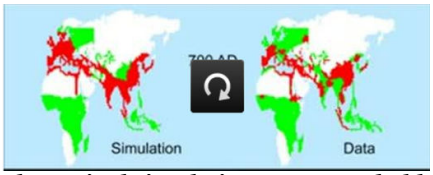
http://www.eurekalert.org/pub_releases/2013-09/nifm-meh091813.php

# Math explains history: Simulation accurately captures the evolution of ancient complex societies

***The question of how human societies evolve from small groups to the huge, anonymous and complex societies of today has been answered mathematically, accurately matching the historical record on the emergence of complex states in the ancient world.***

Intense warfare is the evolutionary driver of large complex societies, according to new research from a trans-disciplinary team at the University of Connecticut, the University of Exeter in England, and the National Institute for Mathematical and Biological Synthesis (NIMBioS). The study appears this week as an open-access article in the journal Proceedings of the National Academy of Sciences. The study's cultural evolutionary model predicts where and when the largest-scale complex societies arose in human history.




***The animation shows how the distributions of large-scale polities in the mathematical simulation are remarkably similar to the historical record for each time slice over the period 1,500 BCE to 1,500 CE.*** **Turchin P, Currie T, Turner E, Gavrilets S**

Simulated within a realistic landscape of the Afro-Eurasian landmass during 1,500 BCE to 1,500 CE, the mathematical model was tested against the historical record. During the time period, horse-related military innovations, such as chariots and cavalry, dominated warfare within Afro-Eurasia. Geography also mattered, as nomads living in the Eurasian Steppe influenced nearby agrarian societies, thereby spreading intense forms of offensive warfare out from the steppe belt.

The study focuses on the interaction of ecology and geography as well as the spread of military innovations and predicts that selection for ultra-social institutions that allow for cooperation in huge groups of genetically unrelated individuals and large-scale complex states, is greater where warfare is more intense.

While existing theories on why there is so much variation in the ability of different human populations to construct viable states are usually formulated verbally, by contrast, the authors' work leads to sharply defined quantitative predictions, which can be tested empirically.

The model-predicted spread of large-scale societies was very similar to the observed one; the model was able to explain two-thirds of the variation in determining the rise of large-scale societies.

"What's so exciting about this area of research is that instead of just telling stories or describing what occurred, we can now explain general historical patterns with quantitative accuracy. Explaining historical events helps us better understand the present, and ultimately may help us predict the future," said the study's co-author Sergey Gavrilets, NIMBioS director for scientific activities.

*Citation: Turchin P, Currie T, Turner E, Gavrilets S. 2013. War, space, and the evolution of Old World complex societies. PNAS.*

http://bit.ly/1eMsuGg

# Herpes virus cleared from blood for first time

***A COMMON virus that can reduce lifespan and cause blindness has been cleared from human blood for the first time.***

**23 September 2013 by Linda Geddes**

Cytomegalovirus (CMV), a type of herpes virus, is carried by about 70 per cent of people and, although it usually doesn't cause illness, shaves 3.7 years off life expectancy. In people with a weakened immune system, however, the virus awakens and can cause serious illness and blindness. This can be a particular problem if the only available donor for a bone marrow transplant is infected with CMV and the recipient is not.

CMV only expresses a handful of genes when it is dormant. One of them is UL138. To investigate what it does to cells, Michael Weekes at the University of Cambridge and colleagues grew healthy human cells alongside cells that were made to express UL138 in the presence of labelled amino acids – the raw ingredients used to make proteins. They then used mass spectrometry to identify how UL138 changed the cells' expression of proteins.

"We know that viruses remodel the landscape at the surface of the cell, so we've been asking 'what proteins are on the cell surface and how does CMV change that?'" says Paul Lehner, also at Cambridge, who supervised the work. CMV appears to dampen the production of a protein called MRP1 that pumps toxic chemicals out of cells – including the cancer drug vincristine. If infected cells can no longer pump out vincristine, perhaps this would kill them while sparing healthy cells that remove the poison?

To find out, the team took blood samples from 15 volunteers with CMV, treated the samples with vincristine and then reactivated the virus. "We either dramatically reduced or eliminated our ability to [detect] any virus,"

says Lehner, who presented the results at the Strategies for Engineered Negligible Senescence conference in Cambridge this month.
"It will be fascinating to see how this new method comes to be applied in clinical practice," says Paul Moss of the University of Birmingham, UK. Vincristine can have severe side effects, so is unlikely to be used to clear CMV in healthy people or transplant patients. However, it could be used to treat donor blood or stem cells from bone marrow before transplantation.

***http://www.eurekalert.org/pub_releases/2013-09/src-wha092313.php***

## Why humans are musical

***Why don't apes have musical talent, while humans, parrots, small birds, elephants, whales, and bats do?***

Matz Larsson, senior physician at the Lung Clinic at Örebro University Hospital, attempts to answer this question in the scientific publication Animal Cognition. In his article, he asserts that the ability to mimic and imitate things like music and speech is the result of the fact that synchronised group movement quite simply makes it possible to perceive sounds from the surroundings better.
The hypothesis is that the evolution of vocal learning, that is musical traits, is influenced by the need of a species to deal with the disturbing sounds that are created in connection with locomotion. These sounds can affect our hearing only when we move.
"When several people with legs of roughly the same length move together, we tend to unconsciously move in rhythm. When our footsteps occur simultaneously, a brief interval of silence occurs. In the middle of each stride we can hear our surroundings better. It becomes easier to hear a pursuer, and perhaps easier to conduct a conversation as well," explains Larsson.
Better chances for survival
However, apes up in the treetops move unpredictably and irregularly in the varied vegetation. Apes do not move in a particularly regular fashion on the ground either. When humans made the transition to walking on two legs, the sounds of their movements became significantly more predictable, making it possible for them to listen to nature better and thereby increase their chances of survival.
A behaviour that has survival value tends to produce dopamine, the "reward molecule". In dangerous terrain, this could result in the stimulation of rhythmic movements and enhanced listening to surrounding sounds in nature. If that kind of synchronized behaviour was rewarding in dangerous environments it may as well have been rewarding for the brain in relative safety, resulting in activities such as hand- clapping, foot-stamping and yelping around the campfire. From there it is just a short step to dance and rhythm. The hormone dopamine flows when we listen to music.
*The entire article is available at: Larsson, M. Self-generated sounds of locomotion and ventilation and the evolution of human rhythmic abilities.*
*Animal Cognition: http://link.springer.com/article/10.1007/s10071-011-0433-2*

***http://www.eurekalert.org/pub_releases/2013-09/uoc--dfa092313.php***

## Data from across globe defines distinct Kawasaki disease season

***Further evidence that long-range wind transport of an infectious agent might result in human disease***

After more than four decades of research, strong evidence now shows that Kawasaki disease has a distinct seasonal occurrence shared by regions across the Northern hemisphere.
The first global analysis of the seasonality of Kawasaki disease, published September 18 by PLOS ONE, was carried out using data obtained between 1970 and 2012. It included 296,203 cases from 39 locations in 25 countries around the globe, with 27 of those locations in the extra-tropical Northern hemisphere, eight in the tropics, and four in the extra-tropical Southern hemisphere.
Kawasaki disease (KD) is a severe childhood disease that many parents, even some doctors, mistake for an inconsequential viral infection. In fact, if not diagnosed or treated in time, it can lead to irreversible heart damage. Decades of research have been unable to pinpoint the cause of the disease, although genetic studies show a heritable tendency to acquiring the disease.
Findings of an international team of scientists - organized by Jane C. Burns, MD, professor of pediatrics and director of the Kawasaki Disease Research Center at the University of California, San Diego School of Medicine and Rady Children's Hospital-San Diego – now support earlier evidence that KD cases are linked to large-scale wind currents that track from Asia to Japan and also traverse the North Pacific.
The study found that 40 percent more cases of Kawasaki disease in the Northern hemisphere occurred from January through March than from August through September – coinciding with high and low intensities of tropospheric winds. Previous studies showed that when winds blew from the northwest across Japan in a southeasterly direction, the number of KD cases there increased. At the conclusion of the epidemics, the wind

had reversed direction and commenced blowing across Japan from the Pacific Ocean in a northwesterly direction. This same pattern was repeated from year to year.
The passage of these large-scale wind patterns across the Pacific was similarly associated with an increase in KD cases in San Diego, California.
This study built and expanded upon earlier research investigating a possible influence from large-scale environmental factors, (published by this scientific team in a November 2011 study in Nature Scientific Reports) by a team of researchers that also included two contributors to this study: Daniel R. Cayan, Climate Atmospheric Science and Physical Oceanography (CASPO) at Scripps Institution of Oceanography in La Jolla, and Xavier Rodó of the Institut Català de Ciències del Clima and the Institució Catalana de Recerca (IC3) in Barcelona, Spain.
"Our data suggest a seasonal exposure to a KD agent that operates over large geographic regions and is concentrated during winter months in non-tropical regions of the Northern hemisphere," Burns said.
Datasets were much sparser in the tropics and the Southern hemisphere, but showed a maximum incidence in May through June, with approximately 30 percent of the cases occurring in that time period; however, the pattern was not considered statistically significant.
"During winter months, there are stronger seasonal winds across the Northern hemisphere, which could lead to increased transport of the suspected KD agent," said Burns. "This may explain, in part, the consistency in the seasonal nature of Kawasaki disease that we observe in our pediatric patients."
While there is no diagnostic test, signs of KD include prolonged fever associated with rash, red eyes, mouth, lips and tongue, and swollen hands and feet with peeling skin. The disease causes damage to the coronary arteries in a quarter of untreated children and may lead to serious heart problems in early adulthood. The aneurysm rate for Kawasaki disease is 5 percent, and the death rate is 0.1 percent.
While seasonality of the disease has been noted in many regions – particularly in Japan, the country of highest incidence for KD – the search for factors that might contribute to epidemics and fluctuations in KD occurrence has been elusive. A study of KD cases in Japan since 1970 showed three dramatic nationwide epidemics, each lasting several months and peaking in April 1979 (6,700 cases), May 1982 (16,100 cases) and March 1986 (14,700 cases). These three peaks represent the largest KD epidemic events ever recorded in the world.
Previous epidemiological investigations suggest that the causative agent for KD is widely distributed in the environment, that there is no person-to-person transmission and that genetic susceptibility plays a part in at least some of the disease variation across different ethnic and racial groups. Japan continues to be the country of highest incidence, but seasonality of the disease has been documented in Hawaii and San Diego as well.
The scientists report that this recent comprehensive analysis to detect seasonal cycles of KD cases from around the world could be significant in efforts to isolate the cause of this devastating childhood disease.
*Additional contributors to the study include Lauren Herzog, BS, Olivia Fabri, and Adriana H. Tremoulet, MD, MAS, UC San Diego and Rady Children's Hospital-San Diego; Ritei Uehara MD, PhD, Jichi Medical School, Tochigi, Japan; David Burgner, MD, PhD, Murdoch Children's Research Institute, The Royal Children's Hospital, Parkville, Victoria, Australia; Emelia Bainto, BS, David Pierce PhD, and Mary Tyree, MS, Scripps Institution of Oceanography, UC San Diego.*
*This work was supported in part by grants from the National Institutes of Health, National Heart, Lung, Blood Institute (HL69413 and iDASH U54-HL108460); by La Marató de TV3 Foundation ('Malaties cardiovasculars 2007') and by the National Oceanographic and Atmospheric Administration Regional Integrated Sciences and Assessments through the California Nevada Applications Program, through the National Oceanographic and Atmospheric Administration Regional Integrated Science Assessments program.*

***http://phys.org/news/2013-09-minimal-amount-debris-japan-tsunami.html***

## Minimal amount of debris from Japan's tsunami has washed ashore in California

***Not long after a massive earthquake and tsunami devastated Japan in 2011, washing whole towns out to sea, concerns grew that huge amounts of debris could wash up on California's coast.***

But as an estimated 70,000 Californians prepare to participate Saturday in the state's annual coastal cleanup, the question remains: Where is it?
Very little tsunami trash has reached California, or other Pacific coastal states, even though the disaster happened 2 { years ago.
Federal officials have confirmed only 35 objects from the tsunami that have come ashore in the United States and British Columbia, ranging from two large chunks of docks that washed up in Oregon and Washington state last year to a soccer ball found off an Alaskan island and traced back to a Japanese schoolboy.
The only verified tsunami object found in California was a barnacle-encrusted fishing boat that hit the beach in April south of Crescent City, near the Oregon border. Through hand-painted characters on its side, the boat was traced to Takata High School in Rikuzentakata, a Japanese town devastated by the tsunami. The boat is scheduled to head back to Japan later this month courtesy of a large shipping company.

And the rest of the floating debris?
"It's possible that a great deal of it sank or broke up," said Dianna Parker, a spokeswoman for the National Oceanic and Atmospheric Administration. "Marine debris can become waterlogged and sink or be damaged by storms and wave action," she said. "It's also possible that we've seen the majority of it wash ashore that we're going to get. If more continues to wash ashore, we're prepared."
The magnitude 9.0 Tohoku earthquake in March 2011 was the largest recorded in Japanese history. It killed 15,833 people, destroyed 129,000 buildings and triggered a meltdown at the Fukushima nuclear plant.
Afterward, the Japanese Ministry of the Environment estimated that 5 million tons of debris - everything from smashed homes to drums of chemicals to tires to millions of plastic toys, bottles and pieces of furniture - ended up in the ocean, but that 70 percent of it sank in the first few weeks.
Scientists say the debris is not radioactive, because it washed out to sea before the nuclear power plant melted down. Satellites were able to track the debris for the first month, but then much of it scattered.
Six months after the tsunami, a Russian ship reported finding a TV set, refrigerator and other floating Japanese debris off Midway. Lumber, Styrofoam and other debris also came ashore in Hawaii and Alaska in the past year.
In California, more than 100 pieces of trash with Japanese writing have been found on beaches this year. But it's impossible to say whether they came from the tsunami.
The National Oceanic and Atmospheric Administration requires serial numbers, writing or other identification to confirm with Japanese Consulate officials that objects definitely came from the disaster.
"Especially on the north coast, up near the Oregon border, we are getting reports of odd stuff," said Eben Schwartz, marine debris manager with the California Coastal Commission. "It's hard to say it is definitely from the tsunami, but we are getting unusual things happening."
Volunteers who are looking for debris as part of a $50,000 NOAA grant to each Pacific Coast state have found a chopping board and crab packing crate with Japanese writing in Pacifica, a milk crate and bottle caps with Japanese writing in Mendocino County, and a pile of lumber near the Oregon border with joinery commonly used in Japanese homes. But nobody knows where the rest is or if it could still wash ashore.
Computer models produced by NOAA scientists based on winds and currents show that the largest concentration of debris could still be floating in the ocean between Hawaii and Alaska, about 750 miles off California.
Nikolai Maximenko, a scientist at the University of Hawaii who has developed computer models of the possible paths of the debris, said much of it may be trapped for years in the North Pacific Gyre, a vast area north of Hawaii also known as the Great Pacific Garbage Patch, where currents converge to trap floating plastic and other refuse.
Because of wind patterns that blow down the California coast, pushing the water westward and causing upwelling in the ocean, much of the debris may never hit California, he said, although more could come ashore in Oregon, Washington, Alaska and Hawaii, particularly during storms. Every object also behaves differently in the currents and winds, he said, and the North Pacific Ocean is vast - 5,100 miles from Tokyo to San Francisco.
"We probably are not going to see a large amount of large objects washing up anymore," he said. "But it's very complicated. We don't have enough observations."
As for Saturday's coastal cleanup, 55 of California's 58 counties are participating, with inland areas holding cleanups on streams, lakes and rivers. Last year, 65,544 volunteers collected 769,000 pounds of trash and recyclables in California. "It doesn't matter where you live, everything flows to the ocean," Schwartz said. "If we can clean up this state, we have a good chance of keeping the ocean clean and healthy."

***http://sfari.org/news-and-opinion/news/2013/autism-genes-are-surprisingly-large-study-finds***

## Autism genes are surprisingly large, study finds

***Longer Than Previously Thought: Researchers have discovered something surprising about autism genes:***

**Virginia Hughes**

They're three to four times longer than the average gene expressed in neurons. Image: Alfred Hermida/Flickr
Enzymes called topoisomerases are crucial for the expression of extremely long genes in neurons, according to a study published 5 September in *Nature*[1]. More than one-quarter of these genes are known autism candidates, the study found.
In the process of doing these analyses, the researchers stumbled on something surprising about autism genes in general: They're three to four times longer than the average gene expressed in neurons.
"It's pretty remarkable that, at least to my knowledge, no one had noticed this before," notes Benjamin Philpot, associate professor of cell biology and physiology at the University of North Carolina, Chapel Hill, and one of the study's leaders. "But the genes are definitely much longer. It's very striking."

The findings suggest that defects in topoisomerases — whether caused by genetic mutations or environmental influences — may contribute to some cases of autism and other developmental disorders, the researchers say.
If it's true that long genes are preferentially affected in autism, "the implications are really quite fascinating," notes James Sutcliffe, associate professor of molecular physiology and biophysics at Vanderbilt University in Nashville, Tennessee, who was not involved in the research.
In genetic sequencing studies, for example, mutations found in long genes tend to be discounted in statistical analyses. That's because the longer a gene is, the more likely it is to harbor a mutation just by chance. But the new study suggests that mutations in long genes should be considered more carefully.
"This raises a really interesting question of whether we may be correcting away something that's inherent to disease risk," Sutcliffe says.

**Transcription targets:**

Topoisomerases are found in all cells and are known to play a role in unraveling knots in DNA.
"When a cell divides, the DNA gets tangled up, and these enzymes cut the DNA to unwind it," says Mark Zylka, associate professor of cell biology and physiology at the University of North Carolina, Chapel Hill, who led the new study along with Philpot.
Drugs that inhibit these enzymes gum up that process, preventing DNA replication and, as a result, cell division. Because of this, these drugs have been used to treat cancer for four decades.
In late 2011, Zylka and Philpot reported in *Nature* that in spinal cord neurons, a topoisomerase inhibitor called topotecan activates the normally silent copy of UBE3A, the gene that is damaged in Angelman syndrome, a developmental disorder related to autism. Duplications of UBE3A are also thought to cause some cases of autism.
It was a shock to find out that topotecan had this affect in neurons, Zylka says, because neurons don't divide. "So we wanted to figure out what the heck these enzymes were doing there."
Some studies had shown that, in addition to their role in untangling DNA, topoisomerases are involved in transcribing DNA into RNA sequences[2]. Following that lead, the researchers exposed cultured mouse and human neurons to topotecan and then measured changes in expression across the genome.
Topoisomerase inhibitors turn up the expression of 28 genes and dial down the expression of 155 genes, the study found. All of the dampened genes are large, at least 67 kilobases (kb).
"As you get bigger and bigger, the odds are greater that the gene's expression goes down," Zylka says. "Around 200 kb or longer, the drugs inhibit like 90 percent of those genes."
The results suggest that topoisomerases are important for the expression of extremely long genes.
The paper showcases "some really, really beautiful cell biology," says Brett Abrahams, assistant professor of genetics at the Albert Einstein College of Medicine in New York, who was not involved in the study. "It's less clear to me what to make of the potential autism link."

**Autism lists:**

The researchers noticed that many of the genes regulated by topoisomerases are involved in the function of synapses, the junctions between neurons, and also in autism. They cross-referenced their list with autism candidate genes catalogued by various sequencing studies and by SFARI Gene, a comprehensive database of genes linked to autism. (SFARI Gene is funded by the Simons Foundation, SFARI.org's parent organization.)
They found that 49 of the 183 genes affected by topoisomerases - 27 percent - had previously been linked to autism, a proportion much higher than would be seen by chance.
While this work was underway, two other studies appeared showing that a few individuals with autism carry mutations in topisomerase genes[3, 4]. This month, two studies in *Nature Neuroscience* linked TOP3B - a topoisomerase that influences RNA - with schizophrenia, cognitive impairment and fragile X syndrome[5, 6].
The researchers also found that the autism candidate genes on their list are 217 kb on average, compared with 59 kb for a typical gene expressed in neurons of the cortex.
Abrahams notes, however, that a lot of the genes on the list have been only weakly linked to autism. What's more, he says, it's unclear whether the long-gene effect is specific to autism.
"What about cancer genes? What about diabetes genes? What about genes involved in sleep regulation?" Abrahams asks. "If you were to take any of these other lists, would they also show enrichment for long genes?"
Nobody knows why autism genes might be so long. Zylka speculates that it might be because of mechanisms involved in replicating DNA. In dividing cells, he says, there is a selective pressure against long genes because the enzymes involved in making RNA and copying DNA can crash into each other.
Neurons don't divide, however. "We think that evolutionarily, neurons can express these really big genes because there aren't as many detrimental effects," he says.

In ongoing experiments, Zylka and Philpot are investigating drugs that, like topoisomerase inhibitors, have the ability to disrupt the enzymes and, in turn, upset a host of autism genes. "That's something we're really, really interested in - environmental influences," Philpot says. So far, he and Zylka have found at least one compound that has effects on long genes similar to those of topoisomerase inhibitors. "We have some exciting data."

***News and Opinion articles on SFARI.org are editorially independent of the Simons Foundation.***

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## Vitamin D alone does little to protect bone health in postmenopausal women

***Calcium or combination supplement reduces bone turnover, osteoporosis risk***

Chevy Chase, MD—While calcium supplements noticeably improved bone health in postmenopausal women, vitamin D supplements did not reduce bone turnover, according to a recent study accepted for publication in The Endocrine Society's Journal of Clinical Endocrinology & Metabolism (JCEM).

Bone turnover is the body's natural process for breaking down old bone. In young people, the body forms enough new bone to replace what is lost. After age 30, however, bone mass in women begins to decline and the process speeds up after menopause. Osteoporosis develops when the body cannot replace bone as fast as it is broken down.

"Vitamin D and calcium interact to suppress bone turnover by decreasing parathyroid hormone levels," said the study's lead author, John Aloia, MD, of Winthrop University Hospital in Mineola, NY. "This can be beneficial in women who are vitamin D deficient. In women who already are receiving the recommended daily allowance of vitamin D, however, the study found there was no advantage to adding a vitamin D supplement."

The double-blind, placebo-controlled, parallel group, longitudinal factorial design study divided 159 postmenopausal women into four groups. One group received a combination of vitamin D and calcium, one was given 1,200 milligrams of calcium daily, one took 4,000 IU of vitamin D daily and the last group received placebos. To measure the effect supplements had on bone health, researchers measured bone turnover markers, such as parathyroid hormone levels in the blood, over the course of six months. In all, 120 women completed the study.

Researchers found a significant decline in bone turnover markers among women who were given daily calcium supplements. The vitamin D supplements did not have any effect on bone turnover markers, although the supplements did decrease parathyroid hormone levels.

"These findings suggest that vitamin D supplements over the recommended dietary allowance (RDA) do not protect bone health, whereas calcium supplements do have an effect," Aloia said. "Women do need to be cautious about the possibility of vascular side effects from too much calcium and should consult their physicians about whether their diet is adequate or whether they should take supplements at all."

*Other researchers working on the study include: R. Dhaliwal, A. Shieh, M. Mikhail, S. Islam and J. Yeh of Winthrop University Hospital.*

*The article, "Calcium and Vitamin D Supplementation in Postmenopausal Women," was published online, ahead of print.*

***http://www.bbc.co.uk/news/health-24202591#sa-ns_mchannel=rss&ns_source=PublicRSS20-sa***

## 'Afternoon naps' aid children's learning

***Getting young children to take an hour-long nap after lunch could help them with their learning by boosting brain power, a small study suggests.***

A nap appeared to help three-to-five-year-olds better remember pre-school lessons, US researchers said.

University of Massachusetts Amherst researchers studied 40 youngsters and report their findings in Proceedings of the National Academy of Sciences. The benefit persisted in the afternoon after a nap and into the next day.

The study authors say their results suggest naps are critical for memory consolidation and early learning.

When the children were allowed a siesta after lunch they performed significantly better on a visual-spatial tasks in the afternoon and the next day than when they were denied a midday snooze.

Following a nap, children recalled 10% more of the information they were being tested on than they did when they had been kept awake. Close monitoring of 14 additional youngsters who came to the researchers' sleep lab revealed the processes at work in the brain during asleep.

As the children napped, they experienced increased activity in brain regions linked with learning and integrating new information.

**Memory aid**

Lead investigator Rebecca Spencer said: "Essentially we are the first to report evidence that naps are important for preschool children. "Our study shows that naps help the kids better remember what they are learning in preschool." She said while older children would naturally drop their daytime sleep, younger children should be encouraged to nap.

Dr Robert Scott-Jupp, of the Royal College of Paediatrics and Child Health, said: "It's been known for years that having a short sleep can improve the mental performance of adults, for example doctors working night shifts. Up until now, no-one has looked at the same thing in toddlers. This is important, because pre-school nurseries are divided on whether they should allow their children a nap.

"Toddlers soak up a huge amount of information everyday as they become increasingly inquisitive about the world around them and begin to gain independence.

"To be at their most alert toddlers need about 11-13 hours of sleep a day, giving their active minds a chance to wind down and re-charge, ready for the day ahead. We now know that a daytime sleep could be as important as a nighttime one. Without it, they would be tired, grumpy, forgetful and would struggle to concentrate."

***http://www.eurekalert.org/pub_releases/2013-09/f-anb092313.php***

## A neurological basis for the lack of empathy in psychopaths

***When individuals with psychopathy imagine others in pain, brain areas necessary for feeling empathy and concern for others fail to become active and be connected to other important regions involved in affective processing and decision-making, reports a study published in the open-access journal Frontiers in Human Neuroscience.***

Psychopathy is a personality disorder characterized by a lack of empathy and remorse, shallow affect, glibness, manipulation and callousness. Previous research indicates that the rate of psychopathy in prisons is around 23%, greater than the average population which is around 1%.

To better understand the neurological basis of empathy dysfunction in psychopaths, neuroscientists used functional magnetic resonance imaging (fMRI) on the brains of 121 inmates of a medium-security prison in the USA.

Participants were shown visual scenarios illustrating physical pain, such as a finger caught between a door, or a toe caught under a heavy object. They were by turns invited to imagine that this accident happened to themselves, or somebody else. They were also shown control images that did not depict any painful situation, for example a hand on a doorknob.

Participants were assessed with the widely used PCL-R, a diagnostic tool to identify their degree of psychopathic tendencies. Based on this assessment, the participants were then divided in three groups of approximately 40 individuals each: highly, moderately, and weakly psychopathic.

When highly psychopathic participants imagined pain to themselves, they showed a typical neural response within the brain regions involved in empathy for pain, including the anterior insula, the anterior midcingulate cortex, somatosensory cortex, and the right amygdala. The increase in brain activity in these regions was unusually pronounced, suggesting that psychopathic people are sensitive to the thought of pain.

But when participants imagined pain to others, these regions failed to become active in high psychopaths. Moreover, psychopaths showed an increased response in the ventral striatum, an area known to be involved in pleasure, when imagining others in pain.

This atypical activation combined with a negative functional connectivity between the insula and the ventromedial prefrontal cortex may suggest that individuals with high scores on psychopathy actually enjoyed imagining pain inflicted on others and did not care for them. The ventromedial prefrontal cortex is a region that plays a critical role in empathetic decision-making, such as caring for the wellbeing of others.

Taken together, this atypical pattern of activation and effective connectivity associated with perspective taking manipulations may inform intervention programs in a domain where therapeutic pessimism is more the rule than the exception.

Altered connectivity may constitute novel targets for intervention. Imagining oneself in pain or in distress may trigger a stronger affective reaction than imagining what another person would feel, and this could be used with some psychopaths in cognitive-behavior therapies as a kick-starting technique, write the authors.

http://94.236.98.240/human_neuroscience/10.3389/fnhum.2013.00489/abstract

Article title: *An fMRI study of affective perspective taking in individuals with psychopathy: imagining another in pain does not evoke empathy* **Journal:** Frontiers in Human Neuroscience DOI: 10.3389/fnhum.2013.00489

List of authors: Jean Decety, Chenyi Chen, Carla Harenski and Kent A. Kiehl.

http://www.eurekalert.org/pub_releases/2013-09/uops-nss092413.php

# New study shows how ICU ventilation may trigger mental decline

***Researchers from Penn Medicine and University of Oviedo identify molecular pathway linking ICU ventilation to brain damage***

PHILADELPHIA - At least 30 percent of patients in intensive care units (ICUs) suffer some form of mental dysfunction as reflected in anxiety, depression, and especially delirium. In mechanically-ventilated ICU patients, the incidence of delirium is particularly high, about 80 percent, and may be due in part to damage in the hippocampus, though how ventilation is increasing the risk of damage and mental impairment has remained elusive.

Now, a new study published in the American Journal of Respiratory and Critical Care Medicine from researchers at the University of Oviedo in Spain, St. Michael's Hospital in Toronto, Canada, and the Perelman School of Medicine at the University of Pennsylvania found a molecular mechanism that may explain the connection between mechanical ventilation and hippocampal damage in ICU patients.

The investigators, including Adrian González-López, PhD, in the laboratory of Guillermo M. Albaiceta, MD, PhD at the University of Oviedo , and co-authored by Konrad Talbot, PhD, an assistant research professor in Neurobiology in the Department of Psychiatry at Penn Medicine, began by studying the hippocampus in control mice and in mice on low or high-pressure mechanical ventilation for 90 minutes. Compared to the controls, those on either low- or high-pressure ventilation showed evidence of neuronal cell death in the hippocampus, as a result of a cell suicide program called apoptosis.

Searching for the molecular cause of the ventilation-induced apoptosis, the team discovered that a well-known apoptosis trigger had been set off in the hippocampus of the ventilated animals. That trigger is dopamine-induced suppression of a molecule known as Akt, which normally acts to prevent neuronal apoptosis. Akt suppression was clearly evident in the hippocampus of the ventilated mice and was associated with a hyperdopaminergic state (increased levels of dopamine) in that brain area. The ventilated mice had elevated gene expression of the enzyme tyrosine hydroxylase, which is critical in synthesizing dopamine. The resulting rise in dopamine increases the strength of dopamine receptor activation in the hippocampus.

The investigators hypothesized that ventilation-induced apoptosis in the hippocampus was at least partly mediated by elevated activation of dopamine receptors in that brain area. This was confirmed by showing that pretreatment of mice with type 2 (D2) dopamine receptor blockers injected into the ventricles of the brain significantly reduced ventilation-induced apoptosis in the hippocampus.

How mechanical ventilation manages to affect the hippocampus was answered by experiments on mice in which the vagus cranial nerve connecting the lungs with the brain was severed. In these mice, mechanical ventilation had virtually no effect on levels of the dopamine-synthesizing enzyme or on apoptosis in the hippocampus.

The investigators then studied the consequences of ventilation and elevated hippocampal dopamine on dysbindin-1, a protein known to affect levels of cell surface D2 dopamine receptors, cognition, and possibly the risk of psychosis. High-pressure ventilation in mice caused an increase in gene expression of dysbindin-1C, and later, in protein levels of dysbindin-1C. Dopamine alone had similar effects on dysbindin-1C in hippocampal slice preparations, effects that were inhibited by D2 receptor blockers.

Since dysbindin-1 can lower cell-surface D2 receptors and protect against apoptosis, the authors speculate that increased dysbindin-1C expression in the ventilated mice may reflect compensatory responses to ventilation-induced hippocampal apoptosis. That possibility applies to ICU cases given the additional finding by the authors that total dysbindin-1 was increased in hippocampal neurons of ventilated compared to non-ventilated humans who died in the ICU.

The findings could lead to new therapeutic uses of established drugs and targets for new drugs that activate a molecular pathway mediating adverse effects of ICU ventilation on brain function.

"The results prove the existence of a pathogenic mechanism of lung stretch-induced hippocampal apoptosis that could explain the development of neurobehavioral disorders in patients exposed to mechanical ventilation," the authors write. One of the coauthors, Dr. Talbot, adds: "The study indicates the need to reevaluate use of D2 receptor antagonists in minimizing the negative cognitive effects of mechanical ventilation in ICU patients and to evaluate the novel possibility that elevation in dysbindin-1C expression can also reduce those effects."

The corresponding author, Dr. Albaiceta, offered a look at future research on this topic: "Now that we have established the mouse model, we are mainly looking for therapeutic approaches aimed at avoiding the vagal activation caused by mechanical ventilation and therefore prevent the deleterious effects observed in the hippocampus," he said. "We are also interested in studying the relationship between the different described

gene polymorphisms of dysbindin, Akt, and type 2 dopamine receptor versus the incidence of neurological disorders in patients on ventilation in ICUs. This could help us to identify susceptible individuals to in which a preventive treatment could be effective."

*This work was supported with grants from the Instituto de Salud Carlos III, the Fundación para el Fomento en Asturias de la Investigación Científica Aplicada y la Tecnología, and the University of Oviedo.*

***http://phys.org/news/2013-09-genetic-timeline-significant-human-population.html***

## Genetic study pushes back timeline for first significant human population expansion

***Using new genetic tools reveal that the first significant expansion of human populations appears to be much older than the emergence of farming and herding***

Using new genetic tools, the authors conclude that the first significant expansion of human populations appears to be much older than the emergence of farming and herding, dating back to the Paleolithic (60,000-80,000 years ago) rather than Neolithic age (10,000 years ago). They also suggest that strong Paleolithic expansions may have favored the emergence of sedentary farming in some populations during the Neolithic.

About 10,000 years ago, the Neolithic age ushered in one of the most dramatic periods of human cultural and technological transition, where independently, different world populations developed the domestication of plants and animals. The hunter-gatherers gave rise to herders and farmers. Changes to a more sedentary lifestyle and larger settlements are widely thought to have contributed to a worldwide human population explosion, from an estimated 4-6 million people to 60-70 million by 4,000 B.C.

Now, researchers Aimé, et al., have challenged this assumption using a large set of populations from diverse geographical regions (20 different genomic regions and mitochondrial DNA of individuals from 66 African and Eurasian populations), and compared their genetic results with archaeological findings. The dispersal and expansion of Neolithic culture from the Middle East has recently been associated with the distribution of human genetic markers.

They conclude that the first significant expansion of human populations appears to be much older than the emergence of farming and herding, dating back to the Paleolithic (60,000-80,000 years ago) rather than Neolithic age. Therefore, hunter-gatherer populations were able to thrive with cultural and social advances that allowed for the expansion. The authors also speculate that this Paleolithic human population expansion may be linked to the emergence of newer, more advanced hunting technologies or a rapid environmental change to dryer climates.

Finally, they also suggest that strong Paleolithic expansions may have favored the emergence of sedentary farming in some populations during the Neolithic. Indeed, the authors also demonstrate that the populations who adopted a sedentary farming lifestyle during the Neolithic had previously experienced the strongest Paleolithic expansions. Conversely, contemporary nomadic herder populations in Eurasia experienced moderate Paleolithic expansions, and no expansions were detected for nomadic hunter-gatherers in Africa. "Human populations could have started to increase in Paleolithic times, and strong Paleolithic expansions in some populations may have ultimately favored their shift toward agriculture during the Neolithic," said Aimé.

***http://www.sciencedaily.com/releases/2013/09/130924113147.htm***

## Fusion, Anyone? Not Quite Yet, but Scientists Show Just How Close We've Come

***The dream of igniting a self-sustained fusion reaction with high yields of energy, a feat likened to creating a miniature star on Earth, is getting closer to becoming reality, according the authors of a new review article in the journal Physics of Plasmas.***

Researchers at the National Ignition Facility (NIF) engaged in a collaborative project led by the Department of Energy's Lawrence Livermore National Laboratory, report that while there is at least one significant obstacle to overcome before achieving the highly stable, precisely directed implosion required for ignition, they have met many of the demanding challenges leading up to that goal since experiments began in 2010.

The project is a multi-institutional effort including partners from the University of Rochester's Laboratory for Laser Energetics, General Atomics, Los Alamos National Laboratory, Sandia National Laboratory, and the Massachusetts Institute of Technology.

To reach ignition (defined as the point at which the fusion reaction produces more energy than is needed to initiate it), the NIF focuses 192 laser beams simultaneously in billionth-of-a-second pulses inside a cryogenically cooled hohlraum (from the German word for "hollow room"), a hollow cylinder the size of a pencil eraser. Within the hohlraum is a ball-bearing-size capsule containing two hydrogen isotopes, deuterium and tritium (D-T). The unified lasers deliver 1.8 megajoules of energy and 500 terawatts of power -- 1,000 times more than the United States uses at any one moment -- to the hohlraum creating an "X-ray oven" which implodes the D-T capsule to temperatures and pressures similar to those found at the center of the sun.

"What we want to do is use the X-rays to blast away the outer layer of the capsule in a very controlled manner, so that the D-T pellet is compressed to just the right conditions to initiate the fusion reaction," explained John Edwards, NIF associate director for inertial confinement fusion and high-energy-density science. "In our new review article, we report that the NIF has met many of the requirements believed necessary to achieve ignition -- sufficient X-ray intensity in the hohlraum, accurate energy delivery to the target and desired levels of compression -- but that at least one major hurdle remains to be overcome, the premature breaking apart of the capsule."

In the article, Edwards and his colleagues discuss how they are using diagnostic tools developed at NIF to determine likely causes for the problem. "In some ignition tests, we measured the scattering of neutrons released and found different strength signals at different spots around the D-T capsule," Edwards said. "This indicates that the shell's surface is not uniformly smooth and that in some places, it's thinner and weaker than in others. In other tests, the spectrum of X-rays emitted indicated that the D-T fuel and capsule were mixing too much -- the results of hydrodynamic instability -- and that can quench the ignition process."

Edwards said that the team is concentrating its efforts on NIF to define the exact nature of the instability and use the knowledge gained to design an improved, sturdier capsule. Achieving that milestone, he said, should clear the path for further advances toward laboratory ignition.

M. J. Edwards, P. K. Patel, J. D. Lindl, L. J. Atherton, S. H. Glenzer, S. W. Haan, J. D. Kilkenny, O. L. Landen, E. I. Moses, A. Nikroo, R. Petrasso, T. C. Sangster, P. T. Springer, S. Batha, R. Benedetti, L. Bernstein, R. Betti, D. L. Bleuel, T. R. Boehly, D. K. Bradley, J. A. Caggiano, D. A. Callahan, P. M. Celliers, C. J. Cerjan, K. C. Chen, D. S. Clark, G. W. Collins, E. L. Dewald, L. Divol, S. Dixit, T. Doeppner, D. H. Edgell, J. E. Fair, M. Farrell, R. J. Fortner, J. Frenje, M. G. Gatu Johnson, E. Giraldez, V. Yu. Glebov, G. Grim, B. A. Hammel, A. V. Hamza, D. R. Harding, S. P. Hatchett, N. Hein, H. W. Herrmann, D. Hicks, D. E. Hinkel, M. Hoppe, W. W. Hsing, N. Izumi, B. Jacoby, O. S. Jones, D. Kalantar, R. Kauffman, J. L. Kline, J. P. Knauer, J. A. Koch, B. J. Kozioziemski, G. Kyrala, K. N. LaFortune, S. Le Pape, R. J. Leeper, R. Lerche, T. Ma, B. J. MacGowan, A. J. MacKinnon, A. Macphee, E. R. Mapoles, M. M. Marinak, M. Mauldin, P. W. McKenty, M. Meezan, P. A. Michel, J. Milovich, J. D. Moody, M. Moran, D. H. Munro, C. L. Olson, K. Opachich, A. E. Pak, T. Parham, H.-S. Park, J. E. Ralph, S. P. Regan, B. Remington, H. Rinderknecht, H. F. Robey, M. Rosen, S. Ross, J. D. Salmonson, J. Sater, D. H. Schneider, F. H. Séguin, S. M. Sepke, D. A. Shaughnessy, V. A. Smalyuk, B. K. Spears, C. Stoeckl, W. Stoeffl, L. Suter, C. A. Thomas, R. Tommasini, R. P. Town, S. V. Weber, P. J. Wegner, K. Widman, M. Wilke, D. C. Wilson, C. B. Yeamans, A. Zylstra. *Progress towards ignition on the National Ignition Facility. Physics of Plasmas, 2013; 20 (7): 070501 DOI: 10.1063/1.4816115*

***http://www.eurekalert.org/pub_releases/2013-09/uog-mhc092513.php***

## Melatonin helps control weight gain as it stimulates the appearance of 'beige fat'

***Melatonin is a natural hormone segregated by the body and melatonin levels generally increase in the dark at night.***

It is also found in fruit and vegetables like mustard, Goji berries, almonds, sunflower seeds, cardamom, fennel, coriander and cherries.

Spanish scientists have discovered that melatonin consumption helps control weight gain because it stimulates the appearance of 'beige fat', a type of fat cell that burns calories in vivo instead of storing them. White adipose tissue stores calories leading to weight gain whereas 'beige fat' (also known as 'good or thinning fat') helps regulate body weight control, hence its metabolic benefits.

In the Journal of Pineal Research, scientists from the University of Granada Institute for Neuroscience, the Hospital Carlos III, Madrid, and the University of Texas Health Science Center in San Antonio (USA) have revealed, for the first time, the previously unknown enigma of why melatonin has metabolic benefits in treating diabetes and hyperlipidemia.

In earlier publications, the researchers analysed the effects of melatonin on obesity, dyslipidemia, high blood pressure and type 2 diabetes mellitus associated with obesity in young obese diabetic Zucker rats—an experimental model of metabolic syndrome.

In view of their most recent results, it seems the key lies in the fact that chronic melatonin consumption not only induces the appearance of 'beige fat' in obese diabetic rats, but also increases its presence in thin animals used as a control group. 'Beige fat' cells are found in scattered lentil-sized deposits beneath the inguinal skin in obese diabetic Zucker rats.

Melatonin is a natural hormone segregated by the human body itself and melatonin levels generally increase in the dark at night. It is also found in small quantities in fruit and vegetables like mustard, Goji berries, almonds, sunflower seeds, cardamom, fennel, coriander and cherries. These findings, together with the pharmacologically safe profile of melatonin, mean it is a potentially useful tool both in its own right and to complement the treatment of obesity. Sleeping in the dark and consuming these foodstuffs could help control weight gain and prevent cardiovascular diseases associated with obesity and dyslipidemia.

The study—coordinated by University of Granada lecturer Ahmad Agil—showed that chronic administration of melatonin sensitizes the thermogenic effect of exposure to cold, heightens the thermogenic effect of exercise and, therefore, constitutes excellent therapy against obesity. The fact is that one of the key differences between 'beige fat', which appears when administering melatonin, and 'white fat', is that 'beige fat' cell mitochondria express levels of UCP1 protein, responsible for burning calories and generating heat.

The study—authored by Aroa Jiménez-Aranda, Gumersindo Fernández-Vázquez, Daniel Campos, Mohamed Tassi, Lourdes Velasco-Perez, Tx Tan, Russel J. Reiter and Ahmad Agil—has been part-financed and supported by the Granada Research of Excellence Initiative on BioHealth (GREIB), the University of Granada Vice-Rectorate for Scientific Policy and Research, and the regional government of Andalusia research group CTS-109.
Given the importance of this discovery, the researchers are confident they will obtain the funding needed to continue their work—says principle researcher Ahmad Agil—"and be able to achieve their final objective: to confirm these findings in humans, by administering melatonin to help combat obesity and diabetes".
*Melatonin induces browning of inguinal white adipose tissue in diabetic fatty zucker rats. Aroa Jiménez-Aranda, Gumersindo Fernández-Vázquez, Daniel Campos, Mohamed Tassi, Lourdes Velasco-Perez, Tx Tan, Russel J. Reiter and Ahmad Agil. Journal of Pineal Research. 2013. September. Doi:10.1111/jpr. 12089.*

***http://phys.org/news/2013-09-duo-instance-non-human-primates.html***

## Research duo discover first instance of non-human primates whispering to each other

***When threatened tamarin monkeys sometimes revert to whispering to one another***

Phys.org - Psychology researchers Rachel Morrison and Diana Reiss of The City University of New York have discovered the first instance of non-human primates whispering to one another. In their paper published in Zoo Biology, the two describe how they recorded vocalizations of captive tamarin monkeys and found that when threatened they sometimes revert to whispering to one another to avoid being overheard.

***A Cotton-top tamarin at Schwerin Zoo.*** **Credit: Harald Hoyer / Wikipedia.**

Whispering is a common strategy used by people to communicate with one or more people while simultaneously trying to avoid having others hear. Other animals have been found to lower the volume of their communications as well under certain circumstances, but never before has any primate other than humans been found to do so. In this new effort, the discovery was inadvertent.

The two researchers were studying cotton-top tamarins at New York's Central Park zoo, hoping to learn more about the kinds of calls the monkeys make to one another under different circumstances. Prior research had found that tamarins are capable of vocalizing a wide range of noises. Morrison and Reiss were most interested in what are known as mobbing calls—sounds members of a group make to confuse or intimidate predators.

To better understand how the tiny monkeys use mobbing calls, the researchers recorded sounds a group made when a known threat entered the vicinity—a supervisor that had been part of the team that had captured them in the wild. Prior to the study, the monkeys had used mob calls whenever the supervisor came into their view. Neither of the researchers noticed anything unusual as recordings were made, but later during playback analysis they discovered the monkeys were engaging in vocalizations that were at such low amplitude that people in the area couldn't hear them—they were whispering to one another.

The researchers acknowledge that it's impossible to know for sure what exactly the monkeys were saying to each other, but it seems pretty clear from observation that they were reminding one another of the threat the man posed and were doing it in a way that wouldn't alert the threat to the calls they were making to each other. The discovery of whispering by a non-human primate, Morrison and Reiss suggest likely means that it occurs in other species as well—researchers just haven't heard them yet.

*More information: Morrison, R. and Reiss, D. (2013), Whisper-like behavior in a non-human primate. Zoo Biol.. DOI: 10.1002/zoo.21099*

***Abstract***

*In humans, whispering has evolved as a counteractive strategy against eavesdropping. Some evidence for whisper-like behavior exists in a few other species, but has not been reported in non-human primates. We discovered the first evidence of whisper-like behavior in a non-human primate, the cotton-top tamarin (Saguinus oedipus), in the course of investigating their use of human-directed mobbing calls. We exposed a family of captive cotton-top tamarins to a supervisor who previously elicited a strong mobbing response. Simultaneous audio–video recordings documented the animals' behavioral and vocal responses in the supervisor's presence and absence. Rather than exhibiting a mobbing response and producing loud human-directed mobbing calls, the tamarins exhibited other anti-predator behaviors and produced low amplitude vocalizations that initially eluded our detection. A post-hoc analysis of the data was conducted to test a new hypothesis—the tamarins were reducing the amplitude of their vocalizations in the context of exposure to a potential threat. Consistent with whisper-like behavior, the amplitude of the tamarins' vocalizations was significantly reduced only in the presence of the supervisor. Due to its subtle properties, this phenomenon may have eluded detection*

*in this species. Increasing evidence of whisper-like behavior in non-human species suggests that such low amplitude signaling may represent a convergence in a communication strategy amongst highly social and cooperative species.*

***http://phys.org/news/2013-09-moon-younger-thought.html***

## Moon is younger than first thought

***Improved age data for the Moon suggests that it is much younger than previously believed according to scientists presenting at a Royal Society discussion meeting entitled Origins of the Moon this week (23 September).***

Professor Richard Carlson of the Carnegie Institution of Washington will say that Earth's Moon is more likely between 4.4 and 4.45 billion years old rather than 4.56 billion years old, as previously thought.

The young age for the Moon implies an origin by a late giant impact into Earth with potentially big consequences for the Earth too.

Scientists have long studied lunar crustal rocks to try and estimate the age of the Moon. In the past obtaining accurate ages for lunar crustal rocks hasn't been easy for technical reasons. However as methods have improved, the ages of lunar crustal rock have begun to cluster not near 4.568 billion years, the precisely determined start time of Solar System formation, but between 4.36 and 4.45 billion years. Looking then at the Earth returns less clearly defined ages for Earth formation, but again, the ages tend to be less than 4.5 billion years.

Current models for planet formation assemble dust in the planetary nebula pretty quickly - where "pretty quickly" means a couple of million years. When assembled at this rate, the energy from violent collisions between planetesimals (small celestial bodies thought to fuse and form planets) and the heating caused by decay of radioactive elements causes even small planetesimals to undergo large-scale or complete melting. Through this melting process, iron metal segregates to the centre of the planetesimal and most of the volatile elements move to the atmosphere. When this chemical differentiation occurs on a small planetesimal, the planetesimal does not have enough gravity to hold on to its atmosphere, so it escapes into space. Earth is very depleted in volatile elements compared to the average composition of the Solar System, likely because it formed from differentiated planetesimals that had already lost their atmospheres.

Professor Carlson uses the example of the asteroid Vesta to explain the variety of approaches scientists have taken to estimating the Moon's age:

"If you asked the question 'How old is the asteroid Vesta?' the answer would be 4.565 ± 0.001 billion years. Scientists can state this so precisely because the global melting of the asteroid Vesta, as sampled by a group of meteorites known as eucrites, happened so quickly that the age was frozen in precisely in the rocks formed during this event. Furthermore, no later significant geologic events happened to disturb the age recorded by the rocks because Vesta is too small to retain enough interior heat to allow further melting/volcanism.

However, ask the same question of the Earth or Moon and you don't get a very precise answer. Earth likely took longer to grow to full size compared to a small asteroid like Vesta and every step in its growth tends to erase, or at least cloud, the memory of earlier events."

By comparing planetary ages in this way, scientists have concluded that Moon formation, which many believe to be the result of a very large impact into the proto-Earth, did not occur until about 4.4 to 4.45 billion years ago. The giant impact set the "age of the Moon" but also reset most (but not all) older ages that can be used to estimate the "age of the Earth'.

The most precisely determined age for the type of lunar crustal rock that is believed to form directly from the magma ocean that occurred during Moon formation is 4.360 ± 0.003 billion years. Over the last decade or so, two areas have been found on Earth that have crustal rocks/minerals with ages approaching this date. The first is an area where a few zircon grains were found in much younger sediment in Western Australia. The other is a group of rocks found along the shores of Hudson's Bay in Canada (the Nuvvuagittuq terrane). Other regions of very old Earth rocks (Isua Greenland, and the Acasta rocks in central Canada) are also beginning to show evidence of a major differentiation event on Earth around 4.45 billion years ago, so the possibility exists that we are now seeing the first crusts formed on both Earth and Moon after the giant impact.

Professor Carlson says:

"There are several important implications of this late Moon formation that have not yet been worked out, for example, if the Earth was already differentiated prior to the giant impact, would the impact have blown off the primordial atmosphere that formed from this earlier epoch of Earth history?"

Scientists will discuss a number of different moon forming theories at the Royal Society meeting with other topics including 'how does ongoing exploration of Mercury inform our understanding of the Moon?" and "Are the Earth and Moon isotopic twins?".

*More information: royalsociety.org/events/2013/origin-moon/*

http://www.eurekalert.org/pub_releases/2013-09/aps-gae092513.php

## Getting an expected award music to the brain's ears

***Several studies have shown that expecting a reward or punishment can affect brain activity in areas responsible for processing different senses, including sight or touch.***

BETHESDA, Md - For example, research shows that these brain regions light up on brain scans when humans are expecting a treat. However, researchers know less about what happens when the reward is actually received—or an expected reward is denied. Insight on these scenarios can help researchers better understand how we learn in general.

To get a better grasp on how the brain behaves when people who are expecting a reward actually receive it, or conversely, are denied it, Tina Weis of Carl-von-Ossietzky University and her colleagues monitored the auditory cortex—the part of the brain that processes and interprets sounds—while volunteers solved a task in which they had a chance of winning 50 Euro cents with each round, signaled by a specific sound. Their findings show that the auditory cortex activity picked up both when participants were expecting a reward and received it, as well as when their expectation of receiving no reward was correct.

The article is entitled "Feedback that Confirms Reward Expectation Triggers Auditory Cortex Activity." It appears in the Articles in Press section of the Journal of Neurophysiology, published by the American Physiological Society. The article is online at http://bit.ly/19fDKn6.

**Methodology**

The researchers worked with 105 healthy adult volunteers with normal hearing. While each volunteer received a functional MRI (fMRI)—a brain scan that measures brain activity during tasks—the researchers had them solve a task with sounds where they had the chance of winning money at the end of each round. At the beginning of a round participants heard a sound and had to learn if this sound signified that they could win a 50 Euro cents reward or not. They then saw a number on a screen and had to press a button to indicate whether the number was greater or smaller than 5. If the sound before indicated that they could receive a reward and they solved the number task quickly and correctly, an image of a 50 Euro cents coin appeared on the screen. The researchers monitored brain activity in the subjects' auditory cortex throughout the task, paying special attention to what happened when they received the reward, or not, at the end of the round.

**Results**

The study authors found that when the volunteers were expecting and finally received a reward, then their auditory cortex was activated. Similarly, there was an increase in brain activity in this area when the subjects weren't expecting a reward and didn't get one. There was no additional activity when they were expecting a reward and didn't get one.

**Importance of the Findings**

These findings add to accumulating evidence that the auditory cortex performs a role beyond just processing sound. Rather, this area of the brain appears to be activated during other activities that require learning and thought, such as confirming expectations of receiving a reward.

"Our findings thus support the view of a highly cognitive role of the auditory cortex," the study authors say.

**Study Team**

In addition to Tina Weis, the study team also includes Andre Brechmann of the Leibniz Institute for Neurobiology, and Sebastian Puschmann and Christiane M. Thiel of Carl-von-Ossietzky University.

http://phys.org/news/2013-09-fish-fossil-yields-jaw-dropping.html

## Fish fossil yields jaw-dropping data on Man's past

The ancestor of all creatures with jaws and a backbone was not a sleek, shark-like beast but a toothless, armoured fish, said a study Wednesday that rewrites Man's evolutionary history.

Scientists said they had found a 419-million-year-old fish fossil in China which disproves the long-held theory that modern animals with bony skeletons (osteichthyans) evolved from a shark-like creature with a frame made of cartilage.

The osteichthyan group includes most living fish, humans and other land animals with limbs.

It had long been thought that modern-day cartilaginous fish like sharks and rays, which form a sister group to osteichthyans, most closely represent the original jawed ancestor that gave rise to the two animal types.

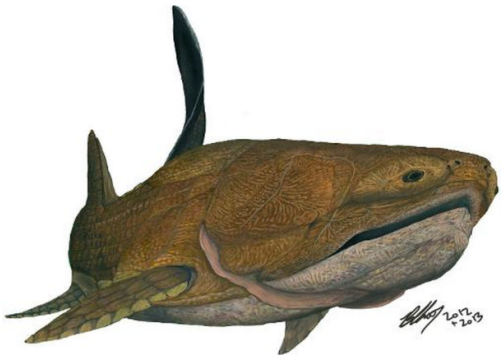
This meant that we osteichthyans would have evolved our bony frames from scratch while the group that includes sharks, rays and ratfish retained their ancestral cartilage skeletons.

But the new find of a primordial fish with a complex arrangement of small skull and jaw bones revealed a missing branch on the evolutionary tree and showed that a bony skeleton was in fact the prototype for all vertebrates, a research team wrote in the journal Nature.

"This astounding discovery does throw a spanner in the works of some long-held ideas about vertebrate evolution," said study co-author Brian Choo from the Institute of Vertebrate Palaeontology and Palaeoanthropology in Beijing.

"The implications are clear: ostheichthyans did not independently acquire their bony skeletons, they simply inherited them" from their ancestors—heavily-armoured fish known as placoderms that are accepted to be the most primitive members of the jawed vertebrate family.

"Osteichthyans didn't go through an unarmoured shark-like... stage during their early evolution only to reacquire their bone later on, they simply kept the plates directly from their... ancestors," said Choo.



***A photo obtained on September 24, 2013 from the Chinese Academy of Sciences shows life restoration of an Entelognathus, an old armoured fish.***

This meant that sharks and rays, instead of being the archetypal vertebrates, shed the common ancestor's bony plates as they evolved, said the team.

The newly discovered creature, dubbed Entelognathus primordialis (meaning primordial complete jaw) was a type of placoderm that lived in the seas of China in the Late Silurian period from about 423 million to 416 million years ago.

The weird-looking animal, whose near-complete fossil was dug up near the southern Chinese town of Qujing, was about 20 centimetres (about eight inches) long, had a heavily armoured head and trunk and a scaly tail. It had jaws but no teeth and tiny eyes set in large, bony goggles. It was not a direct ancestor of today's jawed vertebrates, but an extinct "close nephew" of our common forefather that shared many of its characteristics, according to Choo.

***Life restoraion of Entelognathus, an old armoured fish that rewrites the history of human jaw bones.*** **Credit: Brian Choo**

"I was completely blown away upon seeing this fossil for the first time, even more so as the full implications started to sink in," he told AFP.

"Every now and then you are confronted with jaw-dropping specimens like Lucy the Australopithecus (an extinct, upright-walking hominid) or the first batch of Chinese feathered dinosaur, unleashing a flood of new information that greatly clarifies our view of the distant past and often forces us to rethink what we thought we knew about evolution.

"A little fish called Entelognathus now joins the ranks of these exceptional fossil discoveries."

Commenting on the find, palaeontologists Matt Friedman and Martin Brazeau said the implications were "stunning". "It will take time to fully digest the implications of such a remarkable fossil, but it is clear that a major reframing of our understanding of early gnathostome (jawed vertebrate) evolution is now in full swing," they wrote in Nature.

*More information: Paper: dx.doi.org/10.1038/nature12617*

***http://www.eurekalert.org/pub_releases/2013-09/wcs-wms092513.php***

## Whale mass stranding attributed to sonar mapping for first time

***Investigation of 2008 melon-headed whale stranding in Madagascar conducted by independent review panel***

An independent scientific review panel has concluded that the mass stranding of approximately 100 melon-headed whales in the Loza Lagoon system in northwest Madagascar in 2008 was primarily triggered by acoustic stimuli, more specifically, a multi-beam echosounder system operated by a survey vessel contracted by ExxonMobil Exploration and Production (Northern Madagascar) Limited.

In response to the event and with assistance from IFAW, WCS led an international stranding team to help return live whales from the lagoon system to the open sea, and to conduct necropsies on dead whales to determine the cause of death.

According to the final report issued today, this is the first known marine mammal mass stranding event of this nature to be closely associated with high-frequency mapping sonar systems. Based on these findings, there is cause for concern over the impact of noise on marine mammals as these high-frequency mapping sonar systems are used by various stakeholders including the hydrocarbon industry, military, and research vessels used by other industries.

The report concluded: "The potential for behavioral responses and indirect injury or mortality from the use of similar MBES [multi-beam echosounder systems] should be considered in future environmental assessments, operational planning and regulatory decisions."
The full report can be found at: http://iwc.int/index.php?cID=454&cType=html
The Wildlife Conservation Society (WCS) and the International Fund for Animal Welfare (IFAW) welcomed the report and praised all those involved in the process, including governments, NGOs, and industry.
"WCS and IFAW support these conclusions that add to a mounting body of evidence of the potential impacts of anthropogenic noise on marine mammals," said Dr. Howard Rosenbaum, Director of the Ocean Giants Program for WCS. "Implications go well beyond the hydrocarbon industry, as these sonar systems are widely used aboard military and research vessels for generating more precise bathymetry (underwater mapping). We now hope that these results will be used by industry, regulatory authorities, and others to minimize risks and to better protect marine life, especially marine mammal species that are particularly sensitive to increasing ocean noise from human activities. "
Added Dr. John G. Robinson, Executive Vice President for Conservation and Science for WCS: "We greatly appreciate the efforts of the U.S. government agencies and authorities and the International Whaling Commission for facilitating and overseeing this process, and we are particularly grateful to the Government of Madagascar for authorizing this work and their continued interest in the outcome. Understanding what causes mass strandings of marine mammals is critical to prevent this in the future. In this case, the cooperation by industry, conservation organizations, and government regulatory authorities led to best science being evaluated by an independent panel, which came up with conclusion based on weight of considerable evidence made available."
"Mass stranding response is challenging under the best of circumstances. Together with local individuals and the government of Madagascar, we provided the expertise to rescue as many animals as possible and medical care to those that stranded alive," said Katie Moore, Director of Animal Rescue at IFAW. "Equally important was to gather as much data as possible from the animals to address the root cause of the stranding. We are pleased to see the ISRP report and its conclusions, which will hopefully be used in shaping future conservation policies."
The report was written after a formalized process was established to investigate the mass stranding. The process was undertaken with endorsement of the Government of Madagascar. Several have contributed to this report including organizations involved in the mass stranding response effort, the International Whaling Commission, and several relevant U.S. federal agencies.
A multi-stakeholder steering committee was established to provide guidance in setting up and structuring the review panel and to ensure completion of the process and public release of the report. Those on this steering committee included: Dr. Howard Rosenbaum (WCS); Dr. Rodger Melton and Dr. Linda Zimmerman (ExxonMobil); Dr. Teri Rowles (NOAA Marine Mammal Stranding Network); Dr. Jason Gedamke (NOAA Ocean Acoustics Program); Dr. Peter Thomas (Marine Mammal Commission); Jill Lewandowski (BOEM); Dr. Greg Donovan (IWC); Dr. Brandon Southall (SEA), also head of the independent scientific review panel.
The panel consisted of: Brandon L. Southall, Ph.D.; Teri Rowles, D.V.M., Ph.D.; Frances Gulland, Vet. MB., Ph.D., MRCVS; Robin W. Baird, Ph.D.; and Paul D. Jepson, DVM, Ph.D., Dip.ECZM.
While aspects of the stranding remain unknown, the panel concluded that a multi-beam echosounder system, operated intermittently by a survey vessel moving down the shelf-break the day before the event was the most "plausible and likely behavioral trigger for the animals initially entering the lagoon system."

***http://www.eurekalert.org/pub_releases/2013-09/rpi-nmr092013.php***

## NASA Mars rover Curiosity finds water in first sample of planet surface

***The first scoop of soil analyzed by the analytical suite in the belly of NASA's Curiosity rover reveals that fine materials on the surface of the planet contain several percent water by weight.***

Troy, N.Y. – The results were published today in Science as one article in a five-paper special section on the Curiosity mission. Rensselaer Polytechnic Institute Dean of Science Laurie Leshin is the study's lead author.
"One of the most exciting results from this very first solid sample ingested by Curiosity is the high percentage of water in the soil," said Leshin. "About 2 percent of the soil on the surface of Mars is made up of water, which is a great resource, and interesting scientifically." The sample also released significant carbon dioxide, oxygen, and sulfur compounds when heated.
Curiosity landed in Gale Crater on the surface of Mars on August 6, 2012, charged with answering the question "Could Mars have once harbored life?" To do that, Curiosity is the first rover on Mars to carry equipment for gathering and processing samples of rock and soil. One of those instruments was employed in the current

research: Sample Analysis at Mars (SAM) includes a gas chromotograph, a mass spectrometer, and a tunable laser spectrometer enabling it to identify a wide range of chemical compounds and determine the ratios of different isotopes of key elements.
"This work not only demonstrates that SAM is working beautifully on Mars, but also shows how SAM fits into Curiosity's powerful and comprehensive suite of scientific instruments," said Paul Mahaffy, principal investigator for SAM at NASA's Goddard Space Flight Center in Maryland. "By combining analyses of water and other volatiles from SAM with mineralogical, chemical, and geological data from Curiosity's other instruments, we have the most comprehensive information ever obtained on martian surface fines. These data greatly advance our understanding of surface processes and the action of water on Mars."
"This is the first solid sample that we've analyzed with the instruments on Curiosity. It's the very first scoop of stuff that's been fed into the analytical suite. Although this is only the beginning of the story, what we've learned is substantial," said Leshin, who co-wrote the article, titled "Volatile, Isotope and Organic Analysis of Martian Fines with the Mars Curiosity Rover." Thirty-four researchers, all members of the Mars Science Laboratory Science Team, contributed to the paper.
In this study, scientists used the rover's scoop to collect dust, dirt, and finely grained soil from a sandy patch known as "Rocknest." Researchers fed portions of the fifth scoop into SAM. Inside SAM, the "fines"—as the dust, dirt, and fine soil is known—were heated to 835 degrees Celsius.
Baking the sample also revealed a compound containing chlorine and oxygen, likely chlorate or perchlorate, previously known only from high-latitude locations on Mars. This finding at Curiosity's equatorial site suggests more global distribution. The analysis also suggests the presence of carbonate materials, which form in the presence of water.
In addition to determining the amount of the major gases released, SAM also analyzed ratios of isotopes of hydrogen and carbon in the released water and carbon dioxide. Isotopes are variants of the same chemical element with different numbers of neutrons, and therefore different atomic weights. SAM found that the ratio of isotopes in the soil is similar to that found in the atmosphere analyzed earlier by Curiosity, indicating that the surface soil has interacted heavily with the atmosphere.
"The isotopic ratios, including hydrogen-to-deuterium ratios and carbon isotopes, tend to support the idea that as the dust is moving around the planet, it's reacting with some of the gases from the atmosphere," Leshin said.
SAM can also search for trace levels of organic compounds. Although several simple organic compounds were detected in the experiments at Rocknest, they aren't clearly martian in origin. Instead, it is likely that they formed during the heating experiments, as the non-organic compounds in Rocknest samples reacted with terrestrial organics already present in the SAM instrument background.
"We find that organics are not likely preserved in surface soils, which are exposed to harsh radiation and oxidants," said Leshin. "We didn't necessarily expect to find organic molecules in the surface fines, and this supports Curiosity's strategy of drilling into rocks to continue the search for organic compounds. Finding samples with a better chance of organic preservation is key." The results shed light on the composition of the planet's surface, while offering direction for future research, said Leshin.
"Mars has kind of a global layer, a layer of surface soil that has been mixed and distributed by frequent dust storms. So a scoop of this stuff is basically a microscopic Mars rock collection," said Leshin. "If you mix many grains of it together, you probably have an accurate picture of typical martian crust. By learning about it in any one place, you're learning about the entire planet."
These results have implications for future Mars explorers. "We now know there should be abundant, easily accessible water on Mars," said Leshin. "When we send people, they could scoop up the soil anywhere on the surface, heat it just a bit, and obtain water." In addition to her work research as part of the Mars Science Laboratory Team, Leshin is Dean of the School of Science at Rensselaer Polytechnic Institute, where she leads the scientific academic and research enterprise at the nation's first technological university.

***http://www.scientificamerican.com/article.cfm?id=humans-may-be-most-adaptive-species***

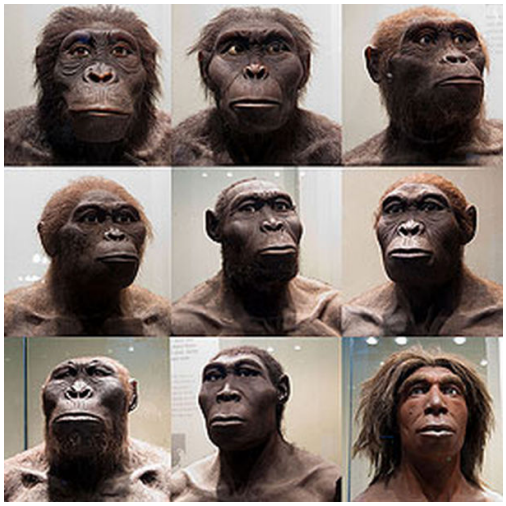
## Humans May Be the Most Adaptive Species

***Constant climate change may have given Homo sapiens their flexibility***

**By Nathanael Massey and ClimateWire | Wednesday, September 25, 2013 | 15**

In the 5 million years since early hominids first emerged from east Africa's Rift Valley, the Earth's climate has grown increasingly erratic. Over cycles lasting hundreds of thousands of years, arid regions of central Africa were overrun by forests, forests gave way to grasslands and contiguous landscapes were fractured by deep lakes. It was within the context of this swiftly changing landscape that humans evolved their sizable brains and capacity for adaptive behavior, said Rick Potts, director of the Human Origins Program at the Smithsonian

Institution National Museum of Natural History. In such a world, the ability to think creatively, to imagine novel solutions to survival threats, proved to be a major asset, he said.
"The evolution of the brain is the most obvious example of how we evolve to adapt," he explained. "But in the modern era, we know that in the human genome there are all kinds of interactions that allow human organisms to have plasticity -- the capacity to adjust is itself an evolved characteristic."
Man had two key advantages, he said: our brains and our capacity for culture.
"Our brains are essentially social brains," he added. "We share information, we create and pass on knowledge. That's the means by which humans are able to adjust to new situations, and it's what differentiates humans from our earlier ancestors, and our earlier ancestors from primates."
This adaptive ability not only allowed our progenitors to ride the massive seesaws of climate shifts but subsequently helped them to colonize new habitats. The earlier hominid species Homo erectus ranged across much of Africa and Asia. Meanwhile, Homo neanderthalensis -- Neanderthals -- occupied large parts of Europe. Our own species, Homo sapiens, dispersed to even more far-flung corners of the globe, employing boats to reach Australia more than 50,000 years ago.



***Evolutionary Challenge: The origin of every hominid genus, including our own, appears to fall within one or another window of climatic variability. Now, with planetary warming occurring at a breakneck pace, human adaptability is likely to face its biggest test.*** **Image: Sebastian Niedlich/Flickr**

**The species that went into the cold**

"You had Homo sapiens going into colder environments than even the Neanderthals could tolerate, at the same time that they were migrating into deserts, tropical forests, steppes and glacial environments," Potts said. "How this thin, long-limbed hominid could make it in all these different environments, to me that is a story about how you become adaptable."
The theory of "variability selection," which Potts first described in 1996, doesn't just relate to humans and their brains but can be applied to any species passing through periods of environmental instability. Generalist traits such as a wide-ranging diet would be an advantage at such times, Potts said, whether for grazing animals or for their predators.
"All organisms have to be able to maintain homeostasis within some range of conditions that are not completely stable," Potts explained. "The genome itself is an evolved structure, and that means that all forms of life have some degree of adaptability to them."
The idea that adaptability might itself be an evolved characteristic is a relatively new concept. When Potts first described his theory nearly two decades ago, it was met with a healthy dose of skepticism from evolutionary geneticists who understood evolution to be a process of matching animals to their environments.
It had been largely understood among paleoanthropologists -- including, formerly, Potts -- that humans had evolved during a period of gradual change from colder, wetter climates to a more arid environment.
The idea that major developments in human evolution happened not gradually, but in fits and spurts during periods of heightened climatic variability, seemed to fly in the face of the scientific consensus. But the theory of variability selection did have one big advantage: It could be tested.
"We have markers for various important events in hominid history -- the origin of new species, the development of new tools," said Matt Grove, a professor of archaeology, classics and Egyptology at the University of Liverpool who has worked with Potts to model variability selection. "If those events line up with what the climate record tells us were the periods of instability, that would seem to support Rick's theory. And, in general, they do."

**New and ominous test on the horizon**

The origin of every hominid genus, including our own, appears to fall within one or another of these windows of climatic variability, he said.
"What we see is that it isn't just the origin of new [hominid] species that emerge during these periods, but also new ways of life, of living and interacting with the environment," Potts said.
The big irony, Grove explained, is that capacity to interact with our environment has put us back on a trajectory of climate instability. And this time, pumped by man-made greenhouse gases, global warming is happening much faster than previous shifts.

With the dawn of agriculture 10,000 years ago, humans embarked on a new experiment -- rather than adapting to our environment, we began adapting our environment to meet our needs, slashing and burning forests to create room for agriculture. That, in turn, allowed more leisure time, larger societies and a freer exchange of information. As cultural and technological knowledge improved, we were able to harness the energy of other animals and, in time, harness the dramatic power of fossil fuels as well.
Several times throughout human history, periods of climate instability sent shock waves through established empires, such as the Akkadian Empire of Mesopotamia or the Bronze Age empires of the Mediterranean (ClimateWire, Aug. 16). Each time, though, the species bounced back, more successful and adaptive than ever. Now, with planetary warming occurring at a breakneck pace, human adaptability is likely to face its biggest test, Grove thinks.
"We've been dealing with climate change since we got here on Earth," he explained. "The problem, though, is that it's happening now over such a short time scale. And that makes it very hard to predict whether or not we'll be able to respond, or at what cost."

***http://www.eurekalert.org/pub_releases/2013-09/whf-ceo092413.php***

## Current estimate of around quarter of a million deaths annually worldwide vastly underestimates true burden of rheumatic heart disease

***Paper suggests that numbers published to date could be substantial underestimates due mainly to lack of high qualitydata from high-prevalence countries and regions***

A paper in the RHD special issue of Global Heart, the journal of the World Heart Federation, analyses the burden of disease and suggests that numbers published to date (ranging from at least 233,000 deaths per year upwards) could be substantial underestimates for a variety of reasons, most commonly lack of high quality (or in some cases any) data from high-prevalence countries and regions.
The paper is by Dr Liesl Zühlke, University of Cape Town and Red Cross War Memorial Children's Hospital, Cape Town, South Africa and Dr Andrew Steer, Centre for International Child Health at the University of Melbourne, Australia.
The authors say: "Currently available figures used to define the global burden of acute rheumatic fever and rheumatic heart disease, although crucial to control efforts, are imperfect. Data have been hindered by methodological differences between studies, by patchy coverage within countries and across regions, and by an incomplete understanding of the relationship between echocardiographic detection of asymptomatic mild disease and progression to symptomatic disease."
A WHO study published in 2005 found an overall global burden of 471,000 annual cases of ARF, with the incidence of acute rheumatic fever (ARF) ranging from 10 cases per 100,000 children aged 5 to 15 years in industrialised countries to 374 cases per 100,000 in the Pacific region. The overall burden of RHD was estimated to be 15.6 million prevalent cases with 282,000 new cases and over 233,000 deaths per year.
The recently published Global Burden of Disease Study reports that the number of years lived with disability (YLD) due to RHD was estimated in 2010 at 1 430 000*, equivalent to a quarter of the figure for all cancers combined.
Lozarno and colleagues reported 345,100 deaths due to RHD in 2010 which represents a 25% reduction compared to 1990; with an age-standardised death rate of 5.2 per 100,000 which was a 53% reduction compared to1990. However, the authors caution that these figures should be viewed with caution and are currently being re-analysed for the next Global Burden of Disease analysis in 2014.
RHD burden of disease estimates also face the new problem of both more definite and borderline cases being diagnosed with echocardiogram equipment. The authors say: "It is perhaps time to change the way that we think about RHD and attempt to describe the disease burden with greater subtlety that takes into account our increasing understanding of the disease." Such a revised model might include an assessment of RHD burden in two categories: 1) Symptomatic disease which could also be called active disease; and 2) Asymptomatic disease which could also be called latent disease This approach has some similarities (but also obvious differences) to the model of disease applied to other latent diseases including infection with Mycobacterium tuberculosis.
The authors conclude: "Moving forward, it will be critical to generate high quality and comprehensive data regarding all aspects of the burden of ARF and RHD to better inform national, regional and global control strategies... New studies are underway in several high-prevalence sentinel areas in diverse geographic locations to address the need of contemporary data... These data will provide vital information in order to advocate even more strongly for directed funding and public health interventions to control ARF and RHD."
*Note to editors: As a comparison, YLD for ischaemic heart disease in 2010 was 8 795 000, showing that RHD is causing a substantial burden of disease globally. As discussed, the YLD for RHD, at 1 430 000, is likely to be a substantial underestimate.*

http://www.sciencedaily.com/releases/2013/09/130926102433.htm?

# Experts Confirm That Fruit and Vegetable Consumption Reduces Risk of Mortality

***A diet rich in fruit and vegetables reduces the risk of cardiovascular disease mortality by 15%***

A European study analyzes the relationship between fruit and vegetable consumption and the risk of mortality. As previous research has already suggested, this study concludes that fruit and vegetable consumption reduces all-cause mortality, and especially cardiovascular disease mortality.

The benefits of fruit and vegetable consumption are not a new discovery. However, new research confirms their role in reducing mortality.

This reduction is more significant in the case of deaths from cardiovascular disease.

The analysis, recently published in the 'American Journal of Epidemiology', was directed by researchers from ten countries, including Spain, as part of the European Prospective Investigation into Cancer and Nutrition (EPIC).

The sample analyzed includes 25,682 deaths (10,438 due to cancer and 5,125 due to cardiovascular disease) among the 451,151 participants studied over more than 13 years.

"This study is the most significant epidemiological study that this association has examined to date," María José Sánchez Pérez, director of the Andalusian School of Public Health's (EASP) Granada Cancer Registry and one of the authors of the research, explains to SINC.

According to the results, a combined fruit and vegetable consumption of more than 569 grams per day reduces the risk of mortality by 10% and delays the risk of mortality by 1.12 years compared to a consumption of less than 249 grams per day.

Furthermore, for every 200 gram increase in daily fruit and vegetable consumption, the risk falls by 6%.

The proportion of deaths that could be prevented if everyone eating too few fruit and vegetables increased their consumption by 100-200 grams per day -- thus reaching the recommended 400-500 grams per day -- is 2.9%.

Previous studies already noted that fruit and vegetable consumption, in accordance with the recommended daily allowance, prevents the development of chronic diseases, and reduces the risk of mortality by 10-25%.

"There is now sufficient evidence of the beneficial effect of fruit and vegetable consumption in the prevention of cancer and other chronic diseases," Sánchez states, "for this reason, one of the most effective preventative measures is promoting their consumption in the population."

**Fruit for the heart**

A diet rich in fruit and vegetables reduces the risk of cardiovascular disease mortality by 15%. Furthermore, more than 4% of deaths due to cardiovascular disease could be prevented by consuming more than 400 grams of fruit and vegetables a day.

Considering fruit consumption separately, no significant risk reduction was observed, whereas vegetable consumption alone was associated with a lower risk of mortality, which was even more significant for raw vegetables: high consumption reduces the risk of mortality by 16%.

"With regard to cancer mortality, no statistically significant risk reduction was found, although it will be necessary to assess this according to specific types of cancer," Sánchez adds.

Nevertheless, the expert highlights that given that fruit and vegetable consumption is associated with the risk of certain cancers -- colon and rectal, stomach, lung, etc. -- it is to be expected that their consumption will also have a positive effect on mortality due to these tumours.

**Greater effect in people with bad habits**

The mortality risk reduction due to fruit and vegetable consumption was greater in those participants who consumed alcohol (around 30-40% risk reduction), who were obese (20%), and "possibly" also in those who smoked.

The authors add that this positive effect is probably due to their high antioxidant content, which mitigates the oxidative stress caused by alcohol, tobacco and obesity.

"As such, these population groups in particular could benefit from the positive effects of fruit and vegetables in preventing chronic diseases and their associated mortality risk," Sánchez concludes.

*M. Leenders, I. Sluijs, M. M. Ros, H. C. Boshuizen, P. D. Siersema, P. Ferrari, C. Weikert, A. Tjonneland, A. Olsen, M.-C. Boutron-Ruault, F. Clavel-Chapelon, L. Nailler, B. Teucher, K. Li, H. Boeing, M. M. Bergmann, A. Trichopoulou, P. Lagiou, D. Trichopoulos, D. Palli, V. Pala, S. Panico, R. Tumino, C. Sacerdote, P. H. M. Peeters, C. H. van Gils, E. Lund, D. Engeset, M. L. Redondo, A. Agudo, M. J. Sanchez, C. Navarro, E. Ardanaz, E. Sonestedt, U. Ericson, L. M. Nilsson, K.-T. Khaw, N. J. Wareham, T. J. Key, F. L. Crowe, I. Romieu, M. J. Gunter, V. Gallo, K. Overvad, E. Riboli, H. B. Bueno-de-Mesquita. Fruit and Vegetable Consumption and Mortality: European Prospective Investigation Into Cancer and Nutrition. American Journal of Epidemiology, 2013; 178 (4): 590 DOI: 10.1093/aje/kwt006*

http://www.eurekalert.org/pub_releases/2013-09/tmsh-mmp092513.php

## Mucus might prove useful in treating IBD, ulcerative colitis and Crohn's disease

***Mount Sinai researchers discover mucus prevents inflammatory reactions in the gut***

Imagine mucus -- which most people find unpleasant -- actually helping your body maintain its equilibrium, prevent inflammation, and reduce food allergy problems.

Researchers from the Icahn School of Medicine at Mount Sinai's Immunology Institute foresee a day when mucus could be manufactured and given to sick people to help them fight inflammation and increase immunity. For the first time ever, they report that mucus in the large intestine provides a valuable anti-inflammatory and self-regulating immune function. In fact, they propose that mucus may one day prove valuable in treating gut diseases, such as inflammatory bowel disease (IBD), Crohn's disease, as well as cancer.

The research is published online September 26 in the peer-reviewed journal Science.

"We asked ourselves whether dendritic cells in the gut could capture mucus, as well as bacteria and food antigens," said Andrea Cerutti, MD, PhD, the study's senior author and Professor in the Department of Medicine at the Immunology Institute at the Icahn School of Medicine. Dendritic cells are a type of immune cell found in the mucosa that launch an immune response. "We found that whenever mucus was present, it was stimulating the production of anti-inflammatory cytokines [regulatory proteins released by the cells of the immune system that act to regulate an immune response]," he added. The mucus prevented bacteria from inducing a damaging immune response.

Put another way, intestinal mucus not only acted as a barrier against bacteria and dietary toxins, but also stopped the onset of inflammatory reactions against these agents. "This important property of mucus was unknown until now," said Meimei Shan, MD, PhD, the study's lead author, and Assistant Professor in the Department of Medicine at the Immunology Institute at Icahn School of Medicine at Mount Sinai.

In this research, mucus was isolated and analyzed from the intestine of healthy mice, from pigs, and from a human intestinal cell line. A number of techniques involving cellular immunology and molecular biology were used to demonstrate the anti-inflammatory properties of mucus. In addition, genetically engineered mice lacking intestinal mucus and mice with colitis were given mucus from healthy mice.

Under normal conditions, people release about one liter of mucus every single day. Mucus is normally secreted by mucosal tissues throughout the body, according to the researchers. The large intestine carries 80 percent of the body's immune cells. In inflammatory gastrointestinal disorders, such as Crohn's disease and inflammatory bowel disease, people may have alterations of intestinal mucus that impede the generation of a protective anti-inflammatory response.

"Future research will focus on further exploring the mechanisms to synthesize gut mucus or an equivalent drug-like compound for oral administration," said Dr. Shan. "We hope to artificially synthesize mucus or an equivalent compound for oral use."

Besides helping to treat inflammatory gut diseases, the researchers see ramifications in treating cancer. Dr. Cerutti explained: "Several aggressive tumors, such as colon, ovarian, and breast cancers produce mucous, including MUC2. Mucus produced by malignant cells may prevent protective immune responses against the malignant cells." As researchers gain a better understanding of the properties of mucus, it could also have a positive effect in treating tumors.

*Other contributors from the Icahn School of Medicine at Mount Sinai, include John R. Yeiser, BS, Research Associate II; A. Cooper Walland, MS and Research Associate II; Victor U. Bornstein, PhD student; Montserrat Cols, PhD and Postdoctoral Fellow; J. Magarian Blander, PhD and Associate Professor; Huabao Xiong, PhD, Assistant Professor; Lloyd Mayer (deceased), MD and Professor of Medicine; and Cecilia Berin, PhD and Assistant Professor. All are from Mount Sinai's Immunology Institute. Other contributors came from the Hospital del Mar d'Investigacions Mediques, Barcelona, Spain; Yale University, New Haven, CT; Wayne State University, Detroit, MI; Albert Einstein College of Medicine, New York, NY; the Catalan Institute for Research and Advanced Studies, Barcelona, Spain; and the National Institutes of Health, Bethesda, MD. The research was funded by the National Institutes of Health.*

http://www.eurekalert.org/pub_releases/2013-09/ind-aam092613.php

## An analgesic molecule discovered in its natural state in Africa

***Even more surprising, analysis show that the molecule is identical to Tramadol, a wholly synthetic medication that is used world-wide as a painkiller.***

According to the research team, this is the first time ever that a synthetic medication produced by the pharmaceutical industry has been discovered in strong concentrations in a natural source.

This unexpected discovery had just been published in the chemical journal' "Angewandte Chemie"Nauclea latifolia (also know as the pin cushion tree) is a small shrub that is widely abundant throughout Sub-Saharan

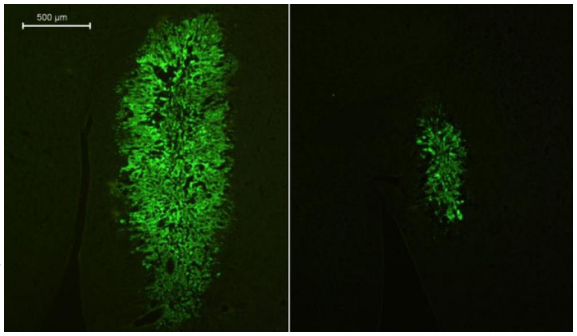
Africa. In traditional medicine, in particular in Cameroon, this plant is used to treat different pathologies including epilepsy, fevers, malaria and pain.
In order to identify the presence and the type of potential active substances in this plant, Michel De Waard, Inserm Research Director, organised joint scientific research with the Grenoble Institute of Neurosciences (Inserm unit 836 UJF/CEA/CHU), the Department of Molecular Pharmacological Chemistry (UMR UJF/CNRS 5063, Pr Ahcène Boumendjel) and the University of Buea (Dr. Germain Sotoing Taiwe).
Thanks to this work, the researchers were able to isolate and determine the properties of the component in the plant that was responsible for the presumed analgesic effects, by analysing part of the root bark. And to everyone's surprise, they found that this component was already commercially available under the name: Tramadol.
The biggest surprise in this study was the fact that this molecule was a known one. "It was identical to Tramadol, a synthetic medication developed in the seventies and often used to treat pain", explained Michel De Waard, Inserm research director. This medication is used world-wide, because although it is a derivative of morphine, it has less side effects than morphine, in particular addiction problems. Tramadol1 is in fact a simplified form of morphine that has conserved the elements needed to produce analgesic effects.
In order to confirm their results, the researchers tested different processes with the aim of proving that the substance discovered was of natural origin. Their analyses were confirmed by three independent laboratories that had received different samples at different times of the year.
"All results converge and confirm the presence of Tramadol in the root bark of Nauclea latifolia. On the other hand, no trace of this molecule was detected in the aerial part of the shrub (leaves, trunk or branches)", explained the researcher. Finally, in order to exclude the possibility of accidental contamination of the samples by synthetic Tramadol, the researchers took samples from inside the roots themselves and thus confirmed the presence of the molecule. From a quantitative point of view, the concentration of Tramadol in the dried bark extracts was measured at 0.4% and 3.9%. These are extremely high levels of active substance.
In addition to the unprecedented aspect of this discovery (the first ever potentially exploitable case where a hitherto synthetically produced medication has been discovered in a natural form and in high quantities), this major result opens up prospects for local populations, giving them access to a source of cheap treatment and validating the concepts of traditional medicines (as decoctions made from barks and roots).

***http://www.sciencedaily.com/releases/2013/09/130926102622.htm***

## Malignant Brain Tumours Can Be Transformed Into Benign Forms

***Researchers from the Nencki Institute in Warsaw show how to deceive brain tumours and change malignant gliomas into benign forms***

Cells of malignant brain tumours deceive our immune system so effectively that it starts working for them. But who lives by the sword, dies by the sword. Researchers from the Nencki Institute in Warsaw show how to deceive brain tumours and change malignant gliomas into benign forms. The research team of Prof. Bożena Kamińska from the Nencki Institute of Experimental Biology of the Polish Academy of Sciences in Warsaw developed -- so far only in animal model -- a method of converting malignant gliomas (brain tumours) into benign forms.




***Left: Typical malignant glioma inside a mouse brain. Right: Glioma in the brain of another mouse, transformed into bening form.*** **(Credit: Nencki Institute)**

Since the cells of benign gliomas are subdued and sometimes even eliminated by the host's immune system, the prospects for survival of sick animals significantly increase. This novel research was funded by the Polish National Science Centre.
The nervous system, including the brain, is inhabited, besides neurons and glial cells, by microglial cells. They support the nervous cells but also have important protective functions, patrolling the surroundings with their extenses and eliminating damaged or unnecessary cells. As macrophages of our immune system they also fight foreign bacteria, viruses and tumorous cells.
Unfortunately, sometimes the glia cells themselves become cancerous. This is how brain tumours called gliomas form. However, they are not uniform entity and could differ significantly with respect to their behaviour and degree of malignancy.
In benign variants the survival prospects for patients are quite high, while in the case of malignant gliomas few patients are expected to live longer than a year.

In 2007 the group of Prof. Kamińska showed that malignant gliomas can "re-program" the brain immune cells (microglia) to support tumour development instead of fighting it. Similarly the tumour even changed the protective immune cells recruited to the brain from blood and bone marrow (peripheral macrophages). The research to understand how the tumour deceives the host's immune system and forces the microglial cells to support and foster its growth has taken several years.
The results of other research groups showed that in the case of breast cancer the factor responsible for changing the behaviour of tumour-infiltrating macrophages is the CSF1 protein, controlling the maturation of macrophages.
Researchers from the Nencki Institute asked, whether a similar substance is not produces by the cells of the malignant gliomas.
Studies conducted by Prof. Kamińska's group has shown that gliomas do not produce larger amounts of the CSF1 protein and this protein does not significantly impact tumour development. They were however lucky to discover the production of a different protein from the same family, the CSF2 protein.
In benign tumours this protein was present in small amounts, while in malignant gliomas large amounts of it were discovered. Researchers from the Nencki Institute decided to investigate, whether this protein really influences tumour invasiveness. With the help of self-developed tools they turned off the gene responsible for the production of the CSF2 protein in glioma cells.
"We have observed that after turning off a single gene -- the gene producing the CSF2 protein -- the tumour cells stopped attracting the microglia and were not capable of converting these cells to support the tumour's development. As a result the immune system started working as expected and the malignant tumour was transformed into a benign form. It did not disappear, but stopped growing," says a PhD candidate Małgorzata Sielska from the Nencki Institute.
The protein responsible for "re-programming" the anti-tumour response and for high invasiveness of gliomas is present only in cancerous cells and is practically absent from healthy brain. Therefore researchers from the Nencki Institute suspect that when the gene responsible for its production is turned off in the brain, it would affect only the tumour.
Research on taming malignant brain tumours and converting them into benign forms has been conducted on mouse glioma cells growing in the brains of experimental animals, and published in the Journal of Pathology. Presently the group of Prof. Kamińska is checking the effectiveness of this method in the cells of human malignant gliomas.
Preliminary results confirm that silencing one gene in human glioma cells growing in mouse brains also stops the growth of the tumour. Developing tools to turn off this gene's expression, following the creation of appropriate carriers, will in the future open new possibilities for gene therapy in humans.
The findings has helped Nencki researchers develop small molecules (short peptides) which interfere with binding the CSF2 protein (expressed by tumorous cells) to the appropriate receptors on microglial cells.
This way the signal coming from tumorous cells gets blocked and the microglia is prevented from "re-programming" itself.
The developed molecules, together with relevant genetic tools, are covered by an international patent. Presently researchers work towards starting preclinical and clinical trials of this method.
The proposed solution holds great potential for therapies using small molecules -- short peptides or in the case of gene therapy, short RNA silencing gene expression.
Will this method really work?
This will be confirmed by further experiments and tests. For Nencki researchers it is important that the patented molecules target only one fragment of the signalling pathway which functions between the cells of the malignant tumour and the microglia, thus guaranteeing that no other functions of the organism are affected. Moreover discovery of such an important signalling pathway encourages scientists to search for ways of blocking it in other places, which could be technically more feasible.
"Our research is investigative in nature and above all aims to explain why and how tumours develop. We conducted our research mostly on experimental models, mouse glioma cells or human glioma cells growing in mice. Therefore the road to develop drugs and therapies limiting the invasiveness of gliomas in human is still very long. Luckily we already discovered the molecule that is worth targeting," sums up Prof. Kamińska.
*Malgorzata Sielska, Piotr Przanowski, Bartosz Wylot, Konrad Gabrusiewicz, Marta Maleszewska, Magdalena Kijewska, Malgorzata Zawadzka, Joanna Kucharska, Katyayni Vinnakota, Helmut Kettenmann, Katarzyna Kotulska, Wieslawa Grajkowska, Bozena Kaminska. Distinct roles of CSF family cytokines in macrophage infiltration and activation in glioma progression and injury response. The Journal of Pathology, 2013; 230 (3): 310 DOI: 10.1002/path.4192*

http://www.bbc.co.uk/news/health-24240409

# Most C. diff infections are 'not hospital spread'

***Most cases of C. difficile are not actually caused by the bug being spread round hospitals, a study suggests.***

**By James Gallagher Health and science reporter, BBC News**

A team from the University of Oxford said "more and more deep cleaning ain't going to do any good". Analysis of every C. diff infection in Oxfordshire for more than three years showed less than a fifth of cases had been spread between hospital patients. Researchers said there was a growing awareness of animal and community sources of infection. The gut bug is one of the most feared "hospital infections". It can be difficult to treat and deadly, especially in the elderly.

Rising levels of a particularly dangerous strain of the bacterium, alongside problems with the MRSA superbug, led to a deep-clean campaign across hospitals in the UK, and infection rates fell. However, a study in the Oxford University Hospital NHS Trust area, between 2008 and 2011, showed that reducing cases even further may require a different approach.

**Family affair**

Researchers essentially tried to build a family tree of the cases. They took samples of the bacterium from every infected patient and looked at the gut bug's DNA. If the genetic codes of bacteria in two patients are similar, it suggests that they came from the same source. This genetic information was combined with patient records to try to work out where the infection was coming from. Their conclusion, reported in the New England Journal of Medicine, was that just 18% of infections were being spread between patients in hospital.

One of the researchers, Prof Tim Peto, told the BBC: "More and more deep cleaning ain't going to do any good." He said we were probably being exposed to C. difficile all the time, but it became a problem only in vulnerable people. "I think we're eating it all the time, probably from animals, and most of us get it and it doesn't matter."

**Medication**

Antibiotics play a crucial role in the infection. They create space in the gut for C. difficile to flourish by killing the other gut bacteria.

Prof Peto suggested that better use of antibiotics had helped reduce infection rates in the past decade and that more intelligent use of the drugs would be the best way to stop the infection in the future. "Changing antibiotic policy is preventative, the focus is to stop someone becoming symptomatic," he said.

Prof Mark Wilcox, from the University of Leeds and Public Health England, said this was a "landmark study". "The results have an important message for infection teams. "Continuing on the same path to controlling C. diff will not ensure that all preventable cases are avoided, new measures are needed to prevent this bug spreading and being provoked to cause infection."

Commenting on the research, Prof Nigel Minton, from the Clostridia Research Group at the University of Nottingham, said: "Obviously hospital infection control measures have had a big impact on C. difficile cases. "But there is a growing feeling that community-acquired C. diff is equally important and there are also studies suggesting possible transmission to humans from animals. This has quite clearly been demonstrated from pigs to humans in the Netherlands" "Nursing homes are a major factor as well, it is where you get a lot of people susceptible to infection."

http://phys.org/news/2013-09-anthropologists-link-cranial-anatomy-two-legged.html

# Anthropologists confirm link between cranial anatomy and two-legged walking

***Anthropology researchers from The University of Texas at Austin have confirmed a direct link between upright two-legged (bipedal) walking and the position of the foramen magnum, a hole in the base of the skull that transmits the spinal cord.***

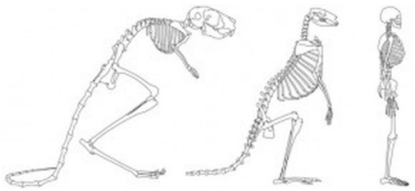
The study, published in a forthcoming issue of the Journal of Human Evolution, confirms a controversial finding made by anatomist Raymond Dart, who discovered the first known two-legged walking (bipedal) human ancestor, Australopithecus africanus. Since Dart's discovery in 1925, physical anthropologists have continued to debate whether this feature of the cranial base can serve as a direct link to bipedal fossil species.

Chris Kirk, associate professor of anthropology and co-author of the study, says the findings validate foramen magnum position as a diagnostic tool for fossil research and sheds further insight into human evolution.

"Now that we know that a forward-shifted foramen magnum is characteristic of bipedal mammals generally, we can be more confident that fossil species showing this feature were also habitual bipeds," Kirk says. "Our methods can be applied to fossil material belonging to some of the earliest potential human ancestors."

The foramen magnum in humans is centrally positioned under the braincase because the head sits atop the upright spine in bipedal postures. In contrast, the foramen magnum is located further toward the back of the

skull in chimpanzees and most other mammals, as the spine is positioned more behind the head in four-legged postures.



***Comparison of the skeletons of three bipedal mammals: an Egyptian jerboa, an eastern gray kangaroo and a human.***

As part of the study, the researchers measured the position of the foramen magnum in 71 species from three mammalian groups: marsupials, rodents and primates. By comparing foramen magnum position broadly across mammals, the researchers were able to rule out other potential explanations for a forward-shifted foramen magnum, such as differences in brain size.

According to the findings, a foramen magnum positioned toward the base of the skull is found not only in humans, but in other habitually bipedal mammals as well. Kangaroos, kangaroo rats and jerboas all have a more forward-shifted foramen magnum compared with their quadrupedal (four-legged walking) close relatives. These particular mammals evolved bipedal locomotion and anteriorly positioned foramina magna independently, or as a result of convergent evolution, says Gabrielle Russo, who is a postdoctoral research fellow at Northeast Ohio Medical University and lead researcher of the study.

"As one of the few cranial features directly linked to locomotion, the position of the foramen magnum is an important feature for the study of human evolution," Russo says. "This is the case for early hominin species such as Sahelanthropus tchadensis, which shows a forward shift of the foramen magnum but has aroused some controversy as to whether it is more closely related to humans or African apes."

*More information: www.sciencedirect.com/science/article/pii/S0047248413001681*

***http://www.livescience.com/39926-easter-islanders-ate-rats.html***

## Rats! Diet of Easter Islanders Revealed

***Chemical analyses of teeth from 41 human skeletons excavated on Easter Island revealed the inhabitants ate rats rather than seafood***

**By Owen Jarus, LiveScience Contributor | September 25, 2013 08:55am ET**

The inhabitants of Easter Island consumed a diet that was lacking in seafood and was, literally, quite ratty.

The island, also called Rapa Nui, first settled around A.D. 1200, is famous for its more than 1,000 "walking" Moai statues, most of which originally faced inland. Located in the South Pacific, Rapa Nui is the most isolated inhabited landmass on Earth; the closest inhabitants are located on the Pitcairn Islands about 1,200 miles (1,900 kilometers) to the west.

To determine the diet of its past inhabitants, researchers analyzed the nitrogen and carbon isotopes, or atoms of an element with different numbers of neutrons, from the teeth (specifically the dentin) of 41 individuals whose skeletons had been previously excavated on the island. To get an idea of what the islanders ate before dying, the researchers then compared the isotope values with those of animal bones excavated from the island.

Additionally, the researchers were able to radiocarbon date 26 of the teeth remains, allowing them to plot how the diet on the island changed over time. Radiocarbon dating works by measuring the decay of carbon-14 allowing a date range to be assigned to each individual; it's a method commonly used in archaeology on organic material. The research was published recently online in the American Journal of Physical Anthropology.

The researchers found that throughout time, the people on the island consumed a diet that was mainly terrestrial. In fact, in the first few centuries of the island's history (up to about A.D. 1650) some individuals used Polynesian rats (also known as kiore) as their main source of protein. The rat is somewhat smaller than European rats and, according to ethnographic accounts, tasty to eat.

"Our results indicate that contrary to previous zooarchaeological studies, diet was predominantly terrestrial throughout the entire sequence of occupation, with reliance on rats, chickens and C3 plants," the researchers write in their journal article, noting that the resources from C3 plants (or those that use typical photosynthesis to make sugars) would have included yams, sweet potatoes and bananas.

**Rats, not fish**

The islanders' use of rats was not surprising to the researchers. Archaeological excavations show the presence of the Polynesian rat across the Pacific. The Polynesian form commonly travels with humans on ocean voyages and, like any other rat, multiplies rapidly when it arrives on a new island. In some cases, the rats were probably transported intentionally to be used as food, something supported by ethnographic accounts stating that, in some areas of Polynesia, rats were being consumed at the time of European contact. Additionally, previous research has suggested the rats were at least partly responsible for the deforestation of Rapa Nui.

What was more surprising to the researchers was the lack of seafood in the diet of the islanders. "Traditionally, from Polynesian cultures you have a heavy predominance of using marine products, especially in the early phase of colonization," said Amy Commendador, of the Idaho Museum of Natural History at Idaho State University, in an interview with LiveScience.

One reason for the lack of seafood may have to do with the island's location and topography, Commendador said. The northern end contains steep cliffs and would be difficult to fish from. Additionally, the island's southerly latitude makes it somewhat cooler and may affect fishing. "Because of their geographic location and climate conditions, there just weren't as many marine products for them to get," Commendador said.
Rats should not be underestimated in their value as a resource, study co-author John Dudgeon, also at Idaho State University, told LiveScience. They could eat anything and multiply rapidly within a few generations. For the people who lived on Rapa Nui, "it was probably easier to go get a rat than it was to go get a fish," Dudgeon said.

**Fish elites?**

Though the study results showed the islanders' diet was mainly terrestrial, a few individuals, dating after A.D. 1600, appeared to have been eating more fish than the others. [The 7 Perfect Survival Foods]
These fish eaters may have lived on a part of the island where the fishing was easier, Commendador suggested. Another possibility the team raises in their paper is that access to marine resources varied due to the social and political constraints people faced. For the islanders, eating fish might have been a mark of "higher status" individuals, an elite person who was allowed more plentiful access to seafood.

**Statues facing inland**

One curious coincidence is that most of the Moai, the statues erected by the islanders, face inland rather than out to sea. Now, this new research suggests the people of the island also turned inland, rather than to the sea, to get their food.
Commendador and Dudgeon don't think any direct relationship between the Moai statues and the islanders' diet exists. Previous research has suggested the statues were positioned facing inland due to ancestor worship, so that the statues could watch over their descendents.
Another, more speculative, idea is that by having the statues facing inland, the islanders were also "saying we're turning inwards and not turning outward," Dudgeon said. While this probably doesn't relate to the islanders' decision to eat rats rather than fish, it shows the mindset the people of Rapa Nui may have developed before the arrival of Europeans. Their lifestyle as well as their diet may have become focused on the land rather than the sea.

***http://bit.ly/17dzcR3***

## Matchstick-sized sensor can record your private chats

***A sensor previously used for military operations can now be tuned to secretly locate and record any single conversation on a busy street***

**26 September 2013 by Jim Nash**

EVERYONE knows that to have a private chat in the NSA era, you go outdoors. Phones, the internet, email and your office can all be compromised with ease. But soon even that whispered conversation in the park may no longer be safe from prying ears.
Carrying out covert audio surveillance along a city street or a wooded path, say, currently requires parabolic microphones, which look like large, clear salad bowls and need a direct, unobstructed view of the subject. Hardly 007 territory.
Now, a Dutch acoustics firm, Microflown Technologies, has developed a matchstick-sized sensor that can pinpoint and record a target's conversations from a distance.
Known as an acoustic vector sensor, Microflown's sensor measures the movement of air, disturbed by sound waves, to almost instantly locate where a sound originated. It can then identify the noise and, if required, transmit it live to waiting ears.
Conventional microphones work when sound waves make a diaphragm move, creating an electrical signal. Microflown's sensor has no moving parts. It consists of two parallel platinum strips, each just 200 nanometres deep, that are heated to 200 °C. Air molecules flowing across the strips cause temperature differences between the pair. Microflown's software counts the air molecules that pass through the gap between the strips to gauge sound intensity: the more air molecules in a sound wave, the louder the sound. At the same time, it analyses the temperature change in the strips to work out the movement of the air and calculate the coordinates of whatever generated the sound.
Until now, the military has been using an early version of the sensor to pinpoint enemy planes and rockets. A single sensor can track and identify multiple distant jets, mortar rounds and sniper rifles in any environment.
Earlier this year, Microflown's researchers discovered by chance that the device can hear, record or stream an ordinary conversation from as far away as 20 metres, says Hans-Elias de Bree, the firm's co-founder. Signal-processing software filters out unwanted noise like wind or traffic commotion. Work is now underway to increase the range.

Given a battery and a tiny antenna, the sensor could be attached to traffic lights, a shrub or park bench. Such systems can be teamed with surveillance cameras. Detecting a shout or a gunshot, the sensor can direct the camera to the precise location of trouble, the way our ears work with our eyes. It can then start recording everything that is being said in that location.

A number of countries are now testing the matchstick sensor attached to drones and crewed vehicles, says de Bree. He foresees governments placing them on small dirigibles that tail suspects or hover over political rallies.

"Not only could this work, it has worked," says Ron Barrett-Gonzalez at the University of Kansas. He has helped boost the sensor's range by 28 per cent to more than 25 metres. It will be possible to record a parade of people on a busy sidewalk all day using a camera and acoustic sensor, and tune into each conversation or voice, live or via stored files, he says.

Security technologist Bruce Schneier says this new capability is unwelcome – particularly given the recent claims about the NSA's success at tapping into our private lives. "It's not just this one technology that's the problem," Schneier says. "It's the mic plus the drones, plus the signal processing, plus voice recognition."

**Listening to the skies**

A tiny sensor that can eavesdrop on private conversations is not just useful to big brother (see main story). Ecuador is using sensors that measure airflow for something other than spycraft. The government is putting sensors in, around and near airports to form an acoustic air-traffic control system. The sensors pinpoint a plane's direction by analysing the air movement. Software can tell if a plane is climbing, descending or straining with cargo.

While geographical features such as mountains can play havoc with radar returns, the comparative simplicity of passive listening can make Microflown's sensors less easy to fool. They are also much cheaper than radar equipment.

http://www.medscape.com/viewarticle/811723?src=rss

## Acupuncture Equal to Talk Therapy for Recurring Depression

***Acupuncture appears to be equal to counseling and may offer an additional nonpharmacologic treatment option for patients with moderate to severe depression, new research suggests.***

**Caroline Cassels**

A randomized controlled trial of acupuncture and counseling showed that both treatments garnered a statistically significant symptom reduction when provided alongside usual care in patients with recurring bouts of depression at 3 months.

"We have provided evidence that acupuncture versus usual care and counselling versus usual care are both associated with a significant reduction in symptoms of depression in the short to medium term, and are not associated with serious adverse events," the investigators led, by Hugh MacPherson, PhD, University of York in the United Kingdom, write. The study was published online September 24 in PLoS Medicine.

**Demand for Nonpharma Treatment Options**

It is estimated that depression affects more than 350 million individuals worldwide. In the United Kingdom, it is the third most common reason for primary care consultation.

In addition, the researchers point out that up to 60% of patients have an inadequate response to antidepressants, and 30% do not adhere to their medication regimen.

The researchers also note that there is a pent-up patient demand for nonpharmacologic treatment options. They note that counseling is widely used in the United Kingom, mainly for mild to moderate depression, and although acupuncture is frequently used for the treatment of depression by acupuncturists, it is rarely used in mainstream medicine. A recent Cochrane review recommended comparing counseling to other treatment modalities, including acupuncture.

With this in mind, the investigators sought to determine the clinical effectiveness of short courses of either acupuncture or counseling compared with usual care for patients with moderate to severe depression in a primary care setting.

The randomized, controlled trial included 755 patients from primary care practices in the United Kingdom who had a Beck Depression Inventory (BDI-II) score of 20 or greater. Patients were randomly assigned to 1 of 3 study arms in a ratio of 2:2:1 to acupuncture plus usual care (n = 302), counseling plus usual care (n = 302), or usual care alone (n = 151). Study participants received 12 weekly sessions of acupuncture plus usual care, 12 weekly sessions of counseling plus usual care, or usual care alone. Usual care was available according to need and was monitored for all 3 study groups for purposes of comparison.

The study's primary outcome measure was difference in mean Patient Health Questionnaire (PHQ-9) scores at 3 months, with secondary analyses at 12-month follow-up.

The final analysis included PHQ-9 data for 614 patients at 3 months and 572 patients at 12 months.

**First Study of Its Kind**

The results revealed that compared with usual care, there was a statistically significant reduction in mean PHQ-9 depression scores at 3 months for acupuncture (-2.46; 95% confidence interval [CI], -3.72 to -1.21) and counseling (-1.73; 95% CI, -3.00 to -0.45). At 12 months, there was no significant difference between acupuncture (-1.55; 95% CI, -2.41 to -0.70) and counseling (-1.50; 95% CI, -2.43 to -0.58) compared with usual care. The researchers note that they have also conducted an economic analysis of the 3 treatments to determine cost effectiveness, the results of which will be published in a separate article.

"To our knowledge, our study is the first to rigorously evaluate the clinical and economic impact of acupuncture and counselling for patients in primary care who are representative of those who continue to experience depression in primary care," the authors write. The researchers note that further research into optimal treatment regimens for acupuncture and counseling in patients with depression is warranted.

"Although these findings are encouraging, our study does not identify which aspects of acupuncture and counselling are likely to be most beneficial to patients, nor does it provide information about the effectiveness of acupuncture or counselling compared with usual care for patients with mild depression," Dr. MacPherson said in a release. *The authors report no relevant financial relationships.*

***http://www.eurekalert.org/pub_releases/2013-09/ef-rtb092713.php***

## Research reveals the benefits of strength training as physical exercise for 90-year-olds

***After doing specific training for 12 weeks, people over the age of 90 improved their strength, power and muscle mass.***

This was reflected in an increase in their walking speed, a greater capacity to get out of their chairs, an improvement in their balance, a significant reduction in the incidence of falls and a significant improvement in muscle power and mass in the lower limbs. These are some of the outcomes of the study recently published in the journal Age of the American Ageing Association and which was led by Mikel Izquierdo-Redín, Professor of Physiotherapy at the NUP/UPNA-Public University of Navarre.

24 people between 91 and 96 participated in the research, eleven of them in the experimental group and 13 in the control group. Two days a week over a 12-week period they did multicomponent training: a programme of various exercises designed specifically for them and which combined strength training and balance improving exercises. As Mikel Izquierdo explained, "the training raised their functional capacity, lowered the risk of falls, and improved muscle power. In addition to the significant increases in the physical capacity of frail elderly people, the study has shown that power training can be perfectly applied to the elderly with frailty."

With ageing, the functional capacity of the neuromuscular, cardiovascular and respiratory system progressively starts to diminish, and this leads to an increased risk of frailty. Physical inactivity is one of the fundamental factors that contributes to the loss of muscular mass and functional capacity, a key aspect in frailty.

"From a practical point of view," says Prof Izquierdo, "the results of the study point to the importance of implementing exercise programmes in patients of this type, exercises to develop muscle power, balance and walking." In his view, "it would be beneficial to apply exercises of this type among vulnerable elderly people to prevent the impact of ageing, improve their wellbeing and help them to adapt to the society in which they live."

The piece of research which has been echoed by the American Ageing Association is entitled:

"Multicomponent exercices including muscle power training enhance muscle mass, power output and functional outcomes in instituzionalized frail nonagenarians".

***http://www.eurekalert.org/pub_releases/2013-09/isu-otl092613.php***

## Over the limit

***Size, shape and color of wine glass affect how much you pour***

AMES, Iowa – Pouring a glass of wine is rarely an exact measurement, especially in a social setting. While most people think of a glass as one serving, in reality it could be closer to two or three. Just how much one pours is influenced by a variety of environmental factors, researchers at Iowa State and Cornell universities discovered, and that could have serious consequences when it comes to overconsumption.

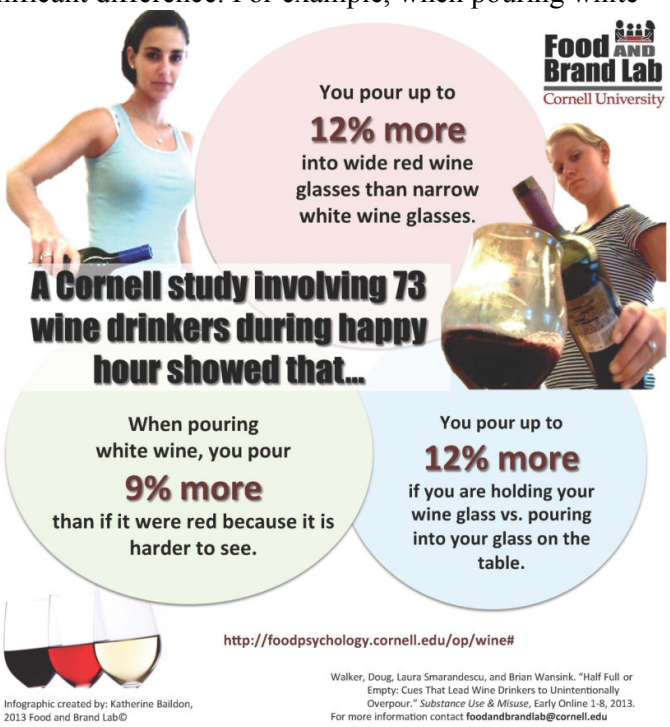
In the study, published in Substance Use and Misuse, participants were asked to pour what they considered a normal drink using different types of glasses in various settings. The results show how easy it is to overdo it. Participants poured around 12 percent more wine into a wide glass than a standard one. The same was true when holding a glass while pouring compared to placing the glass on a table.

"People have trouble assessing volumes," said Laura Smarandescu, an assistant professor of marketing at Iowa State. "They tend to focus more on the vertical than the horizontal measures. That's why people tend to drink less when they drink from a narrow glass, because they think they're drinking more."

Researchers tested six environmental cues to understand how each influenced the amount poured. The contrast between the glass and color of the wine also made a significant difference. For example, when pouring white wine into a clear glass, participants poured 9 percent more than pouring red, which had a greater contrast to the glass. The influence of a small and large table setting was not as strong.

Wine is different from alcoholic drinks that are served in a bottle or measured with a shot glass, making it easy for individuals to over pour. A standard serving of wine is 5 ounces, according to the National Institute on Alcohol Abuse and Alcoholism. But Doug Walker, an assistant professor of marketing at Iowa State and lead author of the study, said it's easy to lose track of how many drinks you've had, if you are pouring more than you realize.

"If you ask someone how much they drink and they report it in a number of servings, for a self-pour that's just not telling the whole story. One person's two is totally different than another person's two," Walker said. "Participants in the study were asked to pour the same amount at each setting, but they just couldn't tell the difference."




**Learning to control serving size**

Efforts to lower obesity rates have generated greater awareness about portion control when it comes to food. The creation of 100-calorie packs and visual aids, like a deck cards to measure 3 ounces of meat, make it easier to limit a serving size. Brian Wansink, director of the Food and Brand Lab at Cornell, said it is just as easy to help people drink less.

"If you want to pour and drink less wine, stick to the red wine glasses and only pour if your glass is on the table or counter and not in your hand – in either case you'll pour about 9-12 percent less," Wansink said.

Unlike eating too much, there are more immediate and serious consequences associated with drinking too much. Smarandescu said people will often rely on internal cues, such as a full feeling, when eating, but that doesn't work with drinking. The study demonstrates the need to educate people about how to measure a proper serving size of alcohol, she said.

"I think this helps us understand drinking behaviors to see how these cues influence individual pours. When you add this information about how people pour, to survey data of how much people drink, then you have a more complete picture about how people drink," Smarandescu said.

**Raising a glass to awareness**

Eliminating all bias to guarantee a perfect serving size is not practical, but making wine drinkers aware of environmental factors can limit the extent to which they over pour. To better understand this impact, researchers asked participants to identify which factors may have caused them to pour too much. The factors that ranked highest, such as the wide glass, were those with the greatest influence on pouring.

"The fact they were able to know retrospectively, but they still poured different amounts, told us they didn't think about it when pouring. Otherwise, they would have adjusted. So they had to be prompted to think about how much they poured," Walker said.

Researchers add that even though participants could identify those environmental factors, it does not suggest they knew how much more they were pouring to accurately track their alcohol intake.

***http://www.eurekalert.org/pub_releases/2013-09/byu-nbc092613.php***

## New breast cancer imaging technique could cut down on false positives

***Researchers getting 5-times more accurate images with sodium MRI device***

A joint BYU-Utah research team is developing a new breast cancer screening technique that has the potential to reduce false positives, and, possibly, minimize the need for invasive biopsies. Led by BYU electrical engineer Neal Bangerter and University of Utah collaborators Rock Hadley and Joshua Kaggie, the group has created an MRI device that could improve both the process and accuracy of breast cancer screening by scanning for sodium levels in the breast.

"The images we're obtaining show a substantial improvement over anything that we've seen using this particular MRI technique for breast cancer imaging," said Bangerter, senior author on a study detailing the method in academic journal Magnetic Resonance in Medicine. Specifically, the device is producing as much as five-times more accurate images than previous efforts with an emerging methodology called sodium MRI.
Currently, there are two clinical imaging methods widely used for screening breast cancer: mammograms and proton MRI scans.
X-ray mammography is the most common screening tool, but the procedure involves x-ray exposure and is generally unpleasant. Mammograms are relatively inexpensive, but they still lead to biopsies when something suspicious is detected.
Because of their increased sensitivity, proton MRI scans are generally used to further examine suspicious areas found by mammograms. However, they can produce false positives leading to unnecessary interventions.
Sodium MRI has the potential to improve assessment of breast lesions because sodium concentrations are thought to increase in malignant tumors. Bangerter and his team believe that the addition of sodium MRI to a breast cancer screening exam could provide important additional diagnostic information that will cut down on false positives.
The team has developed a new device used for sodium imaging that is picking up a level of detail and structure not previously achieved.
"This development by Dr. Bangerter and his group represents a major advance in the field of multinuclear MRI of the breast," said Stanford Professor of Radiology Bruce Daniel. "He and his group have invented a way to dramatically boost the sodium signal from the breast, enabling much better, higher resolution sodium MR images to be obtained. This should open the door to new avenues of research into breast cancer."
So far, the novel technique returns high-quality images in only 20 minutes, improving the odds that sodium MRI breast scans could be implemented clinically.
The MRI team's goal is to produce a device capable of obtaining both excellent sodium and good proton images without requiring the patient being screened to be repositioned for multiple scans.
"This method is giving us new physiological information we can't see from other types of images," Bangerter said. "We believe this can aid in early breast cancer detection and characterization while also improving cancer treatment and monitoring."
*Bangerter's major University of Utah collaborators include Hadley, Glen Morrell and Dennis Parker, all professors of radiology at the University of Utah's Center for Advanced Imaging Research, and Kaggie, a graduate research assistant who is the primary author on the recent academic journal article detailing the work.*

***http://www.sciencedaily.com/releases/2013/09/130926123326.htm***

## Newly Identified Antibodies Effectively Treat Alzheimer's-Like Disease in Mice

***Study conducted in mice suggests that newly identified antibody treatments can prevent the accumulation of tau proteins***

Alzheimer's disease is characterized by the accumulation of particular toxic proteins in the brain that are believed to underlie the cognitive decline in patients. A new study conducted in mice suggests that newly identified antibody treatments can prevent the accumulation of one of these of these toxic components, called tau proteins. The findings, online September 26 in the Cell Press journal Neuron, suggest that these antibodies may provide a basis for a promising therapy for patients with Alzheimer's disease and other neurodegenerative disorders.
In the brains of patients with Alzheimer's disease and several other neurodegenerative conditions, tau proteins aggregate together and become tangled, a process that interferes with the brain's function and can cause many of the symptoms that patients experience.
Investigators led by Drs. David Holtzman and Marc Diamond of Washington University School of Medicine in St. Louis conducted studies in mice to reveal potential treatments to block this process. "We have identified anti-tau antibodies that can strongly reduce tau pathology, decrease tau accumulation, and improve cognitive function in a mouse model of a neurodegenerative disease called frontotemporal dementia," explains Dr. Holtzman. "Similar tau pathology is seen in Alzheimer's disease, implying that this could be an exciting treatment for a large number of patients."
To make their discovery, the researchers used a screening technique to sift through numerous antibodies to isolate those that could prevent uptake of tau aggregates by cells and block subsequent intracellular tau aggregation. They then infused three anti-tau antibodies into the brains of diseased mice over three months. While the anti-tau antibodies markedly reduced tau accumulation and improved cognitive deficits in the animals, a control antibody not directed against tau had no beneficial effects. The findings further support work

suggesting that spread of tau aggregates between cells is an important mechanism underlying tau-mediated disease.

This study, which is the first to report the effects of direct infusion of anti-tau antibodies into the brain, has important implications for the design of therapeutic antibodies for patients struggling with some of the most debilitating brain diseases. "In addition to the near-term implications for passive vaccination of patients, it suggests that therapies designed to target propagation of protein aggregation between cells could be very effective," says Dr. Diamond.

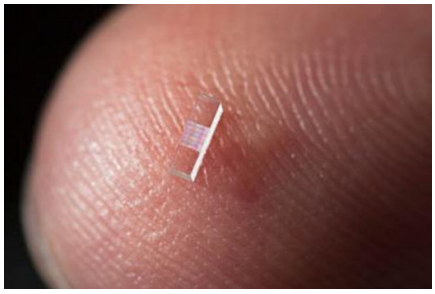
*Yanamandra et al. Anti-tau antibodies that block tau aggregate seeding in vitro markedly decrease pathology and improve cognition in vivo. Neuron, September 2013*

***http://www.eurekalert.org/pub_releases/2013-09/dnal-rd092613.php***

## Researchers demonstrate 'accelerator on a chip'

***Technology could spawn new generations of smaller, less expensive devices for science, medicine***

In an advance that could dramatically shrink particle accelerators for science and medicine, researchers used a laser to accelerate electrons at a rate 10 times higher than conventional technology in a nanostructured glass chip smaller than a grain of rice. The achievement was reported today in Nature by a team including scientists from the U.S. Department of Energy's (DOE) SLAC National Accelerator Laboratory and Stanford University.



"We still have a number of challenges before this technology becomes practical for real-world use, but eventually it would substantially reduce the size and cost of future high-energy particle colliders for exploring the world of fundamental particles and forces," said Joel England, the SLAC physicist who led the experiments. "It could also help enable compact accelerators and X-ray devices for security scanning, medical therapy and imaging, and research in biology and materials science."

***The key to the accelerator chips is tiny, precisely spaced ridges, which cause the iridescence seen in this close-up photo.***
**Matt Beardsley, SLAC National Accelerator Laboratory**

Because it employs commercial lasers and low-cost, mass-production techniques, the researchers believe it will set the stage for new generations of "tabletop" accelerators.

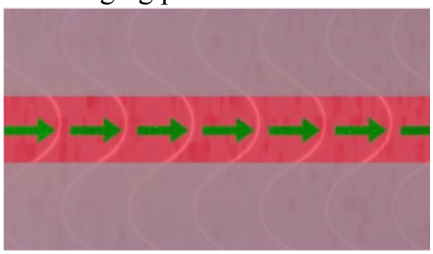
At its full potential, the new "accelerator on a chip" could match the accelerating power of SLAC's 2-mile-long linear accelerator in just 100 feet, and deliver a million more electron pulses per second. This initial demonstration achieved an acceleration gradient, or amount of energy gained per length, of 300 million electronvolts per meter. That's roughly 10 times the acceleration provided by the current SLAC linear accelerator.

"Our ultimate goal for this structure is 1 billion electronvolts per meter, and we're already one-third of the way in our first experiment," said Stanford Professor Robert Byer, the principal investigator for this research.

Today's accelerators use microwaves to boost the energy of electrons. Researchers have been looking for more economical alternatives, and this new technique, which uses ultrafast lasers to drive the accelerator, is a leading candidate.

Particles are generally accelerated in two stages. First they are boosted to nearly the speed of light. Then any additional acceleration increases their energy, but not their speed; this is the challenging part.

In the accelerator-on-a-chip experiments, electrons are first accelerated to near light-speed in a conventional accelerator. Then they are focused into a tiny, half-micron-high channel within a fused silica glass chip just half a millimeter long. The channel had been patterned with precisely spaced nanoscale ridges. Infrared laser light shining on the pattern generates electrical fields that interact with the electrons in the channel to boost their energy. (See the accompanying animation for more detail.)



***This animation shows how our accelerator on a chip uses laser light to boost electron energy. In the accelerator-on-a-chip experiments, electrons are first accelerated to near light-speed in a conventional accelerator. Then they are focused into a tiny, half-micron-high channel within a glass chip just half a millimeter long. The channel had been patterned with precisely spaced nanoscale ridges. Infrared laser light shining on the pattern generates electrical fields that interact with the electrons in the channel to boost their energy.***
**Credit: Greg Stewart, SLAC National Accelerator Laboratory**

Turning the accelerator on a chip into a full-fledged tabletop accelerator will require a more compact way to get the electrons up to speed before they enter the device. A collaborating research group in Germany, led by Peter Hommelhoff at the Max Planck Institute of Quantum Optics, has been looking for such a solution.

It simultaneously reports in Physical Review Letters its success in using a laser to accelerate lower-energy electrons.
Applications for these new particle accelerators would go well beyond particle physics research. Byer said laser accelerators could drive compact X-ray free-electron lasers, comparable to SLAC's Linac Coherent Light Source, that are all-purpose tools for a wide range of research.
Another possible application is small, portable X-ray sources to improve medical care for people injured in combat, as well as provide more affordable medical imaging for hospitals and laboratories. That's one of the goals of the Defense Advanced Research Projects Agency's (DARPA) Advanced X-Ray Integrated Sources (AXiS) program, which partially funded this research. Primary funding for this research is from the DOE's Office of Science.
*The study's lead authors were Stanford graduate students Edgar Peralta and Ken Soong. Peralta created the patterned fused silica chips in the Stanford Nanofabrication Facility. Soong implemented the high-precision laser optics for the experiment at SLAC's Next Linear Collider Test Accelerator. Additional contributors included researchers from the University of California-Los Angeles and Tech-X Corp. in Boulder, Colo.*
*Citation: E. A. Peralta et al., Nature, 27 Sept 2013 (10.1038/nature12664)*

***http://www.eurekalert.org/pub_releases/2013-09/nu-uhi092713.php***

## Understanding how infants acquire new words across cultures

***Research provides new evidence of how infants acquiring Korean learn new words***

EVANSTON, Ill. --- Infants show strong universals as they acquire their native language, but a recent study with infants acquiring Korean also reveals that there are striking language differences.
Sandra Waxman, Louis W. Menk Professor of Psychology at Northwestern University, is senior author of a new study providing the first ever evidence comparing how infants (monolingual, from Korea) acquiring Korean learn new nouns and verbs.
Researchers have long suggested that in "noun friendly" languages including English, infants' attention is focused primarily on objects, typically marked by nouns. In "verb friendly" languages including Korean, Japanese and Hindi, verbs are said to enjoy a more privileged status because infants' attention is focused more directly on the actions and relations typically marked by verbs.
"Almost all of the research on infants acquiring these "verb-friendly" languages has looked at the nouns and verbs that they produce in their daily lives," said Sudha Arunachalam, lead author of the study and assistant professor of speech and hearing sciences at Boston University.
"By using an experimental method instead, our approach lets us watch infants acquire new words, so we can get real insight into the mental processes that are at work during learning."
Waxman said their new work shows strong universals in language acquisition, but also shows some real cross-linguistic differences.
"Like infants acquiring other languages, Korean infants very successfully learn nouns to name objects such as ball, bottle and boy," Waxman said. "However, when it comes to learning verbs -- names for activities and relations -- like running, hugging, twirling, we see differences across languages."
Previous research had shown that in English, 24-month-old infants were better able to learn novel verbs for novel actions (e.g., petting) if the surrounding noun phrases were explicitly mentioned (e.g., "The girl is petting the dog") than if they were dropped from the sentence (e.g., "Look. Petting!"). In contrast, the new research shows that in Korean (a language in which noun phrases are typically dropped in conversation) 24-month-olds were better able to learn novel verbs for novel actions if the surrounding noun phrases (e.g., the girl, the dog) were dropped; in fact, unlike English-acquiring infants, those acquiring Korean struggled if the nouns were explicitly mentioned.
"We know that even before infants begin to say many verbs, they begin to understand them," Waxman said. "What this new research tells us is that the information that infants need to 'get' that understanding varies, depending upon the native language they are learning. This piece of the language acquisition process is not universal; instead, it is 'language-specific.'
"Even in the early stages of language learning, infants are shaped by the structure of their native language, so much so that the way they learn verbs is influenced by the way they've been hearing verbs in the ambient language, even before they could understand them. This means that like early speech and music perception, the structure of what infants passively hear influences how they actively learn," Waxman said.
*In addition to Waxman and Arunachalam, co-authors include Erin M. Leddon of Northwestern; and Hyun-joo Song and Yoonha Lee of Yonsei University. The article "Verb Learning in Korean: Doing more with less: Verb learning in Korean-acquiring 24-month-olds" appeared online in the September 23 issue of Language Acquisition: A Journal of Developmental Linguistics.*

http://www.eurekalert.org/pub_releases/2013-09/cu-cca092713.php

## Combining Chinese and Western medicine could lead to new cancer treatments

***Combining traditional forms of Chinese and Western medicine could offer new hope for developing new treatments for liver, lung, colorectal cancers and osteosarcoma of the bones.***

Experts from Cardiff University's School of Medicine have joined forces with Peking University in China to test the health benefits of a traditional Chinese medicine.

The team also set-out to examine how by combining it with more traditional methods like Chemotherapy could improve patient outcomes and potentially lead to the development of new cancer treatments and therapies.

"Traditional Chinese medicine where compounds are extracted from natural products or herbs has been practised for centuries in China, Korea, Japan and other countries in Asia," according to Professor Wen Jiang from Cardiff University's School of Medicine, who is the director of the Cardiff University-Peking University Joint Cancer Institute at Cardiff and led the research as part of a collaboration between Cardiff University and Peking University.

"Although a few successes, most of the traditional remedies are short of scientific explanation which has inevitably led to scepticism – especially amongst traditionalists in the West.

"As a result, we set out to test the success of a Chinese medicine and then consider how combining it alongside traditional methods like Chemotherapy could result in positive outcome for patients," he adds.

Yangzheng Xiaoji is a traditional Chinese formula consisting of 14 herbs. The formula has been shown to be beneficial to cancer patients – however, until now how it works has remained unknown.

Since 2012 the Team have investigated how the formula works, discovering that it works by blocking a pathway which stops the spread of cancer cells in the body.

"The formula has been shown to be beneficial to patients with certain solid tumours, when used alone and in conventional therapies, such as Chemotherapy.

"It suggests that combining the formula with conventional as well as new therapies could hold the key to developing new treatments for cancer patients.

"We are already looking to clinical trials in treatment of lung and other cancer types."

*Funded by Cancer Research Wales and the Albert Hung Foundation – the results will be presented at the European Cancer Congress 2013 which takes place in Amsterdam between the 27th September and 1st October.*

http://www.eurekalert.org/pub_releases/2013-09/uoic-anp092713.php

## A new paradigm for nanoscale resolution MRI has been experimentally achieved

***Novel MRI technique delivers a roughly 10¬nanometer spatial resolution***

A team from the University of Illinois at Urbana-Champaign and Northwestern University has devised a novel nuclear magnetic resonance imaging (MRI) technique that delivers a roughly 10¬nanometer spatial resolution. This represents a significant advance in MRI sensitivity -- modern MRI techniques commonly used in medical imaging yield spatial resolutions on the millimeter length scale, with the highest-resolution experimental instruments giving spatial resolution of a few micrometers.

"This is a very promising experimental result," said U. of I. physicist Raffi Budakian, who led the research effort. "Our approach brings MRI one step closer in its eventual progress toward atomic-scale imaging."

MRI is used widely in clinical practice to distinguish pathologic tissue from normal tissue. It is noninvasive and harmless to the patient, using strong magnetic fields and non-ionizing electromagnetic fields in the radio frequency range, unlike CT scans and tradiational X-rays, which both use more harmful ionizing radiation.

MRI uses static and time-dependent magnetic fields to detect the collective response of large ensembles of nuclear spins from molecules localized within millimeter-scale volumes in the body. Increasing the detection resolution from the millimeter to nanometer range would be a technological dream come true.

The team's breakthrough -- the new technique introduces two unique components to overcome obstacles to applying classic pulsed magnetic resonance techniques in nanoscale systems. First, a novel protocol for spin manipulation applies periodic radio-frequency magnetic field pulses to encode temporal correlations in the statistical polarization of nuclear spins in the sample. Second, a nanoscale metal constriction focuses current, generating intense magnetic field-pulses.

In their proof-of-principal demonstration, the team used an ultrasensitive magnetic resonance sensor based on a silicon nanowire oscillator to reconstruct a two-dimensional projection image of the proton density in a polystyrene sample at nanoscale spatial resolution. "We expect this new technique to become a paradigm for nanoscale magnetic-resonance imaging and spectroscopy into the future," added Budakian. "It is compatible with and can be incorporated into existing conventional MRI technologies."

*The team's work is published in "Nanoscale Fourier-Transform Magnetic Resonance Imaging" in Physical Review X, v. 3, issue 3, 031016.*

http://www.sciencedaily.com/releases/2013/09/130927183114.htm

# Survival After Cancer Diagnosis Strongly Associated With Governments Spending On Health Care

***The more an EU (European Union) national government spends on health, the fewer the deaths after a cancer diagnosis in that country, according to new research to be presented to the 2013 European Cancer Congress (ECC2013) and published simultaneously in the leading cancer journal Annals of Oncology.***

Researchers will tell the meeting that higher wealth and higher health expenditure are strongly associated both with increased cancer incidence and decreased cancer mortality. In the case of breast cancer, increased health expenditure appears to be even more strongly associated with better outcomes.

Dr Felipe Ades, MD, a medical oncologist at the Breast European Adjuvant Studies Team (BrEAST), a clinical trials unit and data centre in Belgium, will say: "We have observed that the more spent on health, the fewer the deaths after a cancer diagnosis and this is specially marked in breast cancer. We have also noticed that, despite all the initiatives to standardise public health policies, there is significant variation between health expenditure and cancer incidence and mortality in the 27 EU member states. This disparity is more glaring between the Western and Eastern European countries." [3]

Dr Ades and his colleagues obtained information on populations, cancer incidence, and mortality from the World Health Organization, the International Monetary Fund and the World Bank [4]. They looked at factors such as countries' gross domestic product (GDP), the percentage of GDP invested in healthcare and health expenditure per person per year, and compared these wealth and health expenditure indicators with their own estimates of the proportion of patients dying after a cancer diagnosis.

While the population of Western Europe – approximately 400 million inhabitants – is around four times larger than that of Eastern Europe, Western countries' total GDP is more than 10-fold higher than that of Eastern Europe [5]. The researchers also found a significant difference between the health expenditure of these countries.

"Not surprisingly, health expenditure per capita is strongly correlated with the GDP per capita and with the percentage of GDP spent on heath," Dr Ades will say. "The cut-off point between Eastern and Western European countries for health expenditure per person per year is around 2,600 US dollars. For instance, among the Western European countries Portugal has the lowest per capita expenditure at 2,690 dollars, while among the Eastern European countries, Slovenia has the highest per capita expenditure at 2,551 dollars. In the West, Luxembourg spent the most per person per year – 6,592 dollars – while in the East, Romania spent the least – 818 dollars."

The researchers found that, proportionally, Eastern Europe had lower cancer incidence and higher cancer mortality, while the opposite was the case in Western Europe. Dr Ades will tell the congress: "From our results it is evident that Eastern European countries, except Cyprus, have higher mortality rates than the Western European countries for approximately the same range of incidence. This indicates that proportionally more patients die after a diagnosis of cancer in Eastern Europe than in Western Europe. This pattern is strongly associated with health expenditure; the more a country spends on health, the fewer patients die after a cancer diagnosis.

"In countries spending less than 2,000 dollars per capita in health care, like Romania, Poland and Hungary, around 60% of the patients die after a diagnosis of cancer; in countries spending between 2,500-3,500 dollars this figure is around 40% and 50%, as in the case of Portugal, Spain and the United Kingdom; moving up to around 4,000 dollars, less than 40% of the patients die, as in the case of France, Belgium and Germany."

The research does not analyse the reasons for the higher incidence of cancer in Western European countries. However, it suggests that, as cancer deaths do not increase in the same proportion to incidence in these countries, it may be due partly to the existence of greater numbers of Western screening programmes, which detect more cancers at their early, more treatable stages, and to the availability of effective treatments in these countries.

Dr Ades and his colleagues also looked specifically at breast cancer. "We did this because breast cancer is the best example of an oncologic disease with effective screening methods. Also, in European populations it has been shown that breast cancer screening reduces mortality in comparison to non-screening," he will say. "We found that the association between greater wealth and higher health expenditure and the incidence of breast cancer was even stronger than in other cancers, a fact possibly linked to the inherent higher incidence of breast cancer in Western countries but also to the increased detection due to screening availability, although this was not the case for deaths from the disease as breast cancer mortality is similar across the European Union. However, when we divided the number of new cases of breast cancer by the number of deaths from breast cancer to establish the ratio of deaths to incidence, we found that a smaller fraction of patients died after

diagnosis in Western Europe than in Eastern Europe, and this was also strongly associated with higher wealth and health expenditure."
Dr Ades will also say: "Although financing health systems is a responsibility of national governments, the European Union has enacted a Charter of Fundamental Rights to standardise public health policies. Our research demonstrates that despite the initiatives to render more uniform the health policy across the EU member states, there are still marked differences between Eastern and Western Europe in regards to cancer indicators. More research is needed to investigate these issues further."
ECCO president, Professor Cornelis van de Velde, commented: "This is an interesting study confirming that, just as overall life expectancy is higher in countries that spend proportionately more on health, so cancer patients' survival is also higher in these countries. It is interesting to see that this association is even stronger for patients with breast cancer as compared to other cancers, and that, despite the initiatives to standardise health care across Europe, disparities are still present.
"Factors such as the proportion of GDP spent on health, levels of employment and numbers of hospital beds are associated with a favourable prognosis for cancer patients, and previous studies have shown that these appear to be responsible for over 65% of the variations between countries in survival for breast cancer in Western Europe."
ESMO spokesperson, Professor José Martin-Moreno, Professor of Public Health at the Medical School at the Universidad de Valencia (Spain), commented: "Cancer is a leading cause of mortality in Europe, and yet there is an important deficit between the resources needed to control it and those deployed to do so. In this context, Dr Ades and colleagues have produced an important study, confirming that funding for health systems is crucial to ensuring good patient outcomes and warning over health inequalities across the EU countries. Given the ongoing economic recession, this is a message that European governments and citizens need to know. Public health expenditure, along with adequate governance and accountability mechanisms, evidence-based guidelines, and proper capacity-building, are all essential ingredients for a strong health system and for a better society."
*[1] The 2013 European Cancer Congress is the 17th congress of the European CanCerOrganisation (ECCO), the 38th congress of the European Society for Medical Oncology (ESMO) and the 32nd congress of European Society for Therapeutic Radiology and Oncology (ESTRO).*
*[2] "Discrepancies in cancer incidence and mortality and its relationship to health expenditure in the 27 European Union member states," by F. Ades, C. Senterre, E. de Azambuja, R. Sullivan, F. Popescu F. Parent & M. Piccart. Annals of Oncology. doi: 10.1093/annonc/mdt352. Annals of Oncology website: http://annonc.oxfordjournals.org/*
*[3] The study was performed before Croatia joined the European Union on July 1, 2013.*
*[4] Data extracted from the publicly available databases of the World Health Organization (GLOBOCAN 2008 and WHO World Health Statistics 2012), the International Monetary Fund Report 2009, and the World Bank Report 2011.*
*[5] Total Western countries GDP is US$ 16,166,150,000,000. Total Eastern countries GDP is US$ 1,375,320,000,000.*
*[6] This study received no external funding.*
*F. Ades, C. Senterre, E. de Azambuja, R. Sullivan, F. Popescu F. Parent & M. Piccart. Discrepancies in cancer incidence and mortality and its relationship to health expenditure in the 27 European Union member states. Annals of Oncology, September 2013 DOI: 10.1093/annonc/mdt352*

***http://www.sciencedaily.com/releases/2013/09/130927183116.htm***

## Irrefutable Evidence That Fall in Death Rates from Colorectal Cancer Due to Screening Programmes

***Screening for colorectal cancer (CRC) in European countries is highly effective in reducing mortality from the disease.***

Some of the resources currently being devoted to breast and prostate screening programmes, where the evidence of effectiveness is much less clear-cut, should be reallocated to the early detection of CRC, the 2013 European Cancer Congress (ECC2013) will hear today.
Professor Philippe Autier, Vice President, Population Studies, at the International Prevention Research Institute, Lyon, France, will report on results extracted from data on CRC collected as part of the Survey of Health, Aging, and Retirement in Europe (SHARE) project on exposure to screening in men and women aged 50 and over in 11 European countries between 1989 and 2010. Using the World Health Organisation cause of death database, the researchers calculated changes in death rates from CRC in the different countries, and related them to the scope and take-up of CRC screening activities.
Screening involves either a faecal occult blood test (FOBT), which checks a sample of faeces for hidden blood, or endoscopy, where a tiny camera is introduced into the large bowel to look for the polyps that can be a precursor of cancer. Screening activities were either part of national programmes, for example FOBT screening in France and in the UK, FOBT or endoscopy in Germany and some Italian regions, or the result of decisions

made by individuals and their doctors. Endoscopic screening is often carried out without a prior FOBT examination.
"We saw quite clearly that the greater proportions of men and women who were screened, the greater the reductions in mortality," Prof Autier will say. "Reduced death rates from CRC were not noticeable in countries where screening was low, even though healthcare services in those countries were similar to those in countries where screening was more widespread."
In Austria, where 61% of all those studied reported having undertaken a FOBT, deaths from CRC dropped by 39% for men and 47% for women during the period. In Greece, however, where only 8% of males had had an endoscopic examination as opposed to 35% in Austria, death rates from CRC rose during the period by 30% for men and 2% for women.
Overall, in all the European countries studied, 73% of the decrease in CRC mortality over ten years in males, and 82% in females, could be explained by their having had one or more endoscopic examination of the large bowel over the last ten years. "The evidence could not be clearer," Prof Autier says, "and it is therefore very disappointing that national differences in the availability of CRC screening programmes are still so pronounced."
The researchers believe that the large differences in screening rates between different European countries are due to a number of factors. "First, many countries still do not have a national CRC screening programme. Second, the acceptability of screening methods is often low, sometimes due to cultural differences between countries. There is also the question of the availability of qualified personnel. In some countries, there are insufficient gastroenterologists available to perform endoscopy. Even with FOBT screening, an endoscopy is needed if the test is positive," says Prof Autier.
Since the main goal of CRC screening is to remove polyps in the bowel, the risk of over-diagnosis is low, unlike that seen in breast and prostate cancer screening. "The risk of bowel perforation with endoscopy, while not non-existent, is very low and so far no trial has reported rates of perforation that could compromise the feasibility of screening on either practical or ethical grounds," Prof Autier says.
The researchers now intend to gather further data on screening and to include those from the USA, Canada, and Australia. "There are signs that CRC screening can reduce the incidence of this cancer as well as mortality from it, in exactly the same way as is happening with cervical cancer screening. We would also like to investigate the cost-effectiveness of CRC screening, since we believe that it has the potential to bring about economic gains associated with averted CRC cases and deaths, and hence to more than pay for its initial cost," says Prof Autier. "If two-thirds of eligible people in each country attend screening, we believe that we could see a considerable reduction in CRC mortality in a minimum of ten years. National healthcare services need to put more effort into organising screening programmes based on FOBT or endoscopy, and into informing people aged 50 and over about the availability of these tests so that they can make a choice."
The evidence for the reduction in mortality from CRC screening programmes is just as strong as it is for cervical cancer, the researchers say. It is strengthened by the fact that there are major differences between countries where health care is of similar quality, which can only be attributed to the differences in screening rates. For example, 34% of men in France aged 50 or more and 12% of men in the same age group in The Netherlands had an endoscopic screening during the period studied. Between 1996 and 2009, CRC mortality decreased by 31% in men in France but the decrease in men in The Netherlands was only 4% over the same period. A similar pattern was seen in women from the two countries.
"There is a clear relationship between randomised trials showing the ability of any type of CRC screening to reduce the risk of death from the disease, data from cancer registries showing declines in the incidence of advanced CRC, and declines in CRC mortality over time. In breast cancer, there is no such smooth logical sequence between randomised trials and these population statistics. It seems to us that there is now an irrefutable case for devoting some of the resources from breast and prostate cancer screening to the early detection of CRC," Professor Autier will conclude.
Professor Cornelis van de Velde, President of ECCO, said: "Colorectal cancer screening works, but this study shows major differences in Europe in its use and structure. It is very disappointing that there are so many differences in outcome due to limitations in the use of screening. People over 50 should be informed of the availability of the test, and pressure should be put on national health services to put more effort into organising screening programmes. Now there is an initiative to compare data, not only within Europe but also from USA, Canada and Australia. It is certainly an ECCO priority to harmonise colorectal cancer screening throughout Europe so that every future colorectal cancer patient will get the best chance of early detection."
ESMO spokesperson, Professor Eric Van Cutsem, from the University Hospitals Leuven, Leuven, Belgium, said: "These interesting data underline the utility of systematic colorectal cancer screening, as currently

recommended by the European Council. The findings also support the need to sensitise politicians and the public on the need for well-organised screening programmes, incorporating good quality assurance, in order to raise public awareness and achieve high rates of participation."

***http://bit.ly/1aj28Xw***

## Killer cells trained on leukemia may protect some people

***Immune system seems to remember cancer in people who've never had it***

**By Jessica Shugart**

Echoes of past encounters with leukemia flow through the veins of people who have never suffered from the disease, a study suggests. The immune systems of cancer-free people may have gathered antileukemia forces by mounting preemptive strikes against cells that were on their way to becoming cancerous. Leukemia patients, on the other hand, carry meager signs of resistance. “Perhaps we’ve all had a bit of precancerous disease,” says immunologist Mark Cobbold of the University of Birmingham in England, who led the study with Birmingham colleague Hugo De La Peña. Just as immune cells reflect a person’s history of viral infections, the fingerprint of cancer exposures could lie there as well, Cobbold says.

After an encounter with any pathogen, a fraction of immune cells that fought in the battle stick around, lying in wait for the next attack. Cobbold, De La Peña and their colleagues found in healthy people killer immune cells that appeared to have been scent-trained on cancer cells. And the scientists identified the scent as well: a family of peptides, or small fragments of proteins, that coat the surfaces of cancer cells.

The peptides come from proteins inside the cell — signposts that killer cells called T cells normally use to sniff out virus-infected cells. The cancer peptides were adorned with chemical modifications called phosphate groups. The addition of phosphate groups to proteins communicates signals that control cell growth and survival. But cancer cells switch this process into overdrive, says De La Peña. “The cancer cell needs this ‘crazy phosphorylation’ to become malignant,” he says. “And this is exactly what the immune system sees.”

The team identified 95 of these phosphopeptides on the surfaces of malignant cells taken from patients with leukemia. Sixty-one of the peptides appeared only on cancer cells and not on normal ones, the researchers report in the Sept. 18 Science Translational Medicine.

Then the team extracted T cells from 26 leukemia patients: 14 with chronic lymphocytic leukemia and 12 with acute myeloid leukemia, a more aggressive form of the disease. While healthy volunteers all harbored T cells that recognized the cancer phosphopeptides, only five patients with the milder leukemia did, as did two patients with acute myeloid leukemia. The researchers found that the T cells bore proteins that marked them as “memory cells,” indicating that the cells had encountered the phosphopeptides - perhaps on cancerous cells - before.

The reasons some people lack this immunity to the phosphopeptides are unclear, but the researchers speculate that those people may have had the cancer-specific killer cells and then lost them as the immune system waned with age. Or perhaps some people’s immune cells never mounted a response in the first place.

After researchers measured T cells from the patients, the 12 individuals with acute myeloid leukemia received stem cell transplants to treat their disease. Ten of them then showed immune responses to some of the peptides. If other experiments confirm that donated cells can prime a person’s immune system to respond to phosphopeptides, Cobbold proposes that screening donors for immunity to phosphopeptides could improve the success of transplants as treatment.

The researchers hope to find phosphopeptide signatures on other kinds of cancer as well and envision using the peptides to vaccinate people against cancer. “It’s a sort of tantalizing result,” says immunologist Anthony Purcell of Monash University in Melbourne, Australia. Cancer phosphopeptides, he says, likely won’t be a “global panacea.” But he calls them exciting and “a new part of the cancer vaccination toolkit.”

*M. Cobbold et al. MHC Class I-associated phosphopeptides are the targets of memory-like immunity to leukemia. Science Translational Medicine. Vol. 5, September 18, 2013, doi: 10.1126/scitranslmed.3006061.* [Go to]

***http://www.sciencedaily.com/releases/2013/09/130927105129.htm***

## Scientists Reduce Progression of Aggressive Skin Cancers in Mice

***The c-Fos oncogene has traditionally been linked to cellular activities related to cancer, such as cell division, differentiation -- conversion from one cell type to another -- or survival.***

Any alteration of these activities can set off the development of tumours, which has made c-Fos an important target for the understanding and treatment of cancer.

A study led by Erwin Wagner, head of the F-BBVA-CNIO Cancer Cell Biology Programme and of the Genes, Development and Disease Group, has revealed a novel mechanism in which c-Fos is able to promote skin cancer: an increase in c-Fos expression in the skin stimulates the immune system, which induces the appearance of squamous cell carcinomas (SCCs), one of the most aggressive skin cancers.

Another important result from this study is the observation in mice of a decrease in the progression of SCCs by using anti-inflammatory drugs, which block the immune response induced by c-Fos. The conclusions are published in the latest issue of the journal Genes and Development, and are featured on its cover.

**The Immune System: Two Sides Of The Same Coin**

The classic way of looking at inflammatory immune response, which is more than 100 years old, asserts that defence mechanisms protect the organism when faced with neoplasms. This vision has given way over the last few years to new evidence that suggests chronic inflammation favours the proliferation and survival of tumour cells, thus increasing susceptibility to cancer.

"We know that there are cancers, like pancreatic, liver or colon cancer, in which the inflammatory component plays a very important role in the development of the disease," says Juan Guinea-Viniegra, a researcher from Wagner's team.

Furthermore, inflammatory skin diseases, such as lupus or chronic ulcers, predispose patients to develop tumours, although for now the mechanisms responsible for this phenomenon had not been discovered.

The research sheds light on this question for the first time. Eva Briso, first author of the study says: "We have discovered that mice that have higher c-Fos expression in the skin promote the recruitment of immune cells, known as CD4+T, leading to the development of skin lesions and carcinogenesis."

Briso adds that when mice were treated with anti-inflammatory drugs that specifically blocked CD4+T cell-mediated immune response, tumours decreased. Furthermore, the researchers analysed samples from nearly a hundred patients with SCCs, in which they found that up to 75% of the tumours displayed increased c-Fos expression, as well as an increase in inflammatory activity.

These results open up the possibility of using anti-inflammatory drugs as a means of treating patients with this pathology. "If we find molecules that in patients are able to block this immune response, we could think about a new specific therapy for this disease," says Wagner.

Squamous cell carcinoma is a very aggressive type of skin cancer that can invade other tissues and form metastasis. It affects 16 out of every 100,000 people in Europe and is the type of skin cancer most related to sun exposure. Due to the few biological and molecular data available on the disease, the standard treatment is reduced to surgery and radiotherapy.

*E. M. Briso, J. Guinea-Viniegra, L. Bakiri, Z. Rogon, P. Petzelbauer, R. Eils, R. Wolf, M. Rincon, P. Angel, E. F. Wagner. Inflammation-mediated skin tumorigenesis induced by epidermal c-Fos. Genes & Development, 2013; 27 (18): 1959 DOI: 10.1101/gad.223339.113*

***http://www.eurekalert.org/pub_releases/2013-09/sri-sri092713.php***

## Scripps Research Institute study finds new moves in protein's evolution

***Findings point to new approach to drug design***

LA JOLLA, CA - Highlighting an important but unexplored area of evolution, scientists at The Scripps Research Institute (TSRI) have found evidence that, over hundreds of millions of years, an essential protein has evolved chiefly by changing how it moves, rather than by changing its basic molecular structure.

The work has implications not only for the understanding of protein evolution, but also for the design of antibiotics and other drugs that target the protein in question.

"Proteins are machines that have structures and motions," said TSRI Professor Peter E. Wright, who is the Cecil H. and Ida M. Green Investigator in Biomedical Research and a member of TSRI's Skaggs Institute for Chemical Biology. "While we've known that proteins evolve via structural change, we haven't really known until now that they also evolve via changes in their dynamics."

The new study, which appears in Nature Structural and Molecular Biology on September 29, 2013, focuses on the enzyme dihydrofolate reductase (DHFR), which is so important for synthesis of DNA that it is found in almost all living organisms. DHFR is also a frequent target of medicines, including antibiotic, anticancer and antimalarial drugs.

**Family Lineage**

Wright and his laboratory have been interested in learning more about DHFR so scientists can target it more effectively and better thwart the emergence of drug resistance. In a study published in 2011 in Science, Wright and his colleagues demonstrated that the dynamics of the DHFR enzyme in the common bacterium E. coli are crucial to its catalytic function.

For the new study, the researchers analyzed and compared the dynamics of the E. coli DHFR enzyme with those of human DHFR: despite eons of separate evolution, the human and bacterial enzymes retain very similar atomic-level structures.

The team used a variety of techniques to characterize the two versions of the enzyme, including X-ray crystallography and nuclear magnetic resonance, analyses of DHFR amino-acid sequences and evaluations of

the enzyme's functionality in cells and in vitro under various conditions. They also examined DHFRs from other species in addition to bacteria and humans to get a better idea of the evolutionary paths the enzyme took on its way to higher organisms.
"We didn't imagine, when we started, how different the dynamics would turn out to be and that there would be an evolutionary pattern of atomic-level dynamics in the enzyme family," said Gira Bhabha, who was first author of the study. Bhabha, a graduate student at TSRI during the study, is now a postdoctoral researcher at the University of California, San Francisco (UCSF).
E. coli DHFR uses relatively extended motions of flexible amino-acid loops in its active region to grip and release its binding partners. The human enzyme seems to move subtly and efficiently by comparison and essentially with a different mechanism. "The dominant motion in the human enzyme is a clam-shell-like movement with a twist, which allows opening and closing of its active site," said Bhabha.

**Looking Back to Chart a Path Forward**

Bhabha and Wright suspect that these strikingly different dynamics of the E. coli and human DHFRs evolved as adaptations to very different cellular environments. Indeed, the human DHFR appears to be so well tuned for working in human cells that—as the researchers found—it cannot work properly in E. coli cells. "It seems that the much higher concentration of product molecules in E. coli cells effectively shuts down the human version of the enzyme," Bhabha said.
Wright and his laboratory now plan further investigations of DHFR's dynamics and hope eventually to elucidate the sequence of mutations that occurred to differentiate DHFR in humans and other mammals from the evolutionarily older, bacterial forms of the enzyme.
That evolutionary history should help scientists understand how evolutionary changes in DHFR lead to drug resistance. Knowing how human DHFR differs in its dynamics from its counterparts in bacteria and other disease-causing organisms also should enable researchers to design anti-DHFR drugs that are more specific for the target enzyme and have fewer side effects.
*Other contributors to the study, "Divergent evolution of protein conformational dynamics in dihydrofolate reductase," were Damian C. Ekiert, Madeleine Jennewein (who made substantial contributions to this research while working in the Wright lab as a high school and undergraduate intern), Gerard Kroon and Lisa M. Tuttle of TSRI (Ekiert and Tuttle, TSRI graduate students during the study, are now at UCSF and the Fred Hutchinson Cancer Research Center, respectively); Christian M. Zmasek and Adam Godzik of the Sanford-Burnham Medical Research Institute; TSRI Professor H. Jane Dyson, who co-supervised Bhabha's research; and TSRI Professor Ian A. Wilson.*
*The study was supported by funds from the National Institute of General Medical Sciences (GM75995 and U54GM094586), the Skaggs Institute of Chemical Biology at TSRI and the Damon Runyon Cancer Research Foundation.*

***http://www.bbc.co.uk/news/health-24296960***

## Young mothers 'risk factor for early childhood death'

***Children born to mothers under 30 are more likely to die than those born to older mums, a report on child deaths in the UK suggests.***

While overall child mortality fell by 50% in the past 20 years, young maternal age was found to be a risk factor for death in early childhood.
Support should be extended to mothers of all ages, not just first-time teenage mums, the report said.
The research was led by the Institute of Child Health at UCL.
It looked at why children die in the UK using death registration data from January 1980 to December 2010.
It focused on child injuries, birthweight and maternal age to assess the risk factors for child deaths.
The research found that in England, Scotland and Wales, the difference in mortality between children of mothers under 30 and those born to mothers aged 30 to 34 accounted for 11% of all deaths up to nine years old.
This is equivalent to an average of 397 deaths in the UK each year, the report said.
Deaths in children born to mothers under 20 accounted for just 3.8% of all child deaths up to nine years old.
The study compared children with similar birthweight in each age category.

**'Alcohol use, smoking and deprivation'**

It reported that the biggest difference in deaths was in infants aged from one month to one year.
Among this age group, 22% of deaths in the UK were due to "unexplained causes", the report said, "which are strongly associated with maternal alcohol use, smoking and deprivation".
The report added that the current policy, which focuses support on teenage first-time mothers, was not wide-ranging enough because mothers aged under 30 account for 52% of all births in the UK.
Ruth Gilbert, lead researcher and professor of clinical epidemiology at UCL Institute of Child Health, said the findings were important.

"Young maternal age at birth is becoming a marker of social disadvantage as women who have been through higher education and those with career prospects are more likely to postpone pregnancy until their 30s.
"Universal policies are needed to address the disparities."
Jill Rutter, head of policy and research at the Family and Childcare Trust, said the government needed to do more.
"Disadvantage and maternal age are factors often associated with child deaths. The government has recognised the vulnerability of the children of teenage mothers and given these families extra help with parenting.
"In England the Family Nurse Partnership is an intensive, structured, home-visiting programme, which is offered to first-time parents under the age of 20.
"A specially trained nurse visits regularly from early pregnancy until the child is two years old. This project has excellent results, but is not available to older mothers.
"We would like the Family Nurse Partnership to be extended to take older mothers who need help."
Toll from injuries
The study, commissioned by the Healthcare Quality Improvement Partnership and published by the Royal College of Paediatrics and Child Health, had other key findings.
First, injuries continue to be the biggest cause of death in childhood, but they are declining,
Between 1980 and 2010, injuries accounted for 31% of deaths in one to four-year-olds and 48% of deaths in those aged 15 to 18.
England had consistently lower rates of deaths from injury than the other UK countries, particularly among older boys.
But there was no decline in deaths due to intentional injury or self-harm over 30 years, the report found.
Dr Hilary Cass, president of the royal college, said this was worrying.
"Injuries remain the biggest cause of child deaths but are declining, so we need to continue to build upon public policy interventions such as traffic calming.
"The lack of decline in intentional injuries calls for a concerted focus on reducing violence and self-harm in older children."
**Disabilities and serious diseases**
The study also found that up to 70% of children who die in the UK have chronic conditions such as cancer, cystic fibrosis or epilepsy.
This was not necessarily the cause of their death but likely to be an underlying factor in it.
Prof Gilbert said that although the overall number of children dying is falling, the picture was complicated by the increasing number of children now surviving with disabilities and serious diseases, and this meant that proactive care was vital.
"For some children with serious chronic conditions who are expected to die, this means high-quality end-of-life care for the child and to support their families.
"For others, their death may have been premature or completely preventable. Most children with chronic conditions are managed at home by parents with support from primary and community care services as well as hospitals. We need to focus on the quality of long-term care at home for these children as well as in hospital."