 200 billion rocks from early Earth could have been whisked away via weak transfer.
For lithopanspermia to happen, however, microorganisms first have to survive the long, radiation-soaked journey through space.
Moro-Martín and Malhotra consulted a 2009 paper an international team published in the Astrophysical Journal that determined how long microorganisms could survive in space based on the size of the solid matter hosting them. That group's computer simulations showed that survival times ranged from 12 million years for a boulder up to 3 centimeters (roughly one inch) in diameter, to 500 million years for a solid objects 2.67 meters (nearly nine feet) across.
The researchers estimated that under weak transfer, solid matter that had escaped one planet would need tens of millions of years to finally collide with another one. This falls within the lifespan of the sun's birth cluster, but means that lithopanspermia by weak transfer would have been limited to planetary fragments at least one meter, or about three feet, in size.

Matching the theory with life

As for the actual transfer of life, the researchers suggest that roughly 300 million lithopanspermia events could have occurred between our solar system and the closest planetary system. But even if microorganisms survived the trip to Earth, the planet had to be ready to receive them. The researchers reference rock-dating evidence suggesting that the Earth contained water when the solar system was only 288 million years old and that very early life might have emerged before the solar system was 718 million years old.
The sun's birth cluster - assumed to be roughly the same age as the Earth's solar system - slowly broke apart when the solar system was approximately 135 million to 535 million years old, Moro-Martín said. In addition, the sun could have been ripe for weak transfer up to 700 million years after the solar system formed.
So, if life arose on Earth shortly after surface water was available, there were possibly about 400 million years when life could have journeyed from the Earth to another habitable world, and vice versa, the researchers report. If life had an early start in other planetary systems and developed before the sun's birth cluster dispersed, life on Earth may have originated beyond our solar system.
The paper stops short of calculating the likelihood of extrasolar life taking root on a terrestrial planet such as Earth, but the higher probability the researchers determined for solid-matter transfer makes that a more worthwhile pursuit, Moro-Martín said.
"Our study stops when the solid matter is trapped by the second planetary system, but for lithopanspermia to be completed it actually needs to land on a terrestrial planet where life could flourish," Moro-Martín said. "The study of the probability of landing on a terrestrial planet is work that we now know is worth doing because large quantities of solid material originating from the first planetary system may be trapped by the second planetary system, waiting to land on a terrestrial planet. "Our study does not prove lithopanspermia actually took place," Moro-Martín said, "but it indicates that it is an open possibility."
The paper, "Chaotic Exchange of Solid Material between Planetary Systems: Implications for Lithopanspermia," was published Sept. 12 by Astrobiology, and was supported by grants from NASA, the National Science Foundation and the Ministry of Science and Innovation in Spain.

http://www.eurekalert.org/pub_releases/2012-09/s-ftf092412.php

First-ever treatment for rare childhood aging disease shows improvement in all trial participants

Drug originally developed for cancer proves effective for children with progeria

BOSTON, MA – Results of the first-ever clinical drug trial for children with Progeria, a rare, fatal "rapid-aging" disease, demonstrate the efficacy of a farnesyltransferase inhibitor (FTI), a drug originally developed to treat cancer. The clinical trial results, completed only six years after scientists identified the cause of Progeria, included significant improvements in weight gain, bone structure and, most importantly, the cardiovascular system, according to The Progeria Research Foundation (PRF) and Boston Children's Hospital. The study results were published today in Proceedings of the National Academy of Sciences (Epub ahead of print).
Progeria, also known as Hutchinson-Gilford Progeria Syndrome (HGPS), is a rare, fatal genetic disease characterized by an appearance of accelerated aging in children. All children with Progeria die of the same heart disease that affects millions of normal aging adults (atherosclerosis), but instead of occurring at 60 or 70 years of age, these children may suffer heart attacks and strokes as early as age 5 years, with the average age of death at 13 years.
"To discover that some aspects of damage to the blood vessels in Progeria can not only be slowed by the FTI called lonafarnib, but even partially reversed within just 2.5 years of treatment is a tremendous breakthrough,

because cardiovascular disease is the ultimate cause of death in children with Progeria," said Leslie Gordon, M.D., Ph.D., lead author of the study, medical director for PRF, and mother of a child with Progeria. In addition, Dr. Gordon is a staff scientist at Boston Children's Hospital and Harvard Medical School, and associate professor at Hasbro Children's Hospital and Alpert Medical School of Brown University.

Results Yield Improvements in One or More Study Measures for All Children

Twenty-eight children from sixteen countries participated in the two-and-a-half year drug trial, representing 75 percent of known Progeria cases worldwide at the time the trial began. Of those, 26 are children with the classic form of Progeria. The children traveled to Boston every four months to receive comprehensive medical testing through Boston Children's Hospital's Clinical and Translational Study Unit.

Treatment consisted of the FTI lonafarnib, supplied by Merck & Co., given to children orally, twice-a-day over the course of the study, under the supervision of principal investigator Mark Kieran, M.D., Ph.D., director of pediatric medical neuro-oncology at the Dana-Farber/Children's Hospital Cancer Center.

The research team, which included specialists at Boston Children's Hospital, Brigham & Women's Hospital and Dana-Farber Cancer Institute, evaluated the children's rate of weight gain compared to their pre-therapy rate as the primary outcome because children with Progeria experience severe failure to thrive, and have a consistent, very slow linear rate of weight gain over time. Researchers also examined arterial stiffness (a predictor of heart attack and stroke in the general population), bone density and rigidity (indicators of osteoporosis). Every child completing the study showed improvement in an ability to gain additional weight, increased flexibility of blood vessels or improved bone structure.

Results included improvement in one or more of the following areas:

Weight: One in three children demonstrated a greater than 50 percent increase in annual rate of weight gain or switched from weight loss to weight gain, due to increased muscle and bone mass.

Bone Structure: On average, skeletal rigidity (which was highly abnormal at trial initiation) improved to normal levels after FTI treatment.

Cardiovascular: Arterial stiffness, strongly associated with atherosclerosis in the general aging population, decreased by 35 percent. Vessel wall density also improved with treatment.

Following the 2003 discovery of the gene that causes Progeria, researchers identified FTIs as a potential drug treatment for Progeria. Children with Progeria have a genetic mutation that leads to the production of the protein progerin, which is responsible for Progeria. Progerin blocks normal cell function and part of its toxic effect on the body is caused by a molecule called a "farnesyl group," which attaches to the progerin protein. FTIs act by blocking the attachment of the farnesyl group onto progerin.

"In the early stages of planning for this clinical trial, we realized that my team's experience using FTIs to treat children with brain cancer could bring together PRF's preclinical research efforts and the expertise we needed to study the drug in children with Progeria," said Kieran, the study's senior author and associate professor of Pediatrics at Harvard Medical School. "The premise behind studying this drug was that by stopping the attachment of the farnesyl group onto progerin in children with Progeria, progerin may be inactivated, reducing some effects of the disease."

"PRF provides a model for disease research organizations, and is a good example of successful translational research, moving from gene discovery to clinical treatment at an unprecedented pace," added Dr. Kieran. Since PRF's founding in 1999, the organization and its scientific partners have identified the genetic mutation that causes the disease, funded preclinical research and funded clinical trials. A second clinical trial, funded by the National Institutes of Health and PRF, is currently underway and more trials are expected to follow.

"The partnership between The Progeria Research Foundation, the research team and these courageous families was essential for success," said Dr. Gordon. "It required identifying children and their home doctors from around the globe, obtaining the essential pre-trial clinical information, transporting families to and from Boston, supplying translators both inside and outside of the hospital setting, and putting together a multidisciplinary clinical team to assess treatment effects. But it was all worth it, and I believe we have set in motion a blueprint for successful treatment trials for children with Progeria and for other rare diseases."

"The results of this study provide our family with excitement and hope for Megan's future," said Sandy Nighbor, mother of Megan, a 12-year-old child who participated in the clinical trial. "We're grateful to The Progeria Research Foundation and all of the doctors for their commitment to helping my daughter and all children with Progeria."

Progeria Linked to Normal Aging Process

Previous research shows that progerin is also produced in the general population and increases in the body with age. A number of studies successfully linked progerin with normal aging, including a causal link between

progerin and genetic instability, specifically telomere dysfunction in the aging process. Researchers plan to continue researching the effect of FTIs, which may help scientists learn more about cardiovascular disease that affects millions, as well as the normal aging process.
"One of the main reasons we achieved breakthrough results in this first trial is because of the tremendous supporters who provided funding, and helped get us one step closer to achieving our ultimate goal – a cure for Progeria," said Audrey Gordon, Executive Director of PRF. "Every donation makes a difference. With continued support, we will fund research that will not only allow children with Progeria around the world to live long and healthy lives, but may also advance our understanding of the normal aging process that affects us all."

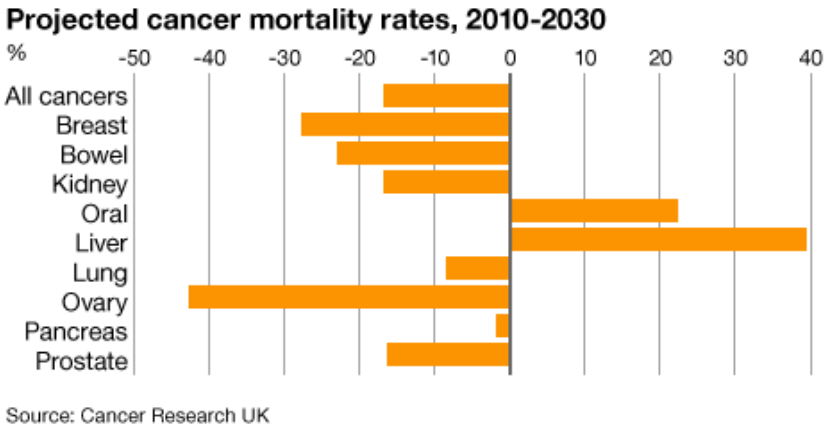
http://www.bbc.co.uk/news/health-19703834

Cancer death rates set for a 'dramatic fall'

Death rates from cancer are "set to fall dramatically" by 2030, according to Cancer Research UK.

By James Gallagher Health and science reporter, BBC News

It says fewer people smoking as well as improvements in diagnosis and treatment will lead to a 17% drop in death rate. About 170 UK deaths per 100,000 of population were from cancer in 2010, and this figure is predicted to fall to 142 out of every 100,000.
Some of the biggest killers - lung, breast, bowel, and prostate cancer - are part of the trend.
The biggest fall is projected to be in ovarian cancer, with death rates dropping by 43%.
Prof Peter Sasieni, from Queen Mary, University of London, said: "Our latest estimations show that for many cancers, adjusting for age, death rates are set to fall dramatically in the coming decades."
As more people live to an elderly age, the total number of people who actually develop and die from cancer will increase - but these deaths will make up a smaller proportion of the total number of deaths, so the death rate will fall.



'Progress'

However, the death rate for other cancers such as those of the liver and mouth will increase over the next two decades.
The chief executive of Cancer Research UK, Dr Harpal Kumar, said: "These new figures are encouraging and highlight the huge progress we're making. "Research across many areas is having real impact."
The Department of Health said: "These figures reflect improvements in cancer services, but we know there is still more to do. "Our aim is to save 5,000 more lives every year by 2015 - and halve the gap in cancer survival between us and the best-performing countries in Europe."

http://www.bbc.co.uk/news/world-europe-isle-of-man-19653677

Isle of Man men find solace in a shed

From the outside, the converted garage in Port Erin shows no sign of the activity going on inside.

By Mark Edwards BBC News

But once the doors are opened a hive of activity is revealed, with about a dozen "shedders" working feverishly on a variety of projects. The sound of tools is heightened by the smell of glue and fresh paint which fills the air.
The activity is all part of the Men In Sheds initiative which was launched in the Isle of Man last year.
The concept - developed in Australia as a novel weapon in the fight against high rates of male suicide and depression - has proved a big success on the island. It gives retired men the opportunity to socialise and learn new skills in a relaxed environment. The workshop is kitted out with tools and neatly ordered work benches, cupboards and shelves filled with the men's inventions.
The "shed" hums with activity and a fair dose of cheeky Manx humour as those inside do their best to set the world to rights.
One man is working on a detailed model boat while others work on woodwork and furniture projects.
The project's coordinator, Les Shires, 65, a retired buyer at the Ronaldsway Aircraft Company, greets visitors with a firm handshake.
"Welcome to the shed," he says.
Mr Shires was offered voluntary redundancy in 2010.

"I signed on for jobseekers and I was told I must start actively seeking employment.
I thought 'I am 64, who the hell is going to employ me?'." "I saw the advert for the project and I thought it looked interesting. I was right," he said with a grin.
Four years ago Mr Shires' wife died from chronic obstructive pulmonary disease (COPD). "We were three years from retirement and we had so many exciting plans. This project was just what I needed," he said.
On Tuesday, the 65-year-old will depart for the Himalayas to begin a trek to Everest base camp.
"Life doesn't stop. Everyone here has been very supportive and all the money will go towards the shed and the Samaritans," he said.
Supporters say the workshops are a breakthrough in men's health as the informal atmosphere encourages them to talk more about their problems - such as depression and loneliness.
A man in the corner of the shed is busy painting a beautiful model ship, apparently a scale model of the Manxman steamer.
Bob Bagshaw is the oldest member of the project at 89. His wife suffers from dementia. "I love coming down here," he said, with a beaming smile and a paint brush in his hand. "Everyone gets on famously and we are always swapping skills and making things."
On the same work bench sits 79-year-old Welshman Richard Blannin. "It's a fantastic place to spend time," he said.
While women are allowed into the shed they are not generally encouraged to do so.
As well as time in the shed, the men regularly display their creations at shows and help the community with their skills and ingenuity.
The Port Erin facility is acting as a pilot scheme for the project, but it is hoped the model can be replicated around the island.
The Manx branch has about 30 members and has recently been asked to join the UK Men In Sheds Association.
The shed itself was donated by the Department of Social Care and is rent free. It is funded through a number of grants and receives support from a number of local businesses. It is also a major part of the Southern Community Initiative.
Outside the workshop, a gaggle of men plot foundations for a new shed - to be exclusively for woodwork.
With an increasing number of men on the island over retirement age, the project is already looking at branching out.

http://www.eurekalert.org/pub_releases/2012-09/cu-lui092512.php

Language use is simpler than previously thought, finds Cornell study

For more than 50 years, language scientists have assumed that sentence structure is fundamentally hierarchical, made up of small parts in turn made of smaller parts, like Russian nesting dolls. But a new Cornell University study suggests language use is simpler than they had thought.

ITHACA, N.Y. - Co-author Morten Christiansen, Cornell professor of psychology and co-director of the Cornell Cognitive Science Program, and his colleagues say that language is actually based on simpler sequential structures, like clusters of beads on a string.
"What we're suggesting is that the language system deals with words by grouping them into little clumps that are then associated with meaning," he said.
Sentences are made up of such word clumps, or "constructions," that are understood when arranged in a particular order. For example, the word sequence "bread and butter" might be represented as a construction, whereas the reverse sequence of words "butter and bread" would likely not.
The sequence concept has simplicity on its side; language is naturally sequential, given the temporal cues that help us understand and be understood as we use language. Moreover, the hierarchy concept doesn't take into account the many other cues that help convey meaning, such as the setting and knowing what was said before and the speaker's intention.
The researchers drew on evidence in language-related fields from psycholinguistics to cognitive neuroscience. For example, research in evolutionary biology indicates that humans acquired language (and animals did not) because we have evolved abilities in a number of areas, such as being able to correctly guess others' intentions and learn a large number of sounds that we then relate to meaning to create words. In contrast, the hierarchy concept suggests humans have language thanks only to highly specialized "hardware" in the brain, which neuroscientists have yet to find.
Research in cognitive neuroscience shows that the same set of brain regions seem to be involved in both sequential learning and language, suggesting that language is processed sequentially. And several recent

psycholinguistic studies have shown that how well adults and children perform on a sequence learning task strongly predicts how well they can process the deluge of words that come at us in rapid succession when we're listening to someone speak. "The better you are at dealing with sequences, the easier it is for you to comprehend language," Christiansen said.
The study by Christiansen and his colleagues has important implications for several language-related fields. From an evolutionary perspective, it could help close what has been seen as a large gap between the communications systems of humans and other nonhuman primates. "This research allows us a better understanding of our place in nature, in that we can tie our language ability, our communication abilities, more closely to what we can see in other species. It could have a big impact in terms of allowing us to think in more humble terms about the origin of language in humans," Christiansen said.
The research could also affect natural language processing, the area of computer science that deals with human language, by encouraging scholars to focus on sequential structure when trying to create humanlike speech and other types of language processing, Christiansen said. He pointed out that machines already successfully perform such tasks as translation and speech recognition thanks to algorithms based on sequential structures.
The study, "How hierarchical is language use?" was published Sept. 12 in the Proceedings of the Royal Society B: Biological Sciences (http://bit.ly/RUGa7E). The research was funded by the European Union, the Netherlands Organization for Scientific Research and the Binational Science Foundation.

http://www.eurekalert.org/pub_releases/2012-09/s-skt092512.php

Spirituality key to Chinese medicine success

Study explores why Chinese medicine has stood the test of time

Are the longevity and vitality of traditional Chinese medicine (TCM) due to its holistic approach? Indeed, Chinese medicine is not simply about treating illness, but rather about taking care of the whole person—body, mind, and spirit. According to an analysis[1] of TCM's origins and development by Lin Shi from Beijing Normal University and Chenguang Zhang from Southwest Minzu University in China, traditional Chinese medicine is profoundly influenced by Chinese philosophy and religion. To date, modern science has been unable to explain the mechanisms behind TCM's effects. The study is published online in Springer's journal Pastoral Psychology, in a special issue[2] dedicated to the psychology of religion in China.
The essence of TCM lies in its foundation in spirituality, religion, and philosophy, making it quite different from Western medicine and leading it to be viewed by some as magical and mysterious. Chinese medicine is an ancient discipline with a long developmental history and is very much influenced by religion and spirituality. Shi and Zhang's paper examines in detail six aspects of traditional Chinese medicine: its history; its fundamental beliefs; spirituality in traditional Chinese healing rituals; spirituality in the traditional Chinese pharmacy; spirituality in health maintenance theories; and spirituality of master doctors of traditional Chinese medicine.
This analysis shows, among other things, that the underlying premise of Chinese medicine is that the mind and body of a person are inseparable. To be in good health, a person must have good spirit and pay attention to cultivating their spirit. Chinese doctors see "people" not "diseases" and equate "curing diseases" with "curing people."
According to the authors: "Good health and longevity are what we pursue. More and more people are concerned about ways to prevent disease and strengthen their bodies, which is the emphasis of traditional Chinese medicine. It pays attention to physical pains, and at the same time is also concerned with spiritual suffering. Therefore, TCM can teach people to be indifferent towards having or not having, to exist with few desires and feel at ease, to keep the body healthy and the mind quiet, and to achieve harmony between the body and the mind and then to achieve harmony with the world and nature."
1. Shi, L., & Zhang, C. (2012), Spirituality in traditional Chinese medicine, Pastoral Psychology, DOI 10.1007/s11089-012-0480-x. The article is freely available to the general public at: http://www.springerlink.com/content/q85013j7h34603m1/
2. Dueck, A., & Han, B. (eds.), Psychology of religion in China (special issue), Pastoral Psychology, 61(5 & 6), http://www.springerlink.com/content/0031-2789/61/5-6/

http://www.eurekalert.org/pub_releases/2012-09/bmj-df092512.php

Doctors' 'gut feeling' should not be ignored

Research: Clinicians' gut feeling about serious infections in children: Observational study

Doctors who experience a gut feeling about serious illness when treating a child in primary care should take action upon this feeling and not ignore it, a study published today on bmj.com suggests.
Serious infection can easily be missed in young children and making a diagnosis has been described as "like finding a needle in a haystack". A clinician's intuitive feeling that something is wrong, even after examination that suggests otherwise, appears to have diagnostic value, even greater diagnostic value than most symptoms

and signs. Studies have suggested it should be seen as highly important in its own right but there is lack of understanding about whether it can be seen as useful.
Researchers from Oxford and Belgium therefore carried out an observational study on 3890 children between the ages of 0-16 years who presented in primary care in Flanders, Belgium in 2004. They wanted to see what added value gut feeling provides to a diagnosis. Factors recorded included the doctor's overall impression and whether gut feeling suggested something more serious was wrong. Gut feeling was defined as "intuitive feeling that something was wrong even if the clinician was unsure why".
Out of the 3369 children assessed as having a non-severe illness at the time of consultation, six (0.2%) were later admitted to hospital with a serious infection. Results show that acting on gut feeling had the potential to prevent two of the six cases being missed at the cost of 44 false alarms, but that these were not "unmanageable". The probability of a serious infection decreased from 0.2% to 0.1% when gut feeling was absent.
In fact, 21 out of the 3890 children were eventually admitted to hospital with a serious infection and nine were not referred at first contact. However, in four of the nine children, the doctor had a gut feeling that something serious was wrong.
The feature most strongly associated with gut feeling was a history of convulsions and the child's overall appearance and breathing.The authors also found that gut feeling is strongly influenced by parental concern that the illness is different. Finally, less experienced clinicians reported it more frequently than their more senior counterparts. However, the diagnostic power of gut feeling was no better in experienced than non-experienced clinicians.
The authors recommend that medical teaching should make clear that an "inexplicable gut feeling is an important diagnostic sign and a very good reason for seeking the opinion of someone with more paediatric expertise or performing additional testing". They say that gut feeling should make three things mandatory: conducting a full and careful examination; seeking advice from a more experienced clinician and providing the parent with safety netting advice. They conclude that clinicians should not ignore gut feeling and use it in decision making.

http://www.eurekalert.org/pub_releases/2012-09/uoc--bnm092012.php

Boosting natural marijuana-like brain chemicals treats fragile X syndrome symptoms

UCI study points to role endocannabinoids play in common genetic cause of autism

Irvine, Calif. — American and European scientists have found that increasing natural marijuana-like chemicals in the brain can help correct behavioral issues related to fragile X syndrome, the most common known genetic cause of autism.
The work indicates potential treatments for anxiety and cognitive defects in people with this condition. Results appear online in Nature Communications.
Daniele Piomelli of UC Irvine and Olivier Manzoni of INSERM, the French national research agency, led the study, which identified compounds that inhibit enzymes blocking endocannabinoid transmitters called 2-AG in the striatum and cortex regions of the brain.
These transmitters allow for the efficient transport of electrical signals at synapses, structures through which information passes between neurons. In fragile X syndrome, regional synapse communication is severely limited, giving rise to certain cognitive and behavioral problems.
Fragile X syndrome is caused by a mutation of the FMR1 gene on the X chromosome. People born with it are mentally disabled; generally experience crawling, walking and language delays; tend to avoid eye contact; may be hyperactive or impulsive; and have such notable physical characteristics as an elongated face, flat feet and large ears.
The researchers stress that their findings, while promising, do not point to a cure for the condition.
"What we hope is to one day increase the ability of people with fragile X syndrome to socialize and engage in normal cognitive functions," said Piomelli, a UCI professor of anatomy & neurobiology and the Louise Turner Arnold Chair in the Neurosciences.
The study involved mice genetically altered with FMR1 mutations that exhibited symptoms of fragile X syndrome. Treated with novel compounds that correct 2-AG protein signaling in brain cells, these mice showed dramatic behavioral improvements in maze tests measuring anxiety and open-space acceptance.
While other work has focused on pharmacological treatments for behavioral issues associated with fragile X syndrome, Piomelli noted that this is the first to identify the role endocannabinoids play in the neurobiology of the condition.
Kwang-Mook Jung and Nicholas DiPatrizio of UCI; Marja Sepers, Olivier Lassalle, Daniela Neuhofer, Henry Martin, Melanie Ginger and Andreas Frick of INSERM; and Christopher Henstridge and Istvan Katona of the Hungarian Academy of Sciences

contributed to the study, which received support from INSERM and the U.S. National Institute on Drug Abuse (grant number DA-012447).

About endocannabinoids

Endocannabinoid compounds are created naturally in the body and share a similar chemical structure with THC, the primary psychoactive component of the marijuana plant, Cannabis. Endocannabinoids are distinctive because they link with protein molecule receptors – called cannabinoid receptors – on the surface of cells. For instance, when a person smokes marijuana, the cannabinoid THC activates these receptors. Because the body's natural cannabinoids control a variety of factors – such as pain, mood and appetite – they're attractive targets for drug discovery and development. Piomelli is one of the world's leading endocannabinoid researchers. His groundbreaking work is showing that this system can be exploited by new treatments to combat anxiety, pain, depression and obesity.

http://www.sciencedaily.com/releases/2012/09/120925091348.htm

Going Viral to Kill Zits: Scientists Uncover Virus With Potential to Stop Pimples in Their Tracks

Watch out, acne. Doctors soon may have a new weapon against zits: a harmless virus living on our skin that naturally seeks out and kills the bacteria that cause pimples.

ScienceDaily — The Sept. 25 online edition of the American Society for Microbiology's mBio publishes the findings by scientists at UCLA and the University of Pittsburgh.

"Acne affects millions of people, yet we have few treatments that are both safe and effective," said principal investigator Dr. Robert Modlin, chief of dermatology and professor of microbiology, immunology and molecular genetics at the David Geffen School of Medicine at UCLA. "Harnessing a virus that naturally preys on the bacteria that causes pimples could offer a promising new tool against the physical and emotional scars of severe acne."

The scientists looked at two little microbes that share a big name: Propionibacterium acnes, a bacterium thriving in our pores that can trigger acne; and P. acnes phages, a family of viruses that live on human skin. The viruses are harmless to humans, but programmed to infect and kill the aforementioned P. acnes bacteria.

When P. acnes bacteria aggravate the immune system, it causes the swollen, red bumps associated with acne. Most effective treatments work by reducing the number of P. acnes bacteria on the skin.

"We know that sex hormones, facial oil and the immune system play a role in causing acne, however, a lot of research implicates P. acnes as an important trigger," explained first author Laura Marinelli, a UCLA postdoctoral researcher in Modlin's laboratory. "Sometimes they set off an inflammatory response that contributes to the development of acne."

Using over-the-counter pore cleansing strips from the drugstore, the researchers lifted acne bacteria and the P. acnes viruses from the noses of both pimply and clear-skinned volunteers. When the team sequenced the bacteriophages' genomes, they discovered that the viruses possess multiple features -- such as small size, limited diversity and the broad ability to kill their hosts -- that make them ideal candidates for the development of a new anti-acne therapy.

"Our findings provide valuable insights into acne and the bacterium that causes it," observed corresponding author Graham Hatfull, Eberly Family Professor of Biotechnology, professor of biological sciences at the University of Pittsburgh and a Howard Hughes Medical Institute researcher. "The lack of genetic diversity among the phages that attack the acne bacterium implies that viral-based strategies may help control this distressing skin disorder." "Phages are programmed to target and kill specific bacteria, so P. acnes phages will attack only P. acnes bacteria, but not others like E. coli," added Marinelli. "This trait suggests that they offer strong potential for targeted therapeutic use."

Acne affects nearly 90 percent of Americans at some point in their lives, yet scientists know little about what causes the disorder and have made narrow progress in developing new strategies for treating it. Dermatologists' arsenal of anti-acne tools -- benzoyl peroxide, antibiotics and Accutane -- hasn't expanded in decades.

"Antibiotics such as tetracycline are so widely used that many acne strains have developed resistance, and drugs like Accutane, while effective, can produce risky side effects, limiting their use," explained coauthor Dr. Jenny Kim, director of the UCLA Clinic for Acne, Rosacea and Aesthetics. "Acne can dramatically disfigure people and undermine their self-esteem, especially in teens. We can change patients' lives with treatment. It's time we identified a new way to safely treat the common disorder."

The research team plans to isolate the active protein from the P. acnes virus and test whether it is as effective as the whole virus in killing acne bacteria. If laboratory testing proves successful, the researchers will study the compound's safety and effectiveness in combating acne in people.

The study was supported by grants from the National Institute of Arthritis and Musculoskeletal and Skin Diseases (R21AR060382, R01 AR053542 and F32AR060655) at the National Institutes of Health in Bethesda, Md.
Additional coauthors included Sorel Fitz-Gibbon, Megan Inkeles, Shawn Cokus, Matteo Pellegrini and Jeffrey F. Miller, all of UCLA; former UCLA researchers Clarmyra Hayes and Anya Loncaric, now of the California Institute of Technology and Solta Medical, respectively; and Charles Bowman, Daniel Russell and Deborah Jacobs-Sera of the University of Pittsburgh.
Laura J. Marinelli, Sorel Fitz-Gibbon, Clarmyra Hayes, Charles Bowman, Megan Inkeles, Anya Loncaric, Daniel A. Russell, Deborah Jacobs-Sera, Shawn Cokus, Matteo Pellegrini, Jenny Kim, Jeff F. Miller, Graham F. Hatfull, and Robert L. Modlin. Propionibacterium acnes Bacteriophages Display Limited Genetic Diversity and Broad Killing Activity against Bacterial Skin Isolates. mBio, 2012 DOI: 10.1128/mBio.00279-12

http://bit.ly/OvvVWG

Newly spotted comet may outshine the full moon

Today, the newfound comet seen above is just a tiny dot in the sky beyond Jupiter. But in about a year, it might be one of the brightest objects in our night sky.

Jeff Hecht, contributor

Vitali Nevski and Artyom Novichonok, of the International Scientific Optical Network (ISON) in Russia, discovered comet C/2012 S1 (ISON) on 21 September via images taken with a 40-centimetre reflecting telescope.

Other sky-watchers soon spotted it, and the International Astronomical Union's Minor Planet Center in Cambridge, Massachusetts, announced the find yesterday. From the combined observations, astronomers were able to trace the comet's recent path and find images of it dating back to late December 2011. From there they calculated a near-parabolic orbit that has comet ISON headed almost straight towards the sun.

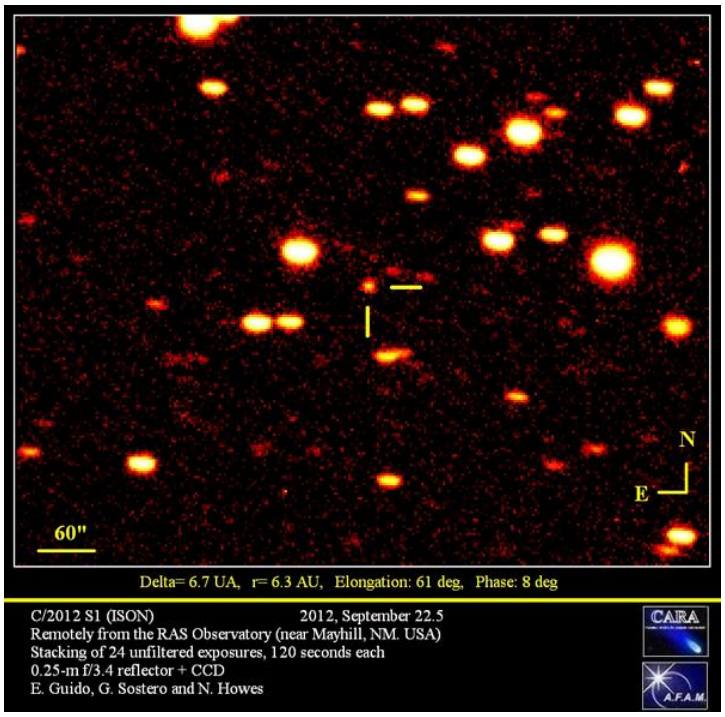
Astronomers at the Remanzacco Observatory in Italy think that ISON will skim less than 1.4 million kilometres from the sun's surface on 28 or 29 November. The comet's orbit also suggests it is a newcomer fresh from the Oort cloud, a distant halo of icy objects that surrounds the solar system. We last had a visitor direct from the cloud in 2009, when the green comet Lulin swooped in and sprouted two tails.

As with Lulin, the intense heat of ISON's solar fly-by should vaporise the comet's hard shell of pristine ices, releasing trapped dust that would help it grow an exceptionally bright tail.

Astronomy Now magazine reports that comet ISON could even be brighter than the full moon around its closest approach to the sun.

Skirting our star means that, to viewers on Earth, the comet will appear close to the horizon and to the sun's glare, making it difficult to see at first. ISON will fade but become easier to spot as it heads back towards the outer solar system. By 9 December it should be about as bright as Polaris, the North Star, according to Remanzacco Observatory astronomers. ISON should continue to be visible to the unaided eye until mid-January 2014.

But veteran astronomers warn that fresh comets with orbits that almost skim the sun are notoriously unpredictable. Results can range from the spectacular comet McNaught of January 2007 to the infamously fizzled comet Kohoutek of 1973.



***C2012S1* Image: E. Guido, G. Sostero, N. Howes**

http://www.sciencedaily.com/releases/2012/09/120925142557.htm

Cannabinoid May Treat Brain Cancer

Dexanabinol kills cultured cancer cells derived from many tumor types

ScienceDaily - Researchers at University of California, San Diego Moores Cancer Center are evaluating the safety and tolerability of a synthetic cannabinoid called dexanabinol (ETS2101). Delivered as a weekly intravenous infusion, the drug is being tested in patients with all forms of brain cancer, both primary and metastatic.

"In this Phase I study, we are examining the safety of multiple doses of dexanabinol, extent of penetration into the brain, and suitability for future trials," said Santosh Kesari, MD, PhD, principal investigator, and director of neuro-oncology, UC San Diego Moores Cancer Center. "What we hope to determine is the safe and optimal dose of drug in the brain."

Dexanabinol is a cannabinoid derivative that causes no psychotropic effects. It was tested previously as a neuroprotective in patients with traumatic brain injury. During these trials the drug was found to cross the blood-brain barrier. More recently, researchers at e-Therapeutics, the trial sponsor, showed that dexanabinol kills cultured cancer cells derived from many tumor types. Additional research in Kesari's lab demonstrated the drug's anti-cancer effects in patient-derived brain cancer cell lines.
Dexanabinol's potential in fighting cancer was identified through a new approach to drug discovery called network pharmacology, a way to analyze the network of proteins underlying a disease process. Network pharmacology enables scientists to seek drugs from among existing compounds, or design new molecules, that act simultaneously on a number of individual proteins to disrupt the cancer-susceptible network.
Kesari added that this trial fits well with a broader national effort to re-purpose existing drugs for the treatment of cancer. He asked, "Why not use drugs that are currently available and learn how they can be applied in new effective ways for different indications?"
Dexanabinol is thought to act on proteins including NFκB, TNFα, COX-2 HAT, FAT and cyclin-dependent kinases. The trial at UCSD Moores Cancer Center is one of two ongoing Phase I studies with dexanabinol, and the first to evaluate the drug in cancer patients.
"In time, we will explore the association between the molecular phenotype of the tumor and the patient's response, which may allow us to personalize future therapies," said Kesari, associate professor, Department of Neurosciences at UC San Diego School of Medicine.
Patients who are eligible for this trial must have failed prior therapy including surgical resection, radiation therapy and systemic therapy.***http://news.discovery.com/animals/vampire-squid-120925.html#mkcpgn=rssnws1***

Vampire Squid Thrive on Feces and Ocean Debris

The squid with Count Dracula-like cloaks, turn out to be living fossils that feast on poo and other waste.

By Jennifer Viegas

Vampire squid, which sport a Count Dracula cloak-like dark web, turn out to be living fossils that feast on poo and other marine waste enveloped in globs of mucus.
The scientific name for this unusual cephalopod is Vampyroteuthis infernalis, which translates to "vampire squid from Hell." This sole species of the Order Vampyromorpha lives between 2,000 to 3,000 feet below the ocean surface in waters with very low levels of oxygen.
Living fossils are animals that have been on Earth for ages, surviving all major extinction events and not seeming to change very much over millions of years. The eclectic diet of the vampire squid, described in a paper published in the latest Proceedings of the Royal Society B, likely hasn't changed much either.
The squid eats "the dead bodies of crustaceans, moults (shedded outer layers) of crustaceans, fecal pellets of zooplankton, parts of gelatinous organisms like the discarded mucus houses of larvaceans, fish scales, foraminifera (single celled marine organisms), pieces of jellyfish and salps, eggs, micro algae, radiolarians (another type of singe celled aquatic animal)," and other marine waste, according to co-author Henk-Jan Hoving, a postdoctoral fellow at the Monterey Bay Aquarium Research Institute.
For many years, the vampire squid has puzzled scientists, both because of this bizarre diet and because of its pair of long, slender threadlike appendages that dangle from the squid's body. The squid live in tropical and temperate regions of the world's oceans. They lack feeding tentacles, but they do possess eight arms.
To learn more about the cephalopod, Hoving and colleague Bruce Robison studied deep-sea video recordings taken from MBARI's remotely operated vehicles. They also conducted laboratory-based feeding experiments and did diet studies as well as examinations of the squid's filaments, arm suckers and other body features.
The analysis solved the long-standing mystery concerning the squid's pair of filaments and how this marine dweller eats.
"The vampire squid deploys a long filament- up to 8 times the animal's body size, and marine detrital matter falling through the water column adheres to the filament," Hoving explained to Discovery News. "The filament is retrieved between the arms of the vampire squid and the food is cleaned off."
"The suckers in vampire squid do not seem to have the sucking capacity as found in other cephalopods," he continued. "The suckers on the distal parts of the arms release mucus and they probably wrap the collected food

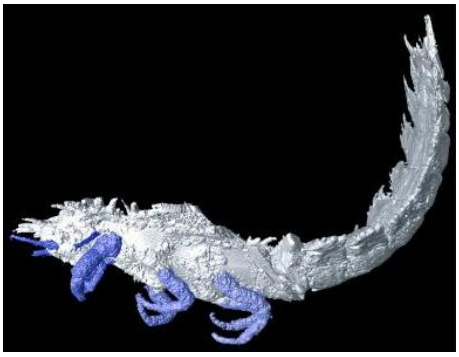
in mucus, forming a food bolus, which is transported via fingerlike projections on the inside of the web to the mouth. Then the food bolus is ingested by the beak."
The squid is therefore the only cephalopod in the world that's not a predatory carnivore.
Instead, it's highly specialized to permanently inhabit parts of the oceans where oxygen concentrations are very low. The ability to survive under such tough conditions could help to explain how the squid lived through so many mass extinction events that wiped out numerous other species.
Richard Young, a biological oceanographer and professor emeritus from the University of Hawaii, is a leading expert on squid and octopi. Young told Discovery News that "the new findings are spectacular."
"Vampire squid have always had these really funny long things that stick out of their body, and scientists like me had no idea what they were used for. Now we know," he said, adding that this "is one peculiar critter. I would be shocked if any other marine organism ate in such a way."
As for whether or not the vampire squid is suitable for human consumption, Hoving said, "I would not eat them. Many marine predators, such as sperm whales and blue sharks, do eat them, though."

http://www.eurekalert.org/pub_releases/2012-09/uom-io3092412.php

Images of 300 million old insects revealed

Writing in the journal PLoS One, the scientists have used a high resolution form of CT scanning to reconstruct two 305-million year old juvenile insects.

Without the pioneering approach to imaging, these tiny insects – which are three-dimensional holes in a rock – would have been impossible to study. By placing the fossils in a CT scanner, and taking over 3,000 X-rays from different angles, the scientists were able to create 2,000 slices showing the fossil in cross section.
From these slices the researchers created 3D digital reconstructions of the fossils. This process allows them to learn more about the lifestyle, biology and diet of the insects, one of which is similar to a modern day cockroach, and glimpse fascinating insights about how both were adapted for survival.
One of the insects reconstructed by the scientists is characterised by a large number of sharp spines. It is a new species and genus which does not exist today.



This shows the spiney-type insect. **The University of Manchester**

The other is an early predecessor of one of the great survivors of the insect world, the cockroach, and is one of the best preserved examples of this age ever seen by insect palaeontologists. Researchers suspect from its well preserved mouthparts that it survived by eating rotting litter from the forest floor.
Both are members of a group called the Polyneoptera – which includes roaches, mantises, crickets, grasshoppers and earwigs. But analysing the exact relationships of the insects will be difficult for the researchers, led by Dr Russell Garwood of the University of Manchester's School of Materials, as insects have a habit of dramatically changing appearance as they develop.
Dr Garwood said: "The most dramatic change is seen in insects like butterflies, which change from a larva, to chrysalis, to adult. But relatively few people look to the fossils try and work out how such a life cycle may have evolved. "We are hoping that work like this will allow us to better understand the biology and development of these early insects, and how major innovations may have come about.
"Around this time a number of early 'amphibians' were insectivores – they lived by eating a lot of insects. The spiney creature was a sitting duck, as it couldn't fly, so the spines probably made it less palatable. It is bizarre – as far as we're aware, quite unlike any members of the Polyneoptera alive today."
"The roach nymph is much like modern day cockroaches – although it isn't a 'true' cockroach, as it may well predate the split between true cockroaches and their sister group, the mantises." "This is very much a first step, and I'll be spending the next few years looking at other fossil insects to build on this work.
Professor Philip Withers, co-author on the paper, added: "I am very excited by our fossil work which is providing unique information in 3D."

http://www.sciencedaily.com/releases/2012/09/120926104255.htm

Ancient Buddhist Statue Made of Meteorite, New Study Reveals

A priceless statue was carved from an ataxite, a very rare class of iron meteorites

ScienceDaily - An ancient Buddhist statue which was first recovered by a Nazi expedition in 1938 has been analyzed by a team of scientists led by Dr. Elmar Buchner from the Institute of Planetology, University of Stuttgart. The probably 1,000-year-old statue, called the "Iron Man," weighs 10 kilograms, portrays the Buddhist god Vaisravana and is believed to originate from the pre-Buddhist Bon culture of the 11th Century.

Geochemical analyses by the German-Austrian research team revealed that the priceless statue was carved from an ataxite, a very rare class of iron meteorites.

It sounds like an artifact from an Indiana Jones film: a 1,000-year-old ancient Buddhist statue which was first recovered by a Nazi expedition in 1938 has been analyzed by scientists and has been found to be carved from a meteorite. The findings, published in Meteoritics and Planetary Science, reveal the priceless statue to be a rare ataxite class of meteorite.

The statue, known as the Iron Man, weighs 10kg and is believed to represent a stylistic hybrid between the Buddhist and pre-Buddhist Bon culture that portrays the god Vaisravana, the Buddhist King of the North, also known as Jambhala in Tibet.

The statue was discovered in 1938 by an expedition of German scientists led by renowned zoologist Ernst Schäfer. It is unknown how the statue was discovered, but it is believed that the large swastika carved into the centre of the figure may have encouraged the team to take it back to Germany. Once it arrived in Munich it became part of a private collection and only became available for study following an auction in 2009.

Photograph of the 'Space Buddha' statue. **(Credit: Dr. Elmar Buchner)**

The first team to study the origins of the statue was led by Dr Elmar Buchner from Stuttgart University. The team was able to classify it as an ataxite, a rare class of iron meteorite with high contents of nickel.

"The statue was chiseled from an iron meteorite, from a fragment of the Chinga meteorite which crashed into the border areas between Mongolia and Siberia about 15.000 years ago. "While the first debris was officially discovered in 1913 by gold prospectors, we believe that this individual meteorite fragment was collected many centuries before," said Dr Buchner.

Meteorites inspired worship from many ancient cultures ranging from the Inuit's of Greenland to the aborigines of Australia. Even today one of the most famous worship sites in the world, Mecca in Saudi Arabia, is based upon the Black Stone, believed to be a stony meteorite. Dr Buchner's team believe the Iron Man originated from the Bon culture of the 11th Century"The Iron Man statue is the only known illustration of a human figure to be carved into a meteorite, which means we have nothing to compare it to when assessing value," said Dr Buchner. "Its origins alone may value it at $20,000; however, if our estimation of its age is correct and it is nearly a thousand years old it could be invaluable."

Elmar Buchner, Martin Schmieder, Gero Kurat, Franz Brandstätter, Utz Kramar, Theo Ntaflos, Jörg Kröchert. Buddha from space: An ancient object of art made of a Chinga iron meteorite fragment. Meteoritics & Planetary Science, 2012; DOI: 10.1111/j.1945-5100.2012.01409.x

http://www.eurekalert.org/pub_releases/2012-09/uou-bqw092012.php

Big quake was part of crustal plate breakup

Study shows huge jolt measured 8.7, ripped at least 4 faults

SALT LAKE CITY – Seismologists have known for years that the Indo-Australian plate of Earth's crust is slowly breaking apart, but they saw it in action last April when at least four faults broke in a magnitude-8.7 earthquake that may be the largest of its type ever recorded.

The great Indian Ocean quake of April 11, 2012 previously was reported as 8.6 magnitude, and the new estimate means the quake was 40 percent larger than had been believed, scientists from the University of Utah and University of California, Santa Cruz, report in the Sept. 27 issue of the journal Nature.

The quake was caused by at least four undersea fault ruptures southwest of Sumatra, Indonesia, within a 2-minute, 40-second period. It killed at least two people, and eight others died from heart attacks. The quake was felt from India to Australia, including throughout South Asia and Southeast Asia.

If the four ruptures were considered separate quakes, their magnitudes would have been 8.5, 7.9, 8.3 and 7.8 on the "moment magnitude" scale used to measure the largest quakes, the scientists report.

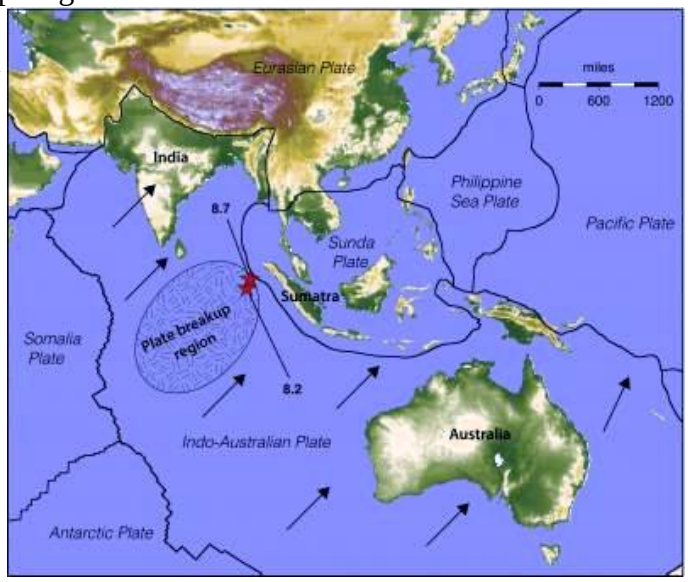
The 8.7 main shock broke three faults that were parallel but offset from each other – known as en echelon faults – and a fourth fault that was perpendicular to and crossed the first fault.

The new study concludes that the magnitude-8.7 quake and an 8.2 quake two hours later were part of the breakup of the Indian and Australian subplates along a yet-unclear boundary beneath the Indian Ocean west of Sumatra and southeast of India – a process that started roughly 50 million years ago and that will continue for millions more.

"We've never seen an earthquake like this," says study co-author Keith Koper, an associate professor geophysics and director of the University of Utah Seismograph Stations. "This is part of the messy business of breaking up a plate. … This is a geologic process. It will take millions of years to form a new plate boundary and, most likely, it will take thousands of similar large quakes for that to happen."

All four faults that broke in the 8.7 quake and the fifth fault that ruptured in the 8.2 quake were strike-slip faults, meaning ground on one side of the fault moves horizontally past ground on the other side.

The great quake of last April 11 "is possibly the largest strike-slip earthquake ever seismically recorded," although a similar size quake in Tibet in 1950 was of an unknown type, according to the new study, which was led by two University of California, Santa Cruz, seismologists: graduate student Han Yue and Thorne Lay, a professor of Earth and planetary sciences. The National Science Foundation funded the study.



The 8.7 jolt also "is probably the largest intraplate [within a single tectonic plate of Earth's crust] ever seismically recorded," Lay, Yue and Koper add. Most of Earth's earthquakes occur at existing plate boundaries.

The researchers cannot be certain the April great quake was the largest intraplate quake or the largest strike-slip quake because "we are comparing it against historic earthquakes long before we had modern seismometers," says Koper.

This map of the Indian Ocean region shows boundaries of Earth's tectonic plates in the area, and the epicenters (red stars) of two great earthquakes that happened April 11, 2012. A new study from the University of Utah and University of California, Santa Cruz, says the main shock measured 8.7 in magnitude, about 40 times larger than the previous estimate of 8.6. An 8.2-magnitude quake followed two hours later.The scientists explain how at least four faults ruptured during the 8.7 main shock, and how both great quakes are likely part of the breakup of the Indo-Australian Plate into separate subplates. The northeastward-moving plate is breaking up over scores of millions of years because the western part of the plate is bumping into Asia and slowing down, while the eastern part is sliding more easily beneath Sumatra and the Sunda plate. **Keith Koper, University of Utah Seismograph Stations.**

Why the Great Quake Didn't Unleash Major Tsunamis

Koper says the 2012 quakes likely were triggered, at least in part, by changes in crustal stresses caused by the magnitude-9.1 Sumatra-Andaman earthquake of Dec. 26, 2004 – a jolt that generated massive tsunamis that killed most of the 228,000 victims in the Indian Ocean region.

The fact the 8.7 and 8.2 quakes were generated by horizontal movements along seafloor strike-slip faults – not by vertical motion along thrust faults – explains why they didn't generate major tsunamis. The 8.7 quake caused small tsunamis, the largest of which measured about 12 inches in height at Meulaboh, Indonesia, according to the U.S. Geological Survey.

Without major tsunamis, the great earthquake caused "very little damage and death, especially for this size of an earthquake, because it happened in the ocean and away from coastlines," and on strike-slip faults, says Koper.

The researchers studied the quake using a variety of methods to analyze the seismic waves it generated. Because the same data can be interpreted in various ways, Koper says it is conceivable that more than four fault segments broke during the 8.7 quake – conceivably five or even six – although four fault ruptures is most likely.

Breaking Up is Hard to Do

The Indo-Australian plate is breaking into two or perhaps three pieces (some believe a Capricorn subplate is separating from the west side of the Indian subplate). The magnitude-8.7 and 8.2 great quakes on April 11 occurred over a broad area where the India and Australian subplates are being sheared apart.

"What we're seeing here is the Indo-Australian plate fragmenting into two separate plates," says Lay.

The breakup of the northeast-moving Indo-Australian plate is happening because it is colliding with Asia in the northwest, which slows down the western part of the plate, while the eastern part of the plate continues moving more easily by diving or "subducting" under the island of Sumatra to the northeast. The subduction zone off Sumatra caused the catastrophic 2004 magnitude-9.1 quake and tsunami.

Seismic analysis shows the April 11 quakes "involve rupture of a very complex network of faults, for which we have no documented precedent in recorded seismic history," the researchers write.

The analysis revealed this sequence for the faults ruptures that generated the 8.7 quake, and the estimated fault rupture lengths and slippage amounts:
-- The quake began with the 50-second rupture of a fault extending west-northwest to east-southeast, with an epicenter a few hundred miles southwest of Sumatra. The fault ruptured along a roughly 90-mile length, breaking "bilaterally" both west-northwestward and east-southeastward, and also at least 30 miles deep, "almost ripping through the whole plate," Koper says. The seafloor on one side of the fault slipped about 100 feet past the seafloor on the fault's other side.
-- The second fault, which slipped about 25 feet, began to rupture 40 seconds after the quake began. This rupture extended an estimated 60 miles to 120 miles north-northeast to south-southwest – perpendicular to the first fault and crossing it.
-- The third fault was parallel to the first fault and about 90 to the miles southwest of it. It started breaking 70 seconds after the quake began and ruptured along a length of about 90 miles. This fault slipped about 70 feet.
-- The fourth fault paralleled the first and third faults, but was to the northwest of both of them. It began to rupture 145 seconds after the quake began and continued to do so for 15 seconds until the quake ended after a total time of 2 minutes and 40 seconds. The fault rupture was roughly 30 miles to 60 miles long. The ground on one side of this fault slipped about 20 feet past ground on the other side.

http://www.eurekalert.org/pub_releases/2012-09/fhcr-mot092412.php

Men on the mind: Study finds male DNA in women's brains

Male DNA is commonly found in the brains of women, most likely derived from prior pregnancy with a male fetus

SEATTLE – Male DNA is commonly found in the brains of women, most likely derived from prior pregnancy with a male fetus, according to first-of-its-kind research conducted at Fred Hutchinson Cancer Research Center. While the medical implications of male DNA and male cells in the brain are unknown, studies of other kinds of microchimerism – the harboring of genetic material and cells that were exchanged between fetus and mother during pregnancy – have linked the phenomenon to autoimmune diseases and cancer, sometimes for better and other times for worse.
The study findings are published Sept. 26 in PLOS ONE. Lead author William F. N. Chan, Ph.D., in the Department of Biochemistry at the University of Alberta, conducted the research while working in the Hutchinson Center laboratory of J. Lee Nelson, M.D., a member of the Center's Clinical Research Division and a leading international authority on microchimerism. Nelson is senior author on the paper.
Chan said the study is the first description of male microchimerism in the female human brain. The findings support the likelihood that fetal cells frequently cross the human blood-brain barrier and that microchimerism in the brain is relatively common. Until this study, it was not known whether these cells could cross the barrier in humans.
For this research, scientists examined brain autopsy specimens from 59 women who had died between the ages of 32 and 101. Male microchimerism was detected in 63 percent of subjects, was distributed in multiple brain regions and was potentially persistent throughout the human lifespan; the oldest female in whom male fetal DNA was detected in the brain was 94.
Twenty six of the women had no neurological disease and 33 had Alzheimer's disease. The brains of women with Alzheimer's had a somewhat lower prevalence of male microchimerism, which appeared in lower concentrations in regions of the brain most affected by the disease. However, the authors noted that the small number of subjects and largely unknown pregnancy history of the women means a link between Alzheimer's disease and level of male cells of fetal origin cannot be established.
The study also does not provide an association between male microchimerism in the female brain and relative health versus disease. "Currently, the biological significance of harboring male DNA and male cells in the human brain requires further investigation," Chan said.
However, other Hutchinson Center studies of male microchimerism in women have found it to impact a woman's risk of developing some types of cancer and autoimmune disease. In some conditions, such as breast cancer, cells of fetal origin are thought to confer protection; in others, such as colon cancer, they have been associated with increased risk. Hutchinson Center studies also have linked lower risk of rheumatoid arthritis to women who previously had given birth at least once as compared to nulliparous women.
Grants from the National Institutes of Health and the Canadian Institutes of Health Research funded the study, which also involved researchers from the Department of Pathology and Division of Rheumatology at the University of Washington School of Medicine.

http://www.eurekalert.org/pub_releases/2012-09/ksu-rdb092612.php

Researchers develop blood test that accurately detects early stages of lung, breast cancer in humans

Researchers at Kansas State University have developed a simple blood test that can accurately detect the beginning stages of cancer.

MANHATTAN, Kan. -- In less than an hour, the test can detect breast cancer and non-small cell lung cancer -- the most common type of lung cancer -- before symptoms like coughing and weight loss start. The researchers anticipate testing for the early stages of pancreatic cancer shortly.

The test was developed by Stefan Bossmann, professor of chemistry, and Deryl Troyer, professor of anatomy and physiology. Both are also researchers affiliated with Kansas State University's Johnson Cancer Research Center and the University of Kansas Cancer Center. Gary Gadbury, professor of statistics at Kansas State University, helped analyze the data from tests with lung and breast cancer patients. The results, data and analysis were recently submitted to the Kansas Bio Authority for accelerated testing.

"We see this as the first step into a new arena of investigation that could eventually lead to improved early detection of human cancers," Troyer said. "Right now the people who could benefit the most are those classified as at-risk for cancer, such as heavy smokers and people who have a family history of cancer. The idea is these at-risk groups could go to their physician's office quarterly or once a year, take an easy-to-do, noninvasive test, and be told early on whether cancer has possibly developed." The researchers say the test would be repeated a short time later. If cancer is confirmed, diagnostic imaging could begin that would otherwise not be routinely pursued.

According to the American Cancer Society, an estimated 39,920 breast cancer deaths and 160,340 lung cancer deaths are expected in the U.S. in 2012. With the exception of breast cancer, most types of cancer can be categorized in four stages based on tumor growth and the spread of cancer cells throughout the body. Breast and lung cancer are typically found and diagnosed in stage 2, the stage when people often begin exhibiting symptoms such as pain, fatigue and coughing. Numerous studies show that the earlier cancer is detected, the greater chance a person has against the disease.

"The problem, though, is that nobody knows they're in stage 1," Bossmann said. "There is often not a red flag to warn that something is wrong. Meanwhile, the person is losing critical time."

The test developed by Kansas State University's Bossmann and Troyer works by detecting increased enzyme activity in the body. Iron nanoparticles coated with amino acids and a dye are introduced to small amounts of blood or urine from a patient. The amino acids and dye interact with enzymes in the patient's urine or blood sample. Each type of cancer produces a specific enzyme pattern, or signature, that can be identified by doctors.

"These enzyme patterns can also help distinguish between cancer and an infection or other diseases that commonly occur in the human body," Bossmann said. "For example, a person who smokes a lot of cigars may develop an inflammation in their lungs. That will drive up some of the markers in the test but not all of them. Doctors will be able to see whether there was too much smoke inhalation or if there is something more serious going on. False-positives are something that we really want to avoid." Once the test is administered, comprehensive results -- which include enzyme patterns -- are produced in roughly 60 minutes.

Bossmann and Troyer have designed a second testing method that is anticipated to produce the same results in about five minutes. The team recently received $305,000 in funding for this project from the National Science Foundation's Division of Chemical, Bioengineering, Environmental and Transport Systems.

In addition to early detection, researchers say the test can be tweaked to monitor cancer. For example, patients being treated with drugs can be observed for drug effectiveness. Similarly, doctors can use the dye in the test to determine if the entirety of a tumor has been successfully removed from a patient after surgery.

Researchers evaluated the test's accuracy on 32 separate participants in various stages of breast or lung cancer. Data was collected from 20 people with breast cancer -- ranging in age from 36 to 81 years old -- and 12 people with lung cancer -- ranging in age from 27 to 63 years old. Twelve people without cancer were also tested as a control group. This group ranged in age from 26 to 62 years old.

A blood sample from each participant was tested three times. Analysis of the data showed a 95 percent success rate in detecting cancer in participants, including those with breast cancer in stages 0 and 1 and those with lung cancer in stages 1 and 2.

Tests detecting for pancreatic cancer are anticipated to begin in October as part of Bossmann and Troyer's collaboration with Dr. Stephen Williamson at the University of Kansas Medical Center. Blood samples from triple-negative breast cancer patients will be tested this fall in collaboration with Dr. Priyanka Sharma, who is also at the University of Kansas Medical Center.

Funding for the study -- titled "Functionalized Bimagnetic Core/Shell Fe/FE3O4 Stealth Nanoparticles for Diag & Treatment Cancer" -- was originally provided through a subcontract of a National Institutes of Health phase II Small Business Innovation Research grant to NanoScale Corp., a Manhattan-based company that manufactures, markets and commercializes advanced products and technologies, and by the Johnson Cancer Rsearch Center at Kansas State University. A Small Business Innovation Research grant is awarded to small businesses with a university partner for the purpose of accelerating research to enter the commercial marketplace.

http://www.eurekalert.org/pub_releases/2012-09/uof-ubd092612.php

UF biologist discovers mammal with salamander-like regenerative abilities

A small African mammal with an unusual ability to regrow damaged tissues could inspire new research in regenerative medicine, a University of Florida study finds.

GAINESVILLE, Fla. --- For years biologists have studied salamanders for their ability to regrow lost limbs. But amphibian biology is very different than human biology, so lessons learned in laboratories from salamanders are difficult to translate into medical therapies for humans.

New research in the Sept. 27 issue of the journal Nature describes a mammal that can regrow new body tissues following an injury. The African spiny mouse could become a new model for research in regenerative medicine.

"The African spiny mouse appears to regenerate ear tissue in much the way that a salamander regrows a limb that has been lost to a predator," said Ashley W. Seifert, a postdoctoral researcher in UF's biology department. "Skin, hair follicles, cartilage -- it all comes back."

That's not the case in other mammals, he said. Usually scar tissue forms to fill the gap created by a wound. The spiny mouse also regrows tissue on its main body when injured but not as completely as it does in its ears. "On their backs, they regrow hair follicles and skin, but the muscle beneath the skin doesn't regenerate," Seifert said.

Seifert was studying scar-free healing in amphibians when a colleague told him that a small rodent he had observed in Africa seemed capable of autotomy, a defense mechanism whereby the animal self-amputates a body part to escape a predator. "Autotomy in skinks, geckos and some salamanders is well known," Seifert said. "But it is very rare in mammals, and so far we've only seen it in a few rodents that can jettison their tail."

Seifert's colleague said that the African spiny mouse appeared to have tear-away skin that allowed it to slip a predator's grasp. The notion was interesting enough to send Seifert packing to the Mpala Research Centre near Nairobi, Kenya.

In Nairobi, Seifert was able to document the first known case of skin autotomy in a mammal. But it was how the animals' injuries appeared to be healing that really got his attention. Seifert used a 4mm biopsy punch, about the size of a large BB, to puncture holes in the ears of the mice to see if the animal showed regenerative capabilities. "The results were astonishing," he said. "The various tissues in the ear grew back through formation of blastema-like structures -- the same sort of biological process that a salamander uses to regenerate a severed limb."

Ken Muneoka, a Tulane University professor of cell and molecular biology who was not involved with the study, agrees that Seifert's findings are important. "It could represent a new model system for skin wound healing and tissue regeneration in humans," he said.

http://www.eurekalert.org/pub_releases/2012-09/uoc--ecc092612.php

Extreme climate change linked to early animal evolution

UC Riverside geoscientists help tie spike in ancient oceanic oxygen levels to 'Snowball Earth' event

RIVERSIDE, Calif. — An international team of scientists, including geochemists from the University of California, Riverside, has uncovered new evidence linking extreme climate change, oxygen rise, and early animal evolution.

A dramatic rise in atmospheric oxygen levels has long been speculated as the trigger for early animal evolution. While the direct cause-and-effect relationships between animal and environmental evolution remain topics of intense debate, all this research has been hampered by the lack of direct evidence for an oxygen increase coincident with the appearance of the earliest animals — until now.

In the Sept. 27 issue of the journal Nature, the research team, led by scientists at the University of Nevada, Las Vegas, offers the first evidence of a direct link between trends in early animal diversity and shifts in Earth system processes.

The fossil record shows a marked increase in animal and algae fossils roughly 635 million years ago. An analysis of organic-rich rocks from South China points to a sudden spike in oceanic oxygen levels at this time — in the wake of severe glaciation. The new evidence pre-dates previous estimates of a life-sustaining oxygenation event by more than 50 million years.

"This work provides the first real evidence for a long speculated change in oxygen levels in the aftermath of the most severe climatic event in Earth's history — one of the so-called 'Snowball Earth' glaciations," said Timothy Lyons, a professor of biogeochemistry at UC Riverside.

The research team analyzed concentrations of trace metals and sulfur isotopes, which are tracers of early oxygen levels, in mudstone collected from the Doushantuo Formation in South China. The team found spikes in concentrations of the trace metals, denoting higher oxygen levels in seawater on a global scale.

"We found levels of molybdenum and vanadium in the Doushantuo Formation mudstones that necessitate that the global ocean was well ventilated. This well-oxygenated ocean was the environmental backdrop for early animal diversification," said Noah Planavsky, a former UCR graduate student in Lyons's lab now at CalTech.

The high element concentrations found in the South China rocks are comparable to modern ocean sediments and point to a substantial oxygen increase in the ocean-atmosphere system around 635 million years ago.

According to the researchers, the oxygen rise is likely due to increased organic carbon burial, a result of more nutrient availability following the extreme cold climate of the 'Snowball Earth' glaciation when ice shrouded much of Earth's surface.

Lyons and Planavsky argued in research published earlier in the journal Nature that a nutrient surplus associated with the extensive glaciations may have initiated intense carbon burial and oxygenation. Burial of organic carbon — from photosynthetic organisms — in ocean sediments would result in the release of vast amounts of oxygen into the ocean-atmosphere system. "We are delighted that the new metal data from the South China shale seem to be confirming these hypothesized events," Lyons said.

The joint research was supported by grants from the National Science Foundation, the NASA Exobiology Program, and the National Natural Science Foundation of China. Besides Lyons and Planavsky, the research team includes Swapan K. Sahoo (first author of the research paper) and Ganqing Jiang (principal investigator of the study) of the University of Nevada, Las Vegas; Brian Kendall and Ariel D. Anbar of Arizona State University; Xinqiang Wang and Xiaoying Shi of the China University of Geosciences (Beijing); and UCR alumnus Clint Scott of United States Geological Survey.

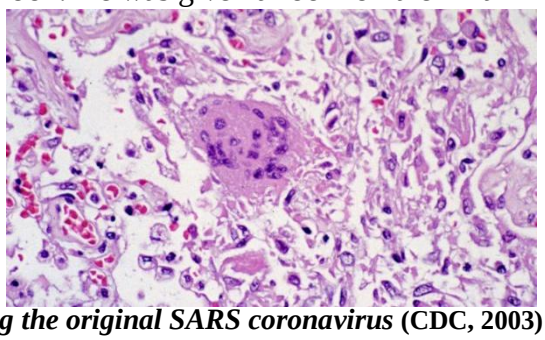
http://www.wired.com/wiredscience/2012/09/coronavirus-memory-sars/

Why the New Coronavirus Unnerves Public Health: Remembering SARS

The novel virus apparently has been responsible for a very few illnesses and deaths in the past few weeks.

By Maryn McKenna

On Feb. 21, 2003, a 65-year-old physician who lived in the Chinese province that abuts Hong Kong crossed into the territory surrounding the city and checked into a hotel in Kowloon. He was given a room on the ninth floor. Sometime during his stay - no one has ever fully traced his path - he encountered roughly a dozen other people; most of them were hotel guests whose rooms were on the same floor, but some were staying on other floors, and some were visitors to events there. The physician had been sick for a week with symptoms that had started like the flu, but were turning into pneumonia, and the next day, he checked out of the hotel and went to a Hong Kong hospital. Before the end of the day, he died.



Lung tissue containing the original SARS coronavirus **(CDC, 2003)**

In the next few days, the people who had crossed paths with the physician left the hotel. Most of them were visitors to the special administrative region: Hong Kong is not only a port and transit hub, but a business and shopping destination for much of the Pacific Rim. They went to Vietnam, Singapore, Canada, and Ireland. As they traveled, some of them started to feel as though they had picked up the flu. Within a month, health authorities in 14 countries had identified more than 1,300 cases of respiratory illness that all traced back to those brief encounters somewhere in the hotel. Within five months, the illness - dubbed SARS, for severe acute respiratory syndrome — had caused 8,098 illnesses, and 774 deaths in 26 countries around the world.

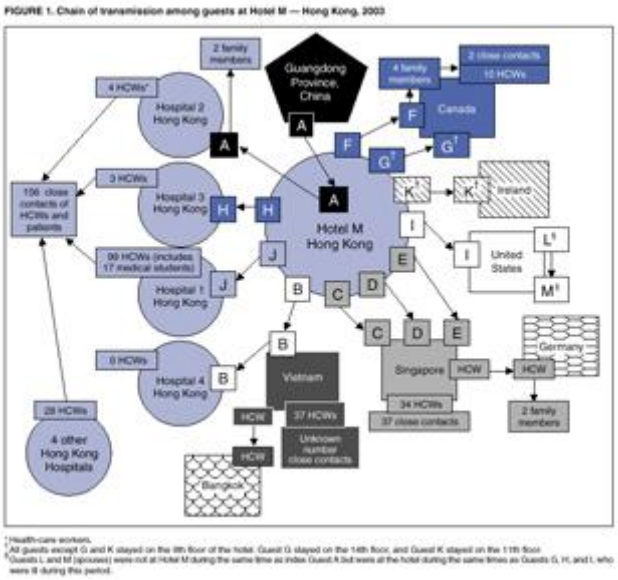
SARS (which had been brewing in China for months but never previously escaped) was caused by a novel coronavirus, for which there was no uncomplicated treatment and no vaccine, and despite being seeded in a very small group of people, it spread rapidly around the world. That goes a long way to explain why health

authorities are so unnerved now by the identification of another novel coronavirus, which has been identified in a part of the world where millions of people are about to converge, mingle and leave.

To recap:

The novel virus apparently has been responsible for a very few illnesses and deaths in the past few weeks. It has caused the illness of one man who visited Saudi Arabia but now is hospitalized in England, and an almost-identical virus has caused the death of one man who was a Saudi resident. There has been a report of a second death in Saudi, and concerns have been raised about an outbreak of respiratory illness in Jordan (which shares a border with Saudi Arabia) in April, and of the illnesses last night of five people who were put into isolation in Denmark.

The World Health Organization has issued an alert and written a preliminary case definition, which because it is early in this episode is so loose - involving fever, cough and either travel to Qatar or Saudi Arabia, or contact with someone who did - that it is likely to turn up many unrelated cases that could temporarily inflate the numbers.



The CDC's 2003 diagram of the first SARS cases outside China.

The virus is so new that it has not been named officially, but as of last night it had been partially sequenced and aligned with other coronoviruses including the SARS virus. The dendrogram, and information about lab options for molecular diagnostics, were posted last night by the U.K.'s Health Protection Agency. (Soon afterward, virologist and commentator Vincent Racaniello cautioned that Koch's postulates haven't yet been fulfilled, underlining that the virus has been isolated from people with respiratory symptoms, but has not yet been proven to cause those symptoms.)

And the WHO's spokesman on the emerging virus, Gregory Hartl, has repeatedly reminded media covering the story that (as he said in a briefing taped Tuesday) "this is not SARS, it will not become SARS, it is not SARS-like" — a point that was not necessarily meant to be a reassurance, since he added, "It is distinct from SARS at least in the fact that we've seen so far, it causes very rapid renal failure."

The concern underlying these developments is that exposure to the new virus seems to have occurred only or primarily in Saudi Arabia, which houses Mecca, the physical heart of Islam - and which, next month, will be the center of the worldwide annual pilgrimage known as the Hajj. The Hajj brings more than 2 million people to the country, in extraordinarily crowded conditions, and when those pilgrims leave, they disperse all over the world.

The spread of disease during the Hajj has always been a concern (discussed, for instance, in this UK document from 2005, when avian flu H5N1 was a cross-border threat), and the Saudi authorities have always taken it seriously, including requiring that pilgrims be vaccinated in order to be granted a visa. According to news reports today, they are ramping up scrutiny of visitors, who have already begun arriving: The first official day of the pilgrimage season this year is tomorrow, Sept. 27, though the central observances in Mecca do not begin until Oct. 24.

Given the periodically flaring tensions between the Islamic world and the West - exemplified most recently by the attack on the U.S. embassy in Libya - preventing the Hajj from being identified with the spread of a disease is a priority not just for health authorities, but for governments. But a month is a long lead time in modern public health, even given how fast diseases such as SARS can spread. Meanwhile, here are some key sources to watch for news:

- ***The WHO's page***
- ***The HPA's excellent list of resources***
- ***The blogs of Mike Coston and Crawford Kilian, who do a phenomenal and completely unrecompensed job of keeping track of international developments in public health.***

It is also a good idea to watch for any stories by Helen Branswell of the Canadian Press, one of very few reporters who covered SARS almost a decade ago and is still on the beat (with this story, for instance). I also covered SARS, and I'll do my best to update here.

Almost immediate update: As an example of how fast things are moving, just as I hit the button on this, Agence France Presse posted a report that the five Danish cases have been diagnosed with influenza B.

SARS image, PHIL, CDC

Maryn McKenna is a journalist for national magazines and the author of SUPERBUG and BEATING BACK THE DEVIL. She finds emerging diseases strangely exciting. Read more by Maryn McKenna

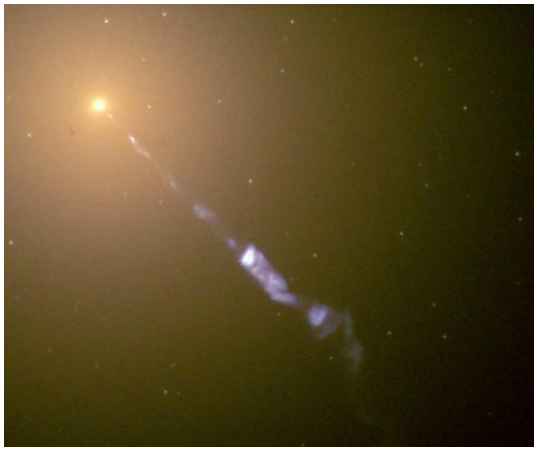
http://arstechnica.com/science/2012/09/first-images-of-particle-jets-at-edge-of-a-supermassive-black-hole/

First images of particle jets at edge of a supermassive black hole

Thanks to the Event Horizon Telescope, see matter being swallowed in the M87 galaxy.

by John Timmer - Sept 28 2012, 3:00am TST

Supermassive black holes appear to occupy the center of almost all galaxies. When they are actively swallowing matter, these black holes can power energetic jets that shine brighter than the entire rest of the galaxy, and can shoot matter free of it. Despite the mass and energy involved, however, the origin of these jets has been extremely hard to image, both because they're relatively compact, and because they're situated in the crowded centers of distant galaxies.



One of the relativistic jets of the galaxy M87. **NASA**

Now, however, researchers are putting together an array of telescopes stretched across the globe with the specific goal of imaging the environment near these supermassive black holes. The team behind the Event Horizon Telescope has now used it to image the black hole at the center of the M87 galaxy, and returned the first details of the disk of matter that is being sucked into that galaxy's central black hole.

It's difficult to imagine the environment near a supermassive black hole. These objects are typically over a million times the mass of our Sun, but all of that matter is crammed into a space that may only be a fraction of the Sun's radius. Any matter falling into one piles up into an orbiting disk of material (called an accretion disk) that increases in density and energy as you get closer to black hole. Any matter that crosses a critical point, however, rapidly spirals inward to the black hole itself. The inner area of the disk is so energetic that it actually sends matter away from the black hole in a wind of particles.

But that's not the most energetic part. Even further inward, the intense magnetic field lines sometimes cross the event horizon of the black hole itself, propelling intense beams of charged particles away from the black hole. These jets interact with the wind of particles coming from the accretion disk, which focuses them into narrow beams that move at nearly the speed of light. These have so much energy that they are (in some cases) able to propel particles for hundreds of thousands of light years, sending them entirely out of the galaxy, where the particles eventually slow by interacting with the intergalactic medium.

Or that's what theoretical considerations seem to tell us. To actually image any of this, however, has been a serious challenge. It's what the Event Horizon Telescope was intended to solve. In a paper in this week's edition of Science, four of the telescope's instruments were pointed towards the center of M87: Hawaii's James Clerk Maxwell Telescope, the Submillimeter Telescope in Arizona, and two telescopes at CARMA in California. By carefully timing the incoming signals at each of these scopes (and using the two neighboring instruments in California to refine the signal), the researchers could turn these distant instruments into a single, giant telescope, one that could resolve details of the environment near the central black hole.

This system managed to image the area around the black hole down to a resolution on the scale of the Schwarzchild radius. And they were able to spot that the base of the high-energy jets is only a few times the size of the black hole itself (5.5 times the Schwarzchild radius), which "is consistent with scales on which energy is extracted from the black hole and accretion disk to feed the jet."

This also tells us something about the accretion disk. If the disk and black hole were rotating in opposite directions, the inner edge of the disk would be much further from the black hole itself than if they were rotating in the same direction. The size of the jets seen here is too small to arise from a system where the two bodies are rotating in opposite directions, so we can conclude that the disk is following the rotation of the black hole it orbits.

(Ars contributor Matthew Francis has provided more details on the structure of the accretion disk at his personal blog.)

Even if the Event Horizon Telescope is improved, we're not likely to get a better picture of the black hole's environment, because the model built from the observation runs up against limits that arise from our uncertainties regarding the distance to M87 and the mass of the black hole within it. But the authors hope to be

able to use the telescope to continue observations over longer periods of time, since the accretion disk probably contains an uneven distribution of matter, which could create periodic irregularities in the output.
Plus, eventually, they hope to turn the telescope on our own galaxy's black hole. It's not as active as M87's, but it still seems to be swallowing enough matter to make checking it out at high resolution worth our while.
Science, 2012. DOI: 10.1126/science.1224768 (About DOIs).

http://www.eurekalert.org/pub_releases/2012-09/tcob-cms092012.php

Chocolate makes snails smarter

Type the word 'superfood,' into a web browser and you'll be overwhelmed: some websites even maintain that dark chocolate can have beneficial effects.

But take a closer look at the science underpinning these claims, and you'll discover just how sparse it is. So, when University of Calgary undergraduate Lee Fruson became curious about how dietary factors might affect memory, Ken Lukowiak was sceptical. 'I didn't think any of this stuff would work', Lukowiak recalls. Despite his misgivings, Lukowiak and Fruson decided to concentrate on a group of compounds – the flavonoids – found in a wide range of 'superfoods' including chocolate and green tea, focusing on one particular flavonoid, epicatechin (epi). However, figuring out how a single component of chocolate might improve human memory is almost impossible – too many external factors influence memory formation – so Lukowiak turned to his favourite animal, the pond snail Lymnaea stagnalis, to find out whether the dark chocolate flavonoid could improve their memories. They publish their discovery that epi improves the length and strength of snail memories in The Journal of Experimental Biology at http://jeb.biologists.com.
According to Lukowiak, the molluscs can be trained to remember a simple activity: to keep their breathing tubes (pneumostomes) closed when immersed in deoxygenated water. He explains that pond snails usually breathe through their skins, but when oxygen levels fall, they extend the breathing tube above the surface to supplement the oxygen supply. However, the snails can be trained to remember to keep the breathing tube closed in deoxygenated water by gently tapping it when they try to open it, and the strength of the memory depends on the training regime.
First, Fruson identified an epi concentration – 15 mg m1 pond water – that didn't affect the snails' behaviour; 'We have to be sure that we're not looking at wired animals', chuckles Lukowiak. Then, the duo tested the molluscs' memories. Explaining that a half-hour training session in deoxygenated water allows the snails to form intermediate-term memories (lasting less than 3 h) but not long-term memories (lasting 24 h or more), Fruson and Lukowiak wondered whether epi would improve the snail's memories, allowing them to form long-term memories after shorter memory training. Amazingly, when Fruson plunged the molluscs into deoxygenated water to tested their memories a day later, they remembered to keep their breathing tubes closed. And when the duo provided the snails with two training sessions, the animals were able to remember to keep their breathing tubes shut more than 3 days later. Epi had boosted the molluscs' memories and extended the duration, but how strong were the epi-memories?
Lukowiak explains that memories can be overwritten by another memory in a process called extinction. However, the original memory is not forgotten and if the additional memory is stored weakly, it can be lost and the original memory restored. So, Fruson and Lukowiak decided to find out how strong the epi-boosted memory was by trying to extinguish it. Having trained the snails, the duo then tried to replace it with a memory where the snails could open their breathing tubes. However, instead of learning the new memory, the epi-trained snails stubbornly kept their breathing tubes shut. The epi-memory was too strong to be extinguished.
The duo also found that instead of requiring a sensory organ to consolidate the snails' memories – like their memories of predators triggered by smell – epi directly affects the neurons that store the memory. So, Lukowiak is keen to look directly at the effect that epi has on memory neurons and adds that the cognitive effects of half a bar of dark chocolate could even help your grades: good news for chocoholics the world over.
REFERENCE: Fruson, L., Dalesman, S. and Lukowiak, K. (2012) A flavonol present in cocoa [(–)epicatechin] enhances snail memory. J. Exp. Biol. 215, 3566-3576. http://jeb.biologists.org/content/215/20/3566.abstract

http://www.eurekalert.org/pub_releases/2012-09/tu-sas092512.php

Smooth as silk 'transient electronics' dissolve in body or environment

Tiny resorbable semiconductors could be used for medical implants, environmental sensors, consumer electronics

MEDFORD/SOMERVILLE, Mass. - Tiny, fully biocompatible electronic devices that are able to dissolve harmlessly into their surroundings after functioning for a precise amount of time have been created by a research team led by biomedical engineers at Tufts University in collaboration with researchers at the University of Illinois at Urbana-Champaign.

Dubbed "transient electronics," the new class of silk-silicon devices promises a generation of medical implants that never need surgical removal, as well as environmental monitors and consumer electronics that can become compost rather than trash.
"These devices are the polar opposite of conventional electronics whose integrated circuits are designed for long-term physical and electronic stability," says Fiorenzo Omenetto, professor of biomedical engineering at Tufts School of Engineering and a senior and corresponding author on the paper "A Physically Transient Form of Silicon Electronics" published in the September 28, 2012, issue of Science.
"Transient electronics offer robust performance comparable to current devices but they will fully resorb into their environment at a prescribed time—ranging from minutes to years, depending on the application," Omenetto explains. "Imagine the environmental benefits if cell phones, for example, could just dissolve instead of languishing in landfills for years."
The futuristic devices incorporate the stuff of conventional integrated circuits -- silicon and magnesium -- but in an ultrathin form that is then encapsulated in silk protein.
"While silicon may appear to be impermeable, eventually it dissolves in water," says Omenetto. The challenge, he notes, is to make the electrical components dissolve in minutes rather than eons.
Researchers led by UIUC's John Rogers -- the other senior and corresponding author -- are pioneers in the engineering of ultrathin flexible electronic components. Only a few tens of nanometers thick, these tiny circuits, from transistors to interconnects, readily dissolve in a small amount of water, or body fluid, and are harmlessly resorbed. Controlling materials at these scales makes it possible to fine-tune how long it takes the devices to dissolve.
Device dissolution is further controlled by sheets of silk protein in which the electronics are supported and encapsulated. Extracted from silkworm cocoons, silk protein is one of the strongest, most robust materials known. It's also fully biodegradable and biofriendly and is already used for some medical applications. Omenetto and his Tufts colleagues have discovered how to adjust the properties of silk so that it degrades at a wide range of intervals.
The researchers successfully demonstrated the new platform by testing a thermal device designed to monitor and prevent post-surgical infection (demonstrated in a rat model) and also created a 64 pixel digital camera. Collaborating with Omenetto from Tufts' Department of Biomedical Engineering were Hu Tao, research assistant professor and co-first author on the paper; Mark A. Brenckle, doctoral student; Bruce Panilaitis, program administrator; Miaomiao Yang, doctoral student; and David L. Kaplan, Stern Family Professor of Engineering and department chair. In addition to Tufts and UIUC, co-authors on the paper also came from Seoul National University, Northwestern University, Dalian University of Technology (China), Nano Terra (Boston), and the University of Arizona.
In the future, the researchers envision more complex devices that could be adjustable in real time or responsive to changes in their environment, such as chemistry, light or pressure.
The work was supported by the Defense Advanced Research Projects Agency, the National Science Foundation, the Air Force Office of Scientific Research Multi University Research Initiative program, the National Institute of Biomedical Imaging and Bioengineering of the National Institutes of Health under award EB002520 and the U.S. Department of Energy.

http://www.eurekalert.org/pub_releases/2012-09/bmj-o6a092612.php

Over 65s at increased risk of developing dementia with benzodiazepine

Research: Benzodiazepine use and risk of dementia: Prospective population based study

Patients over the age of 65 who begin taking benzodiazepine (a popular drug used to treat anxiety and insomnia) are at an approximately 50% increased risk of developing dementia within 15 years compared to never-users, a study published today on bmj.com suggests.
The authors say that "considering the extent to which benzodiazepines are prescribed and the number of potential adverse effects indiscriminate widespread use should be cautioned against".
Benzodiazepine is a widely prescribed drug for the over 65s in many countries: 30% of this age group in France, 20% in Canada and Spain, 15% in Australia. Although less widespread in the UK and US it is still very widely used and many individuals take this drug for years despite guidelines suggesting it should be limited to a few weeks. Previous studies have found an increased risk of dementia, but others have been non-conclusive.
Researchers from France therefore carried out a study on 1063 men and women (average age 78) in France who were all free of dementia at the start. The study started in 1987 and follow-up was 20 years. The researchers used the first 5 years to identifying the factors leading to benzodiazepine initiation and evaluated then the association between new use of this drug and the development of dementia. They also assessed the association between further benzodiazepine initiation during the follow-up period and risk of subsequent dementia. Rates

were adjusted for many factors potentially affecting dementia, such as age, gender, educational level, marital status, wine consumption, diabetes, high blood pressure, cognitive decline, and depressive symptoms.
95 out of the 1063 patients started taking benzodiazepine during the study. 253 (23.8%) cases of dementia were confirmed, 30 in benzodiazepine users and 223 in non-users. New initiation of the drug was associated with shorter dementia-free survival.
In absolute numbers, the chance of dementia occurring was 4.8 per 100 person years in the exposed group compared to 3.2 per 100 person years in the non-exposed group. A "person year" is a statistical measure representing one person at risk of development of a disease during a period of one year.
The authors say that although benzodiazepine remains useful for treating anxiety and insomnia, there is increasing evidence that its use may induce adverse outcomes in the elderly such as serious falls and fall-related fractures and this study may add dementia to the list. They say that their data add to the accumulating evidence that the use of benzodiazepines is associated with increased risk of dementia and, if true, that this "would constitute a substantial public health concern". Therefore, taken the evidence of potential adverse effects into account, physicians should assess expected benefits, limit prescriptions to a few weeks, and uncontrolled use should be cautioned against. They conclude that further research should "explore whether use of benzodiazepine in those under 65 is also associated with increased risk of dementia and that mechanisms need to be explored explaining the association"

http://bit.ly/Qeuokw

First Mother-to-Daughter Uterus Transplants

Two women now carry their mothers' wombs after successful transplant surgery in Sweden, the University of Gothenburg reports.

Analysis by Sheila Eldred

It's a major step in a research project that surgeons had been training for for years, according to the university.
"More than 10 surgeons that had trained together on the procedure for several years took part in the complicated surgery," said team leader Mats Brännström, professor of Obstetrics and Gynecology at the University of Gothenburg chief physician at the Sahlgrenska University Hospital Women's Clinic.
He described the patients as tired, but doing fine. One had her uterus removed during surgery for cancer; the other was born without one.
"We are not going to call it a complete success until this results in children," surgeon Michael Olausson told The Associated Press. That won't be known for a while: Doctors will monitor the transplanted organs for a year before continuing in vitro fertilization.
There have been other uterus transplants: in 2000, a woman received a uterus from a live donor that was removed after three months due to a blood clot, and last year doctors in Turkey transplanted a womb from a deceased donor. The hope with familial transplants is that there's a lower chance of organ rejection. The emotional connection is also important, Olausson said.
Potential concerns for pregnancies in the transplanted wombs include how the immune-suppressing drugs that prevent organ rejection could affect a fetus, and how a uterus without all its original blood vessels may affect the chances of getting pregnant, doctors said.

http://www.eurekalert.org/pub_releases/2012-09/uop-pif092812.php

Penn immunologists find a molecule that puts the brakes on inflammation

A crucial signaling molecule involved in counterbalancing the immune system attack has been identified

PHILADELPHIA — We couldn't live without our immune systems, always tuned to detect and eradicate invading pathogens and particles. But sometimes the immune response goes overboard, triggering autoimmune diseases like lupus, asthma or inflammatory bowel disease.
A new study led by University of Pennsylvania researchers has now identified a crucial signaling molecule involved in counterbalancing the immune system attack.
"The immune response is like driving a car," said Christopher Hunter, professor and chair in the Department of Pathobiology in Penn's School of Veterinary Medicine. "You hit the accelerator and develop this response that's required to protect you from a pathogen, but, unless you have a brake to guide the response, then you'll just careen off the road and die because you can't control the speed of the response."
The research to characterize this immune system "brake" was led by Hunter and Aisling O'Hara Hall, a doctoral candidate in the Immunology Graduate Group. Additional Penn collaborators included scientists from the Penn Genome Frontiers Institute's Department of Biology and the Perelman School of Medicine's Department of Medicine. Researchers from Merck Research Laboratories, the National Institute of Allergy and Infectious

Disease, Harvard Medical School and Janssen Research and Development also contributed to the work, which was published in the journal Immunity.
"Healthy people have these cells — you have them, I have them — that are called Tregs," or regulatory T cells, Hunter said. "If you don't have them you develop spontaneous inflammation and disease."
Different forms of regulatory T cells operate as the brakes on various kinds of inflammation, but, until now, scientists hadn't been certain of how these Tregs became specialized to do their particular jobs.
Hall, Hunter and colleagues decided to follow up on a molecule called IL-27. Scientists used to think IL-27 played a role in causing inflammation, but, in 2005, a team of Penn researchers, including Hunter, found the opposite; it was actually involved in suppressing inflammation. Thus, when mice that lack IL-27 are challenged with the parasite Toxoplasma gondii, they develop overwhelming inflammation.
"We never worked out how it did that, but it was a paradigm change at the time," Hunter said.
In the new study, the researchers delved deeper into IL-27's role. They found that exposing regulatory T cells to IL-27 promoted their ability to suppress a particular type of inflammation. The Penn-led team also demonstrated that they could rescue infected IL-27-deficient mice by giving them a transfusion of regulatory T cells. This finding suggests that IL-27 is required to produce the Treg cells that normally keep inflammatory responses in check during infection.
"Very surprisingly, we were able to show that the Tregs could ameliorate the pathology in this system," Hall said. "We don't think this is the only mechanism by which IL-27 limits immune pathology, but it sheds light on one mechanism by which it could be functioning."
Further experiments showed that Tregs express a different suite of genes in the presence of IL-27 as compared to another molecule that has been implicated in this process, interferon gamma, or IFN-γ. The researchers' findings indicate that the two molecules have division of labor when it comes to suppressing inflammation: IL-27 seems to be important in helping control inflammation at the site of inflammation, whereas IFN-γ appears more significant in the peripheral tissues.
"At the site of inflammation, where you're getting your pathology, that's where IL- 27 is important," Hall said.
With a new understanding of how IL-27 may cause a class of Tregs to become specialized inflammation fighters, researchers have a new target for ameliorating the unwanted inflammation associated with all kinds of autoimmune conditions.
"Now we have a molecular signature that may be relevant in inflammatory bowel disease, in multiple sclerosis, in colitis and Crohn's disease, in rheumatoid arthritis, in lupus," Hunter said.
Next on tap, the team plans to study IL-27 in the context of asthma , lupus and arthritis.
In addition to Hall and Hunter, the authors included Beena John, Claudia González Lombana, Gretchen Harms Pritchard, Jonathan S. Silver, Jason S. Stumhofer, Tajie H. Harris, Elia D. Tait Wojno, Sagie Wagage and Philip Scott of Penn Vet's Department of Pathobiology; Daniel P. Beiting, David S. Roos and Sara Cheery of the Penn Genome Frontiers Institute Department of Biology; Steven Reiner, formerly of the Penn Department of Medicine; Cristina M. Tato and Daniel Cua of Merck Research Laboratories; Yasmine Belkaid, Guillaume Oldenhove, Nicolas Bouladoux and John Grainger of the National Institute of Allergy and Infectious Disease; Laurence A. Turka of Harvard Medical School; and M. Merle Elloso of Janssen Research and Development.
The study was supported by the Commonwealth of Pennsylvania and the National Institutes of Health.

http://www.eurekalert.org/pub_releases/2012-09/uori-usm092812.php

URI scientists: Marine plants can flee to avoid predators

First observation of predator avoidance behavior by phytoplankton

NARRAGANSETT, R.I. - Scientists at the University of Rhode Island's Graduate School of Oceanography have made the first observation of a predator avoidance behavior by a species of phytoplankton, a microscopic marine plant.
Susanne Menden-Deuer, associate professor of oceanography, and doctoral student Elizabeth Harvey made the unexpected observation while studying the interactions between phytoplankton and zooplankton.
Their discovery will be published in the September 28 issue of the journal PLOS ONE.
"It has been well observed that phytoplankton can control their movements in the water and move toward light and nutrients," Menden-Deuer said. "What hasn't been known is that they respond to predators by swimming away from them. We don't know of any other plants that do this."

While imaging 3-dimensional predator-prey interactions, the researchers noted that the phytoplankton Heterosigma akashiwo swam differently in the presence of predators, and groups of them shifted their distribution away from the predators.
In a series of laboratory experiments, Menden-Deuer and Harvey found that the phytoplankton not only flee when in the presence of the predatory zooplankton, but they also flee when in water that had previously contained the predators. They found only a minimal effect when the phytoplankton were exposed to predators that do not feed on phytoplankton.
"The phytoplankton can clearly sense the predator is there. They flee even from the chemical scent of the predator but are most agitated when sensing a feeding predator," said Menden-Deuer.
When the scientists provided the phytoplankton with a refuge to avoid the predator – an area of low salinity water that the predators cannot tolerate – the phytoplankton moved to the refuge.
The important question these observations raise, according to Menden-Deuer, is how these interactions affect the survival of the prey species.
Measuring survival in the same experiments, the researchers found that fleeing helps the alga survive. Given a chance, the predators will eat all of the phytoplankton in one day if the algae have no safe place in which to escape, but they double every 48 hours if they have a refuge available to flee from predators. Fleeing makes the difference between life and death for this species, said Menden-Deuer.
"One of the puzzling things about some phytoplankton blooms is that they suddenly appear," she said. "Growth and nutrient availability don't always explain the formation of blooms. Our observation of algal fleeing from predators is another mechanism for how blooms could form. Amazingly, looking at individual microscopic behaviors can help to explain a macroscopic phenomenon."
The researchers say there is no way of knowing how common this behavior is or how many other species of phytoplankton also flee from predators, since this is the first observation of such a behavior.
"If it is common among phytoplankton, then it would be a very important process," Menden-Deuer said. "I wouldn't be surprised if other species had that capacity. It would be very beneficial to them."
In future studies, she hopes to observe these behaviors in the ocean and couple it with genetic investigations.
Funding for this research was provided by the National Science Foundation, the National Oceanic and Atmospheric Administration, and the U.S. Department of Agriculture. The study was conducted, in part, at the URI Marine Life Science Facility, which is supported by the Rhode Island Experimental Program to Stimulate Competitive Research.

http://www.eurekalert.org/pub_releases/2012-09/uoc--rfm092812.php

Researchers find multiple similarities between cancer cells and induced pluripotent stem cells

Findings have important implications for helping scientists create safer stem cell therapies and may open door to new cancer therapies

SACRAMENTO, Calif.- UC Davis investigators have found new evidence that a promising type of stem cell now being considered for a variety of disease therapies is very similar to the type of cells that give rise to cancer. The findings suggest that although the cells -- known as induced pluripotent stem cells (iPSCs) -- show substantial promise as a source of replacement cells and tissues to treat injuries, disease and chronic conditions, scientists and physicians must move cautiously with any clinical use because iPSCs could also cause malignant cancer.
The article, "Induced pluripotency and oncogenic transformation are related processes," is now online in the journal, Stem Cells and Development.
"This is the first study that describes the specific molecular pathways that iPSCs and cancer cells share from a direct comparison" said Paul Knoepfler, associate professor of cell biology and human anatomy, and principal investigator of the study. "It means that much more study is required before iPSCs can be used clinically. However, our study adds to a growing knowledge base that not only will help make stem cell therapies safer, but also provide us with new understandings about the cancer-causing process and more effective ways to fight the disease."
Since 2007, cell biologists have been able to induce specialized, differentiated cells (such as those obtained from the skin or muscle of a human adult) to become iPSCs. Like embryonic stem cells, iPSCs are a type of stem cell that is able to become any cell type. This "pluripotent" capability means that iPSCs have the potential of being used in treatments for a variety of human diseases, a fundamentally new type of clinical care known as regenerative medicine.
iPSCs are considered particularly important because their production avoids the controversy that surrounds embryonic stem cells. In addition, iPSCs can be taken from a patient's own skin and induced to produce other

needed tissues, thereby evading the possibility of immunologic rejection that arises when transplanting cells from a donor to a recipient. In contrast to therapies based on ES cells, iPSCs would eliminate the need for patients to take immunosuppressive drugs.

Earlier research indicated that both ES cells and iPSCs pose some health risks. Increasing evidence suggests that pluripotency may be related to rapid cellular growth, a characteristic of cancer. iPSCs, as well as embryonic stem cells, are well known by scientists to have the propensity to cause teratomas, an unusual type of benign tumor that consists of many different cell types. The new UC Davis study demonstrates for the first time that iPSCs -- as well as ES cells -- share significant similarities to malignant cancer cells.

The investigators compared iPSCs to a form of malignant cancer known as oncogenic foci that are also produced in laboratories; these cell types are used by medical researchers to create models of cancer, particularly sarcoma. Specifically, the scientists contrasted the different cells' transcriptomes, comprised of the RNA molecules or "transcripts." Unlike DNA analysis, which reflects a cell's entire genetic code whether or not the genes are active, transcriptomes reflect only the genes that are actively expressed at a given time and therefore provide a picture of actual cellular activity.

From this transcriptome analysis, the investigators found that the iPSCs and malignant sarcoma cancer cells are unexpectedly similar in several respects. Genes that were not expressed in iPSCs were also not expressed in the cancer-generating cells, including many that have properties that guide a cell to normally differentiate in certain directions. Both cell types also exhibited evidence of similar metabolic activities, another indication that they are related cell types.

"We were surprised how similar iPSCS were to cancer-generating cells," said Knoepfler. "Our findings indicate that the search for therapeutic applications of iPSCs must proceed with considerable caution if we are to do our best to promote patient safety."

Knoepfler noted, for example, that future experimental therapies using iPSCs for human transplants would most often not involve implanting iPSCs directly into a patient. Instead, iPSCs would be used to create differentiated cells -- or tissues -- in the laboratory, which could then be transplanted into a patient. This approach avoids implanting the actual undifferentiated iPSCS, and reduces the risk of tumor development as a side effect. However, Knoepfler noted that even trace amounts of residual iPSCs could cause cancer in patients, a possibility supported by his team's latest research.

Encouragingly, the UC Davis team also found important differences between the cell types that could provide clues to making iPSCs safer. As part of this study, the researchers transformed tumor-generating cell types into iPS-like cells by manipulating their genetic make up. Although the reprogrammed cancer cells did not behave identically to iPSCs, and had reduced ability to produce different cell types, the findings are exciting because they suggest that cancer cells can be reprogrammed into more normal cell types, possibly opening the door to new cancer therapies.

"We found that we could reprogram the cancer cells to behave more akin to normal stem cells," said Knoepfler. "This suggests that such cancer cell reprogramming could become a new way of treating cancer patients, in essence telling their tumors to turn into normal stem cells."

Knoepfler said the team is continuing to study the differences and similarities between iPSCs and cancer cells, as well as investigate possible ways to make iPSCs safer. It appears that targeting specific metabolic pathways may enhance iPSC formation, while modulating other pathways may improve safety.

Other study authors are John Riggs, Bonnie Barrilleaux, Natalia Varlakhanova, Kelly Bush and Vanessa Chan, all of the UC Davis Department of Cell Biology and Human Anatomy.

The study was funded by grants from the California Institute for Regenerative Medicine and from the National Institutes of Health (NIH grant 5R01GM100782-01).