http://www.eurekalert.org/pub_releases/2013-10/du-blt100713.php

Babies learn to anticipate touch in the womb

Babies learn how to anticipate touch while in the womb, according to new research by Durham and Lancaster universities.

Using 4-d scans psychologists found, for the first time, that fetuses were able to predict, rather than react to, their own hand movements towards their mouths as they entered the later stages of gestation compared to earlier in a pregnancy.

The Durham-led team of researchers said that the latest findings could improve understanding about babies, especially those born prematurely, their readiness to interact socially and their ability to calm themselves by sucking on their thumb or fingers. They said the results could also be a potential indicator of how prepared babies are for feeding.

The researchers carried out a total of 60 scans of 15 healthy fetuses at monthly intervals between 24 weeks and 36 weeks gestation. Fetuses in the earlier stage of gestation more frequently touched the upper part and sides of their heads. As the fetuses matured they began to increasingly touch the lower, more sensitive, part of their faces including their mouths.

By 36 weeks a significantly higher proportion of fetuses were observed opening their mouths before touching them, suggesting that later in pregnancy they were able to anticipate that their hands were about to touch their mouths, rather than reacting to the touch of their hands, the researchers said.

Increased sensitivity around a fetus' mouth at this later stage of pregnancy could mean that they have more "awareness" of mouth movement, they added. Previous theories have suggested that movement in sequence could form the basis for the development of intention in fetuses. The researchers said their findings could potentially be an indicator of healthy development, as arguably fetuses who are delayed in this development due to illness, such as growth restriction, might not show the same behaviour observed during the study.

The research, published in the journal Developmental Psychobiology, involved eight girls and seven boys and the researchers noticed no difference in behaviour between boys and girls.

Lead author Dr Nadja Reissland, in the Department of Psychology, at Durham University, said: "Increased touching of the lower part of the face and mouth in fetuses could be an indicator of brain development necessary for healthy development, including preparedness for social interaction, self-soothing and feeding.

"What we have observed are sequential events, which show maturation in the development of fetuses, which is the basis for life after birth. "The findings could provide more information about when babies are ready to engage with their environment, especially if born prematurely."

Brian Francis, Professor of Social Statistics at Lancaster, added: "This effect is likely to be evolutionally determined, preparing the child for life outside the womb. Building on these findings, future research could lead to more understanding about how the child is prepared prenatally for life, including their ability to engage with their social environment, regulate stimulation and being ready to take a breast or bottle."

The study builds on previous research by Durham and Lancaster into fetal development. Earlier this year another of their studies showed that unborn babies practise facial expressions in the womb in what is thought to be preparation for communicating after birth.

And in 2012 Dr Reissland published research showing that unborn babies yawn in the womb, suggesting that yawning is a developmental process which could potentially give doctors another index of a fetus' health.

http://www.eurekalert.org/pub_releases/2013-10/l-rih100713.php

Rhode Island Hospital uncovers pathway linking heartburn and esophageal cancer

Blocking pathway might prevent esophageal cancer in patients with existing Barrett's esophagus

PROVIDENCE, R.I. – Got heartburn? More than 60 million adults in the U.S. have acid reflux, or heartburn, and approximately 10 percent are at risk for developing esophageal cancer, due in part to complications from Barrett's esophagus. But researchers at Rhode Island Hospital discovered a pathway they believe links Barrett's esophagus to the development of esophageal cancer. Their data suggest that blocking this pathway, such as with a proton pump inhibitor (e.g. omeprazole), may prevent the development of esophageal cancer. The study is published online in advance of print in the journal American Journal of Cell Physiology.

The common ailment goes by many names: heartburn, acid reflux, gastroesophageal reflux disease (GERD). But no matter what you call it, it's uncomfortable and at times painful.

There are numerous causes of acid reflux, including pregnancy; large meals and eating habits; bending forward; hiatal hernia; peptic ulcers and insufficient digestive enzymes; asthma; smoking; and alcohol. Only a small percentage of those with GERD or heartburn will develop Barrett's esophagus, a condition in which the cells of the lower esophagus become damaged from repeated exposure to stomach acid.

"Patients with persistent acid reflux complicated by Barrett's esophagus may be at a higher risk of developing cancer of the esophagus," said principal investigator Weibiao Cao, M.D., of the department of pathology and medicine at Rhode Island Hospital. "However, we have discovered a pathway connecting the two that, if blocked by complete acid suppression with a proton pump inhibitor, may reduce the risk of esophageal cancer."
Patients with acid reflux and Barrett's esophagus may need to take a proton pump inhibitor (PPI) such as omeprazole twice a day if they are still experiencing symptoms with just a single daily dose. The study also suggests that an enzyme NADPH oxidase NOX5-S, which produces hydrogen peroxide, is responsible for gene damage such as p16, a tumor suppressor, and plays an important role in the development of esophageal cancer. NOX5-S may be a preventive and/or therapeutic target for esophageal cancer.
"Further research is needed, but this finding suggests that patients with acid reflux complicated by Barrett's esophagus may be able to significantly reduce, or even eliminate, their risk of esophageal cancer through daily or twice-daily doses of PPI," Cao said.
One of the PPIs, omeprazole, is available by prescription and over the counter, but patients should consult with their physicians before taking any medication.
This study was funded by a National Institutes of Health grant (N1DDK R01 DK080703). Cao's principal affiliation is Rhode Island Hospital, a member hospital of the Lifespan health system in Rhode Island. He also has an academic appointment at The Warren Alpert Medical School of Brown University, department of pathology and medicine. Other researchers involved in the study are Jie Hong, department of medicine and department of gastroenterology at Shanghai Jiao-Tong University School of Medicine Renji Hospital in Shanghai, China; Dan Li and Jack Wands, department of medicine at Rhode Island Hospital and the Alpert Medical School; and Rhonda Souza, department of medicine, Veterans Affairs North Texas Health Care System and the University of Texas Southwestern Medical Center in Dallas.

http://www.eurekalert.org/pub_releases/2013-10/ru-gh100713.php

'White graphene' halts rust in high temps

Rice U. researchers find nano-thin films of hexagonal boron nitride protect materials from oxidizing

HOUSTON –Atomically thin sheets of hexagonal boron nitride (h-BN) have the handy benefit of protecting what's underneath from oxidizing even at very high temperatures, Rice University researchers have discovered.
One or several layers of the material sometimes called "white graphene" keep materials from oxidizing – or rusting -- up to 1,100 degrees Celsius (2,012 degrees Fahrenheit), and can be made large enough for industrial applications, they said. The Rice study led by materials scientists Pulickel Ajayan and Jun Lou appears today in the online journal Nature Communications.
Oxidation prevention is already big business, but no products available now work on the scale of what the Rice lab is proposing. The researchers see potential for very large sheets of h-BN only a few atoms thick made by scalable vapor deposition methods.
"We think this opens up new opportunities for two-dimensional material," said Lou, an associate professor of mechanical engineering and materials science. "Everybody has been talking about these materials for electronic or photonic devices, but if this can be realized on a large scale, it's going to cover a broad spectrum of applications."
Lou said ultrathin h-BN protection might find a place in turbines, jet engines, oil exploration or underwater or other harsh environments where minimal size and weight would be an advantage, though wear and abrasion could become an issue and optimum thicknesses need to be worked out for specific applications.
It's effectively invisible as well, which may make it useful for protecting solar cells from the elements, he said.
"Essentially, this can be a very useful structural material coating," Lou said.
The researchers made small sheets of h-BN via chemical vapor deposition (CVD), a process they said should be scalable for industrial production. They first grew the thin material on nickel foil and found it withstood high temperature in an oxygen-rich environment. They also grew h-BN on graphene and found they could transfer sheets of h-BN to copper and steel with similar results.
"What's amazing is that these layers are ultrathin and they stand up to such ultrahigh temperatures," Ajayan said. "At a few nanometers wide, they're a totally non-invasive coating. They take almost no space at all."
Lead authors are Rice postdoctoral researcher Zheng Liu and graduate student Yongji Gong. Co-authors are Rice graduate student Lulu Ma and Senior Faculty Fellow Robert Vajtai; Wu Zhou, a Wigner Fellow, and Juan Carlos Idrobo, a staff scientist at Oak Ridge National Laboratory; Jingjiang Yu of Agilent Technologies; Jeil Jung, a research fellow at the National University of Singapore and a postdoctoral researcher at the University of Texas at Austin; and Allan MacDonald, the Sid W. Richardson Foundation Regents Chair Professor at the University of Texas at Austin. Ajayan is the Benjamin M. and Mary Greenwood Anderson Professor in Mechanical Engineering and Materials Science and of chemistry at Rice.

The Army Research Office, the Office of Naval Research, the Welch Foundation, the Korean Institute of Machinery and Materials, the National Science Foundation, Oak Ridge National Laboratory and the Department of Energy supported the research.

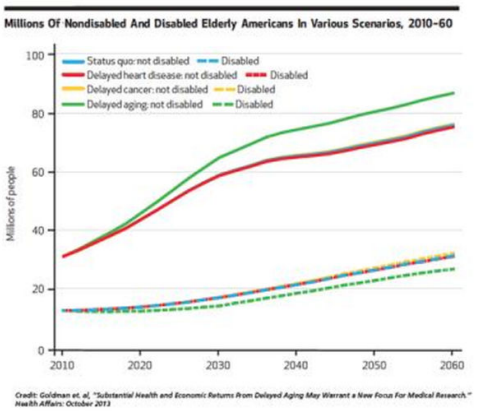
http://www.eurekalert.org/pub_releases/2013-10/uosc-dai100313.php

Delayed aging is better investment than cancer, heart disease

Even modest success in slowing aging would increase number of non-disabled older adults by five percent every year from 2030 to 2060

On the heels of an announcement from Google that the company's next startup, Calico, will tackle the science of aging, a new study shows that research to delay aging and the infirmities of old age would have better population health and economic returns than advances in individual fatal diseases such as cancer or heart disease.

With even modest gains in our scientific understanding of how to slow the aging process, an additional 5 percent of adults over the age of 65 would be healthy rather than disabled every year from 2030 to 2060, reveals the forthcoming study in the October issue of Health Affairs.



Put another way, an investment in delayed aging would mean 11.7 million more healthy adults over the age of 65 in 2060. The analysis, from top scientists at USC, Harvard, Columbia, the University of Illinois at Chicago and other institutions, assumes research investment leading to a 1.25 percent reduction in the likelihood of age-related diseases. In contrast to treatments for fatal diseases, slowing aging would have no health returns initially, but would have significant benefits over the long term.

An investment in delayed aging would mean 11.7 million more healthy adults over the age of 65 in 2060 -- far more than even optimistic advances in cancer or heart disease research, which would barely improve on the baseline of not doing anything. **Courtesy Health Affairs**

In the United States, the number of people aged 65 and over is expected to more than double in the next 50 years, from 43 million in 2010 to 106 million in 2060. About 28 percent of the current population over 65 is disabled.

"In the last half-century, major life expectancy gains were driven by finding ways to reduce mortality from fatal diseases," said lead author Dana Goldman, Leonard D. Schaeffer Director's Chair at the USC Schaeffer Center for Health Policy and Economics. "But now disabled life expectancy is rising faster than total life expectancy, leaving the number of years that one can expect to live in good health unchanged or diminished. If we can age more slowly, we can delay the onset and progression of many disabling diseases simultaneously."

The study shows significantly lower and declining returns for continuing the current research "disease model," which seeks to treat fatal diseases independently, rather than tackling the shared, underlying cause of frailty and disability: aging itself.

Lowering the incidence of cancer by 25 percent in the next few decades – in line with the most favorable historical trends – would barely improve population health over not doing anything at all, the analysis showed. The same is true of heart disease, the leading cause of death worldwide: About the same number of older adults would be alive but disabled in 2060 whether we do nothing or continue to combat cancer and heart disease individually. The findings are in line with earlier research showing that curing cancer completely would only increase life expectancy by about three years.

"Even a marginal success in slowing aging is going to have a huge impact on health and quality of life. This is a fundamentally new approach to public health that would attack the underlying risk factors for all fatal and disabling diseases," said corresponding author S. Jay Olshansky of the School of Public Health at the University of Illinois-Chicago. "We need to begin the research now. We don't know which mechanisms are going to work to actually delay aging, and there are probably a variety of ways this could be accomplished, but we need to decide now that this is worth pursuing."

Several lines of scientific inquiry have already shown how we might age more slowly, including studies of the genetics of "centenarians" and other long-lived people. Slowing the signs of biological aging has also been achieved in animal models, using pharmaceuticals or interventions such as caloric restriction.

But until now, no assessment has been made of the costs and health returns on developing therapies for delayed aging: "We would be affecting every generation. This study is a benchmark in the world of public health," Olshansky said.

The study shows that, with major advances in cancer treatment or heart disease, a 51-year-old can expect to live about one more year. A modest improvement in delaying aging would double this to two additional years — and those years are much more likely to be spent in good health.
The increase in healthy years of life would have an economic benefit of approximately $7.1 trillion over the next five decades, the researchers find. Their analysis did not account for the potential cognitive benefits for older adults with research in delayed aging.
However, the results of the study also show that improving the population of healthy, older adults will not lower overall health care spending. With research advances in delayed aging, more people would be alive past the age of 65, which means significantly higher outlays for Medicare and Medicaid despite less per-person spending on medical costs.
"Shifting the focus of medical investment to delayed aging instead of targeting diseases individually would lead to significant gains in physical health and social engagement," Goldman said. "We see extremely large population health benefits, and the benefits will extend to future generations. There are major fiscal challenges, but these are manageable with reasonable policy changes, and the economic value of such a shift is too large to ignore."
David Cutler of Harvard University, John Rowe of the Mailman School of Public Health at Columbia University, Pierre-Carl Michaud of the University of Quebec at Montreal, and Jeffrey Sullivan and Desi Peneva of Precision Health Economics are co-authors on the study.
This research was supported by the MetLife Foundation through the MetLife Foundation Silver Scholar Award, administered by the Alliance for Aging Research. Additional support for this research came from the Ellison Medical Foundation and the American Federation for Aging Research. The development of the Future Elderly Model was supported by the National Institute of Aging of the National Institutes of Health (grants: P30AG024968, RC4AG039036) and the MacArthur Research Network on an Aging Society.

http://www.eurekalert.org/pub_releases/2013-10/acos-cpm100213.php

Contralateral prophylactic mastectomy may not significantly increase life expectancy

New decision-making model helps women with early-stage breast cancer decide on most appropriate treatment

WASHINGTON, DC—Women with early-stage breast cancer in one breast are increasingly opting to undergo a more aggressive operation to remove both breasts called contralateral prophylactic mastectomy (CPM).
Rates of double mastectomies have more than doubled over the last decade for women with early-stage cancer, but for women with cancer in one breast, having the healthy breast removed may not provide a survival benefit, according to new research findings presented today at the 2013 Clinical Congress of the American College of Surgeons.
According to the American Cancer Society, more than 232,000 women are diagnosed with breast cancer in the U.S. every year,* making breast cancer the second most common type of cancer in women, after skin cancer. Many women who face this diagnosis worry about cancer recurring in the healthy breast and therefore choose to have both breasts removed, even though the risk of developing cancer in the other breast is very low. Women at high risk include those with a family history of breast or ovarian cancer and women who test positive for the BRCA1 and BRCA2 gene mutations.
Importantly, until now no study has looked at the decision-making processes that lead women to choose CPM.
"There have been several studies in the last couple of years indicating that there may be a survival benefit for selected patients by having their healthy breast removed," said study coauthor Todd M. Tuttle, MD, FACS, chief of surgical oncology, University of Minnesota, Minneapolis. "This research will provide physicians and patients with accurate and easily understood information about whether removal of the healthy breast will impact their survival at all."
To better understand the effect of CPM on life expectancy, the researchers conducted an analytic modeling study among women without a BRCA gene mutation. Within this group, the researchers compared women who underwent CPM with women who did have early-stage breast cancer in one breast and no prophylactic operation to remove the second breast.
The study authors primarily analyzed data from the Early Breast Cancer Trialists' Collaborative Group (EBCTCG) and the Surveillance, Epidemiology, and End Results (SEER) program to determine the risk of developing contralateral breast cancer (CBC), dying from CBC, dying from primary breast cancer, and the reduction in CBC due to CPM.
The two databases include information on the treatment and survival of early breast cancer and include more than 100,000 women who have participated in randomized trials over the last 30 years across the United States.

For the study, the researchers estimated the life expectancy gain of CPM among sub-groups of women newly diagnosed with cancer in one breast by age 40 to 60 years, estrogen receptor status as positive or negative, and stage of cancer I or II. They found that the maxi- mum life expectancy gain for women who underwent CPM was six months for all scenarios including age, estrogen receptor status, and cancer stage groups.
Because many women are driven by their fears of contracting a second cancer in their healthy breast, they choose a double mastectomy, the more aggressive treatment.
This procedure is a bigger operation associated with a longer recovery period and potentially more complications. Thus, experts are concerned that some patients are being overtreated with a prophylactic procedure.
"I think this decision model study will provide women who are considering these extensive operations with more accurate information about whether or not CPM is going to improve their survival," Dr. Tuttle said.
With this analytic modeling tool, women and physicians can make more informed and better decisions when choosing between different treatments. These results can help educate women that a contralateral mastectomy will not improve their survival rate if they don't have hereditary breast cancer, he explained.
"This information may ultimately help them answer an important question: 'If I have that opposite breast removed, is that procedure really going to improve the likelihood that I will be alive 10 to 20 years from now?'"
Other participants in the study include Pamela Rochelle Portschy, MD and Karen Kuntz, ScD.

http://www.eurekalert.org/pub_releases/2013-10/econ-gia100513.php

GABA inverse agonist restores cognitive function in Down's syndrome

This press release is in support of a presentation by Dr. Benoit Delatour on Monday Oct. 7 at the 26th ECNP Congress in Barcelona, Spain

BARCELONA, SPAIN - A selective GABA inverse agonist has restored cognitive function in a mouse model of Down's syndrome (DS) and has the potential to benefit humans, French researchers have revealed.
"The drug we used is a specific GABA-A α5 inverse agonist (α5IA) that hypothetically could combat the abnormal neuronal excitation/inhibition balance associated with DS", explained lead researcher Dr Benoit Delatour from the Research Centre of the Institute of Brain and Spinal Cord (Centre de Recherche de l'Institut du Cerveau et de Moelle Epinière) at the University Pierre and Marie Curie, Paris.
"We observed that repeated and even single administrations of the α5IA molecule can potentiate learning and memory performances in cognitively-impaired DS mice, underlying the potency of this therapeutic approach," he added.
An imbalance between inhibitory and excitatory neurotransmission has recently been proposed as a factor in the altered brain function of individuals with DS. While several studies have suggested GABA-A antagonists for restoring learning and memory performances in DS mouse models, many tend to cause seizures in animal models as well as in humans.
To investigate safer agents, the researchers used a GABA-A inverse agonist (α5IA) to specifically target the α5 subunit of GABA-A receptors in Ts65Dn mice, a classical animal model of DS.
They found that the drug had no convulsant effects and did not promote any side effects on sensory-motor and anxiety-related behaviours. They also found no evidence of histological changes in various organ tissues following chronic administration.
To investigate what impact α5IA had on learning and memory function, the team trained the mice in a spatial navigation (Morris water maze) task. They found that Ts65Dn mice showed a clear learning impairment that was reversed following daily treatment with α5IA. Furthermore, an acute injection of α5IA before acquisition was enough to alleviate recognition memory impairments in the Ts65Dn mice.
"α5IA enhanced behaviourally-evoked immediate early gene products (as markers of neuronal activation) in specific brain regions and also restored normal levels of gene expression in several disregulated pathways", explained Dr Delatour.
"Such stimulation of neuronal activity and normalisation of gene expression combined with the known effects of α5IA on synaptic plasticity, might support the promnestic [memory enhancing] and therapeutic effects of the drug," he added.
With future human trials planned, Dr Delatour is optimistic about the impact his research could have on cognitive impairment in individuals with DS. "The results obtained by us and by others are very encouraging ... it appears that several targets in DS have been identified and can be the source of new pharmaceutical interventions. It is very likely that the combination of different emerging therapies will provide significant clinical outcomes for people with DS."

http://www.medscape.com/viewarticle/812146

2-Dose Varicella Vaccine Having Substantial Effect

The incidence of varicella, as well as hospitalizations and outbreaks associated with it, has declined significantly since a 2-dose vaccine regimen was instituted in 2006, according to an analysis of active surveillance areas in California and Pennsylvania.

Steven Fox Pediatrics. Published online October 7, 2013

"Declines in incidence across all ages, including infants who are not eligible for varicella vaccination, and adults, in whom vaccination levels are low, provide evidence of the benefit of high levels of immunity in the population," write Stephanie R. Bialek, MD, MPH, from the National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention, Atlanta, Georgia and coauthors. The researchers published their results online October 7 in Pediatrics.

Single-dose varicella vaccination for children was introduced in the United States in the mid-1990s and has been associated with dramatic declines in incidence, hospitalizations, and deaths.

In 2006, the Advisory Committee on Immunization Practices recommended a second dose in hopes of further quelling the disease. Although it has been generally believed that the addition of the second dose would increase efficacy, there has been scant evidence to substantiate that assumption.

Therefore, Dr. Bialek and colleagues assessed 1995-2010 epidemiologic data from 2 active surveillance areas: Antelope Valley, California, and West Philadelphia, Pennsylvania.

By 2010, varicella incidence in Antelope Valley was 0.3 cases per 1000 individuals compared with 1.1 in 2006 (a 76% decline). In West Philadelphia, the incidence had declined to 0.1 per 1000 individuals from 0.4 cases (a 67% decline). Both surveillance areas showed 98% decreases in varicella cases since 1995, the authors say.

In addition, the investigators report, the incidence of varicella decreased among all age groups after introduction of the second dose, including those individuals not eligible to receive the vaccine, such as infants.

By 2010, 61.7% of patients in both Antelope Valley and West Philadelphia had received a single dose of the vaccine, whereas just 7.5% had received 2 doses.

Vaccination also appeared to curb the severity of the disease. Of patients who received a single dose of the vaccine, but nevertheless contracted the disease, 62.8% had 50 lesions or fewer. Of comparable patients who received 2 doses of the vaccine, 70.3% had fewer than 50 lesions. The difference in the number of lesions between the 2 vaccine regimens was not statistically significant. The 2-dose regimen also appeared to reduce the risk for hospitalization: Varicella-related hospitalizations declined more than 40% during 2006-2010 compared with 2002-2005, and by more than 85% compared with 1995-1998.

Further evidence of the positive effects of the 2-dose regimen is that only 12 varicella outbreaks occurred in Antelope Valley during 2007-2010 compared with 47 during 2003-2006 and 236 during 1995-1998 ($P < .01$).

The authors emphasize the importance of broadening vaccine coverage. "Full implementation of varicella vaccination recommendations across all age groups, including adolescents, adults, and women postpartum, remains critically important for ensuring the greatest possible protection of susceptible individuals at risk for severe varicella disease," they conclude.

This study was funded through a cooperative agreement with the Centers for Disease Control and Prevention.

The authors have disclosed no relevant financial relationships.

http://phys.org/news/2013-10-climate-geological-instant.html

New finding shows climate change can happen in a geological instant

"Rapid" and "instantaneous" are words geologists don't use very often. But Rutgers geologists use these exact terms to describe a climate shift that occurred 55 million years ago.

Provided by Rutgers University

Phys.org - In a new paper in the Proceedings of the National Academy of Sciences, Morgan Schaller and James Wright contend that following a doubling in carbon dioxide levels, the surface of the ocean turned acidic over a period of weeks or months and global temperatures rose by 5 degrees centigrade – all in the space of about 13 years. Scientists previously thought this process happened over 10,000 years.

Wright, a professor of earth and planetary sciences in the School of Arts and Sciences and Schaller, a research associate, say the finding is significant in considering modern-day climate change.

"We've shown unequivocally what happens when CO2 increases dramatically – as it is now, and as it did 55 million years ago," Wright said. "The oceans become acidic and the world warms up dramatically. Our current carbon release has been going on for about 150 years, and because the rate is relatively slow, about half the CO2 has been absorbed by the oceans and forests, causing some popular confusion about the warming effects of CO2. But 55 million years ago, a much larger amount of carbon was all released nearly instantaneously, so the effects are much clearer."

The window to this important decade in the very distant past opened when Wright helped a colleague, Kenneth Miller, and his graduate students split core samples they extracted from a part of southern New Jersey once covered by the ocean.
The patterns found in the long cylinder of sediment told a story. There were distinct clay bands about 2 centimeters thick occurring rhythmically throughout the cores.
"They called me over and said, 'Look at this," said Schaller. "What jumped out at me were these rhythmic clay layers, very cyclic. I thought, 'Wow, these have got to mean something."
Wright and Schaller surmised that only climate could account for the rhythmic pattern they saw. "When we see cycles in cores, we see a process," Schaller said. "In this case, it's like a tree ring. It's giving us a yearly account through the sediments."
This discovery provided the necessary data to finally solve the huge conundrum surrounding this event – the significant error in how fast the carbon was released.
Whatever the cause of the carbon release,—some scientists theorize that a comet struck the earth—Wright and Schaller's contention that it happened so rapidly is radically different from conventional thinking, and bound to be a source of controversy, Schaller believes.
"Scientists have been using this event from 55 million years ago to build models about what's going on now," Schaller said. "But they've been assuming it took something like 10,000 years to release that carbon, which we've shown is not the case. We now have a very precise record through the carbon release that can be used to fix those models."

http://phys.org/news/2013-10-runaway-binary-stars.html

Runaway binary stars

CfA astronomers made a remarkable and fortuitous discovery in 2005: an extremely fast moving star, clocked going over three million kilometers an hour.

It appears to have been ejected from the vicinity of the galactic center's supermassive black hole around 80 million years ago by powerful gravitational effects as it swung past the black hole. Racing outward from the galaxy, the star lends added credibility to the picture of a massive black hole at the galactic center, and to calculations of how black holes might interact with their stellar environments.
Other hypervelocity stars and less fast-moving runaway stars have also been found. Most of them have been accelerated by one of the two other gravitational mechanisms: ejection from a dense cluster of stars as random motions bring it into a slingshot-like orbit, or ejection from a supernova binary system after the supernovae explodes and frees it from its orbit. A binary star is a pair of stars that orbit each other, and many (perhaps most) stars are members of binary systems. So far, there have been no hypervelocity binary stars discovered. They have been predicted, however, with at least one theory proposing that the discovery of a hypervelocity binary pair might indicate that the nuclear black hole is itself a binary pair.
CfA astronomers Warren Brown and Scott Kenyon and their colleagues decided to investigate the case of the peculiar runaway binary LP400-22. The binary pair was known to consist of two very evolved orbiting stars, so-called white dwarf stars, currently about 1400 light-years away from us. The object is unique in being the only known runaway white dwarf pair, and moreover its velocity is larger than most other runaway stars. The astronomers examined its motion across the sky over a period of five years and conclude from its path in the galaxy that it almost surely was not ejected from the vicinity of the galactic center. Moreover, they report that the supernovae mechanism is also very unlikely because there is no hint at X-ray wavelengths of the remnants of such a supernova. The team concludes that the probable origin of this binary pair is in a dense stellar cluster - and indeed they can tentatively traced the path back to one of several possible globular clusters. The runaway pair was either involved in a multi-body interaction there, or was originally part of a triple-star system that was disrupted by an intermediate mass black hole in the cluster. Although the result of the investigation ended up not addressing the properties of the galactic center's black hole, it provides key insights into runaway stars, white-dwarf binaries, and the complex interactions going on in dense stellar clusters.
More information: Kilic, M. et al. The Runaway Binary LP 400?22 is Leaving the Galaxy, MNRAS, 434, 3582, 2013.

http://phys.org/news/2013-10-scientists-technique-high-speed-low-cost-epigenomic.html

Scientists create technique for high-speed, low-cost epigenomic mapping

The labs of Howard Chang, left, and William Greenleaf have developed a technique that could yield huge amounts of information about which genes are active in particular cells.

(Phys.org) —A new technique developed by researchers at the Stanford University School of Medicine could pave the way to an era of personalized epigenomics. The technique, described in a study published online Oct. 6 in Nature Methods, could quickly yield huge amounts of useful information about which genes are active in

particular cells. The technology involved is cheap, fast and easy to use, and all that would be needed from the patient is a blood sample or needle biopsy.
As word of the new technique has leaked, dozens of researchers around the world have begun putting it to work in their labs, said Howard Chang, MD, PhD, professor of dermatology at Stanford and a Howard Hughes Medical Institute early-career scientist. Chang shared senior authorship of the study with William Greenleaf, PhD, assistant professor of genetics. The lead author is graduate student Jason Buenrostro.
Genes are recipes for the production of proteins, which do almost all the work in every living cell. The biological field of genomics focuses on describing which genes an organism has. The newer field of epigenomics aims to discern which genes are actually used by various tissues within an organism—or, in the case of disease, misused. Virtually every cell in a person's body contains essentially the same genes. Yet cells from different tissues—liver, skin, muscle, blood—do very different things because they use different genes, as do otherwise identical cells in different biochemical environments, developmental stages or states of health.
For a gene to give rise to the specific protein it codes for, the gene must be read and copied (or "transcribed") by complex molecular machines. The genes of simpler, single-celled life forms, such as bacteria, are all available for transcription because those microbes' DNA floats around as a flexible, circular chromosome within the cell.
But in complex organisms from yeast and amoebas to orchids and people, few of any cell's genes are transcription-ready at any point in time. For example, humans' much larger genomes feature vastly more DNA, much of which is devoted to regulating the timing and extent of each gene's activation rather than encoding proteins. Human DNA, as well as that of other advanced life forms, is confined within a tiny cellular compartment known as the nucleus.
"If you could stitch together all 46 chromosomes in one of your cells and stretch the resulting, single string of DNA full-length, it would be about 2 meters long," said Greenleaf. "But in real life, all that DNA is scrunched up inside the cell's nucleus, which is about one two-hundred-thousandth of a meter in diameter." That's the rough equivalent, Greenleaf said, of bunching up a telephone line that stretches from New York City to Los Angeles and stuffing it into a two-bedroom house.
Most of a chromosome's DNA is tightly spooled around ball-shaped protein assemblies called nucleosomes, rendering it inaccessible for transcription. Much of the genome is blocked this way. Elsewhere, various enzymes within the cell are capable of chemically relaxing some nucleosomes' grip, unleashing erstwhile inaccessible DNA for transcription and hence altering the cell's gene-use patterns.
Some of the current methods of determining the epigenomic state of a cell are so complex that only a handful of laboratories are equipped to carry them out. These procedures require dozens of separate technical steps, start-to-finish timescales of several days or more, and millions to tens of millions of cells from the same tissue.
In order to study relatively rare cell types using these methods, you have to do one of two things, said Chang. "You can force those cells to copy themselves repeatedly in the artificial environment of a laboratory dish or flask, driving their replication with biochemical sledgehammers. By the time you get enough cells for analysis, their epigenomic state may have changed wildly from its original condition."
Alternatively, he said, you can pool biological samples from numerous different individuals. But this wipes out any possibility of meaningful personalized analyses.
The new method requires only 500 to 50,000 cells, which can easily be provided by one individual, Chang said. It involves about 15 minutes of hands-on technician time and takes as few as 10 hours from start to finish. Samples obtained on a daily basis from, say, a hospitalized patient or a subject in a clinical trial measuring a drug's effect, can be processed in a clinically relevant time frame.
The insight that opened the door to this new technique came a year ago when the study's lead author, Buenrostro, proposed that a bacterial enzyme could be used to "spray paint" the regions of the genome that are accessible to the molecular machines employed by cells to read genetic information.
Transposases—the kind of enzyme the Stanford scientists borrowed from bacteria—are found in all creatures. These enzymes insert copies of a particular DNA sequence into random sites along the genome. But because bacteria lack barriers such as nucleosomes, bacterial transposases haven't evolved ways of inscribing their DNA "tags" on nucleosomally or otherwise blocked DNA.
The investigators used a bacterial transposase modified so that, instead of inserting its usual DNA tag at any part of the genome, it inserted special DNA sequences only in parts of the genome where nothing stood in the way. These DNA sequences were chosen to facilitate a high-throughput, laboratory-based, DNA-copying procedure. Incubating myriad copies of these sequences in a test tube, along with the modified transposase and a line of well-studied immune cells, yielded tags on whatever parts of the genome weren't spooled around a nucleosome or occupied by one or another DNA-binding protein.

A single nucleosome ties up just under 150 chemical units of DNA. Tag-free DNA stretches of just that length designated nucleosome-blocked regions at numerous spots along the genome. Much shorter tag-free zones, numbering between eight and 10 DNA chemical units, occurred at specific sites along open areas of the genome known to be regulatory. These small, tag-free stretches, the Stanford team reasoned, had been occupied by DNA-binding proteins whose exact identities could be inferred from the size and sequence of the tag-free "footprint" they'd left. This was an important finding, as various DNA-binding proteins either facilitate or impede genes' transcription.

To demonstrate the method's clinical potential, the investigators drew blood from a healthy volunteer on three consecutive days, performing their analytic procedure each time. They were able to show, for this volunteer, which of three different regulatory DNA sites on a particular gene had been engaged by a DNA-binding protein. This regulatory-site pinpointing could guide clinical decisions about which drug would be best for changing a gene's activity level with minimal side effects.

More information: Transposition of native chromatin for multimodal regulatory analysis and personal epigenomics, DOI: 10.1038/nmeth.2688

http://phys.org/news/2013-10-volkswagen-xl1-world-efficient-car.html

Volkswagen XL1: 'World's most efficient car' makes its US debut

'World's most efficient car' makes its US debut

Volkswagen XL1

Phys.org - VW's XL1 hybrid car made its official debut in the United States this past week at this year's Annual Society of Environmental Journalists conference in Chattanooga Tennessee—home of one of VW's hi-tech manufacturing plants. The vehicle has been dubbed by various media outlets as the "world's most efficient car." Testing has shown the vehicle to have a fuel consumption rate of 261mpg European-200mpg US. VW reports that the car is able to travel 32 miles when driven in all-electric mode.

The car has a sleek, aerodynamic look—the back wheels are covered and mirrors on the doors are digital cameras instead of the wind grabbing old-school variety—the body is also tapered. The XL1 is the latest entry by VW to make vehicles it calls 1-liter cars—those that consume just one liter of fuel when traveling 100 kilometers. The XL1 is considered a limited edition vehicle that VW is making to test demand. To achieve such high efficiency, VW has followed three main ideas: making cars that are light, aerodynamic and that have a low center of gravity. To that end, the car is made light (it weighs just 1,753 pounds) by using carbon fiber polymers, magnesium, ceramics and aluminum in its various parts. It's small as well, measuring just 153.1 inches in length, and 65.6 inches across and 45.5 inches from ground to roof.

VW has given operators several options when driving the vehicle—it can be run as an all-electric, all-gasoline, or as a hybrid. It can also be set to run in electric mode for cruising then jump to gas mode automatically if more power is needed for sudden acceleration. The XL1, despite its name, is actually the third generation of a line of 1-liter vehicles from VW—the first was so thin driver and passenger had to sit in tandem. The XL1 is the first such vehicle from VW to be made for sale to consumers, though initially, only a lucky 250. That's all the company is going to make unless there is added demand. VW has not yet announced when the car will be made for sale in the U.S. or how much it will cost.

http://www.bbc.co.uk/news/science-environment-24429621

Nuclear fusion milestone passed at US lab

Researchers at a US lab have passed a crucial milestone on the way to their ultimate goal of achieving self-sustaining nuclear fusion.

By Paul Rincon Science Editor, BBC News website

Harnessing fusion - the process that powers the Sun - could provide an unlimited and cheap source of energy. But to be viable, fusion power plants would have to produce more energy than they consume, which has proven elusive. Now, a breakthrough by scientists at the National Ignition Facility (NIF) could boost hopes of scaling up fusion.

NIF, based at Livermore in California, uses 192 beams from the world's most powerful laser to heat and compress a small pellet of hydrogen fuel to the point where nuclear fusion reactions take place. The BBC understands that during an experiment in late September, the amount of energy released through the fusion reaction exceeded the amount of energy being absorbed by the fuel - the first time this had been achieved at any fusion facility in the world. This is a step short of the lab's stated goal of "ignition", where nuclear fusion

generates as much energy as the lasers supply. This is because known "inefficiencies" in different parts of the system mean not all the energy supplied through the laser is delivered to the fuel.

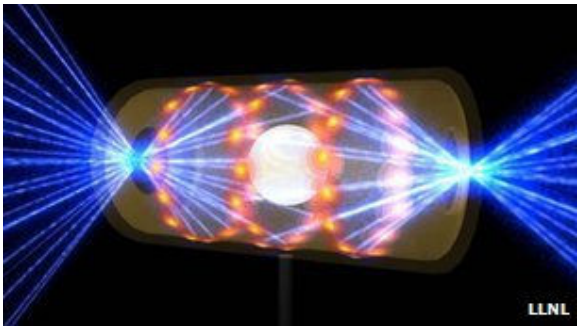
But the latest achievement has been described as the single most meaningful step for fusion in recent years, and demonstrates NIF is well on its way towards the coveted target of ignition and self-sustaining fusion.

For half a century, researchers have strived for controlled nuclear fusion and been disappointed. It was hoped that NIF would provide the breakthrough fusion research needed.

In 2009, NIF officials announced an aim to demonstrate nuclear fusion producing net energy by 30 September 2012. But unexpected technical problems ensured the deadline came and went; the fusion output was less than had originally been predicted by mathematical models.

Soon after, the $3.5bn facility shifted focus, cutting the amount of time spent on fusion versus nuclear weapons research - which was part of the lab's original mission.

Nuclear fusion at NIF



192 laser beams are focused through holes in a target container called a hohlraum

Inside the hohlraum is a tiny pellet containing an extremely cold, solid mixture of hydrogen isotopes

Lasers strike the hohlraum's walls, which in turn radiate X-rays

X-rays strip material from the outer shell of the fuel pellet, heating it up to millions of degrees

If the compression of the fuel is high enough and uniform enough, nuclear fusion can result

However, the latest experiments agree well with predictions of energy output, which will provide a welcome boost to ignition research at NIF, as well as encouragement to advocates of fusion energy in general. It is markedly different from current nuclear power, which operates through splitting atoms - fission - rather than squashing them together in fusion.

NIF, based at the Lawrence Livermore National Laboratory, is one of several projects around the world aimed at harnessing fusion. They include the multi-billion-euro ITER facility, currently under construction in Cadarache, France. However, ITER will take a different approach to the laser-driven fusion at NIF; the Cadarache facility will use magnetic fields to contain the hot fusion fuel - a concept known as magnetic confinement.

http://www.eurekalert.org/pub_releases/2013-10/mu-pbf100713.php

Primate brains follow predictable development pattern

In a breakthrough for understanding brain evolution, neuroscientists have shown that differences between primate brains - from the tiny marmoset to human – can be largely explained as consequences of the same genetic program.

In research published in the Journal of Neuroscience, Professor Marcello Rosa and his team at Monash University's School of Biomedical Sciences and colleagues at Universidade Federal do Rio de Janeiro, in Brazil, used computer modelling to demonstrate that the substantial enlargement of some areas of the human brain, vital to advanced cognition, reflects a consistent pattern that is seen across primate species of all sizes.

This finding suggests how the neural circuits responsible for traits that we consider uniquely human – such as the ability to plan, make complex decisions and speak – could have emerged simply as a natural consequence of the evolution of larger brains.

"We have known for a long time that certain areas of the human brain are much larger than one would expect based on how monkey brains are organised," Professor Rosa said. "What no one had realised is that this selective enlargement is part of a trend that has been present since the dawn of primates."

Using publicly available brain maps, MRI imaging data and modelling software, the neuroscientists compared the sizes of different brain areasin humans and three monkey species: marmosets, capuchins and macaques. They found that two regions, the lateral prefrontal cortex and the temporal parietal junction, expand disproportionally to the rest of the brain.

The prefrontal cortex is related to long term planning, personality expression, decision-making, and behaviour modification. The temporal parietal junction is related to self-awareness and self-other distinction.

Lead author Tristan Chaplin, from the Department of Physiology will commence his PhD next year. He said the findings showed that those areas of the brain grew disproportionately in a predictable way.

"We found that the larger the brain is, the larger these areas get," Tristan said.

"When you go from a small to big monkey - the marmoset to macaque - the prefrontal cortex and temporal parietal junction get larger relative to the rest of the cortex, and we see the same thing again when you compare macaques to humans."

"This trend argues against the view that specific human mutations gave us these larger areas and advanced cognition and behaviour, but are a consequence of what happens in development when you grow a larger brain," Tristan said.
Professor Rosa said the pattern held for primate species that evolved completely separately.
"If you compare the capuchin of South America and the macaque of Asia, their brains are almost identical, although they developed on opposite sides of the world. They both reflect the genetic plan of how a primate brain grows," Professor Rosa said.
This is the first computational comparative study conducted across several primate species. Tristan now hopes, in collaboration with zoos, to check if our closest primate relatives, the chimpanzees and gorillas, also have brain areas organised as his theory predicts.

http://www.eurekalert.org/pub_releases/2013-10/su-imn100713.php

Iron melt network helped grow Earth's core, Stanford study suggests

The same process that allows water to trickle through coffee grinds to create your morning espresso may have played a key role in the formation of the early Earth and influenced its internal organization, according to a new study by scientists at Stanford's School of Earth Sciences.

The finding, published in the current issue of the journal Nature Geoscience, lends credence to a theory first proposed nearly half a century ago suggesting that Earth's iron-rich core and layered internal structure might have formed in a series of steps that took place over millions of years under varying temperature and pressure conditions.
"We know that Earth today has a core and a mantle that are differentiated. With improving technology, we can look at different mechanisms of how this came to be in a new light," said study leader Wendy Mao, an assistant professor of geological and environmental sciences at Stanford, and of photon sciences at the SLAC National Accelerator Laboratory, which is operated by the university.
Earth's innards are presently divided into layers, with the rocky mantle composed mostly of silicates overlying an iron-rich metallic core. How the planet came to have this orderly arrangement is a major mystery, especially since scientists think its beginnings were messy and chaotic, the result of small bodies made up of rock and metals crashing and clumping together shortly after the formation of the sun and the birth of the solar system some 4.5 billion years ago.
How did Earth evolve from this conglomerated mass of rocks and metals into its current layered state?

Separating metal from rock

One idea is that the heat generated by the collisions and by the radioactive decay of certain isotopes warmed the Earth. The planet could have gotten so hot that its rocks and metals melted. The molten rocks and metals in this "magma ocean" would then have separated into distinct layers as a result of their different densities. Iron would have drifted downward towards the planet's center, while silicates remained on top.
Other scientists have proposed that even if the early Earth's temperature was not hot enough to melt silicates, the molten iron might still have separated out by percolating through the solid silicate layer.
The thought was that pockets of molten iron trapped in the mantle layer could tunnel through the surrounding rock to create channels, or capillaries. This network of tunnels could have helped funnel molten iron towards the planet's center to join the spherical metallic heart that was slowly amassing there.
However, this "percolation" theory was dealt a major blow when scientists discovered that, in the upper mantle layer at least, the molten iron tended to form isolated spheres that didn't interact with one another, similar to the way water beads up on a waxed surface.
For this reason, scientists had previously thought that percolation couldn't be possible, Mao said.

Recreating ancient Earth

But a new experiment conducted by Mao and her team uncovered fresh evidence that percolation might still be a viable mechanism for explaining the formation of Earth's core.
Working with researchers at the U.S. Department of Energy's SLAC facility, Mao and her team recreated a speck of the molten silicate and iron material that scientists believe existed deep inside the early Earth.
To do this, Mao's team placed minute amounts of iron and silicate rock into a metal chamber that they then inserted between the tips of two small diamonds. Squeezing these "diamond anvils" together recreated the immense pressures present in the Earth's interior, and a laser beam was used to heat the sample to a high enough temperature to melt the iron.
After the sample cooled, the scientists examined it using X-ray-computed tomography. Tomography creates a three-dimensional image of an object by combining a series of two-dimensional slices. A computer program then helps flesh out the re-creation of the object.

A state-of-the-art X-ray microscope at SLAC allowed Mao's team to resolve nanometer-scale details in their sample of heated silicates and iron. The higher resolution allowed the scientists to observe never-before-seen changes in the texture and shape of the molten iron and silicates as they responded to the same intense pressures and temperatures that were present deep in the early Earth.

Which happened first?

The experiment confirmed the findings from previous studies that molten iron in the upper mantle tended to form isolated blobs, which would have prevented percolation from happening. "In order for percolation to be efficient, the molten iron needs to be able to form continuous channels through the solid," Mao explained. However, the scientists found that at the higher pressures and temperatures that would have been present in the early Earth's lower mantle, the structure of the silicates changed in a way that permitted connections to form between pockets of molten iron, making percolation possible.

"Scientists had said this theory wasn't possible, but now we're saying, under certain conditions that we know exist in the planet, it could happen," Mao said. "So this brings back another possibility for how the core might have formed."

The team's new findings do not rule out the possibility that differentiation began when Earth was in a magma ocean state. In fact, both mechanisms could have occurred, said study first author Crystal Shi, a graduate student in Mao's lab.

"We don't know which mechanism happened first, or if the two happened together," Shi said. "At the very beginning, Earth would have still been very hot, and the magma ocean mechanism could have been important. But later as the planet cooled, percolation may have become the dominant mechanism."

Scientists from China's Center for High Pressure Science and Technology Advanced Research, and the Carnegie Institution of Washington also contributed to this research.

http://www.earthmagazine.org/article/new-subduction-zone-may-close-atlantic-ocean

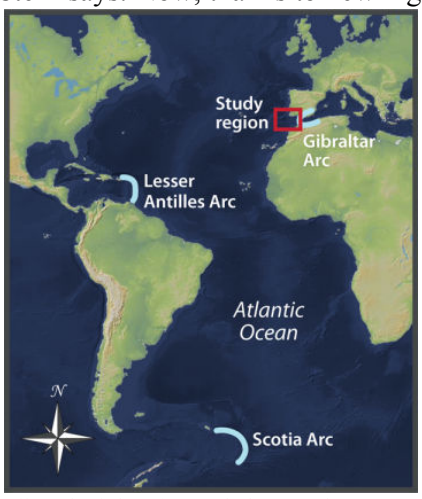
New subduction zone may close Atlantic ocean

Evidence of that subduction starting in the Atlantic Ocean off the coast of Portugal

Mary Caperton Morton

"Every first-year geology student learns about the Wilson Cycle: Oceans open and then new subduction zones form and the oceans close," says Robert Stern, a geoscientist at the University of Texas at Dallas. Throughout the history of the Earth, supercontinents and ocean basins have opened and closed over timescales of 300 million to 500 million years. "But we don't actually see evidence" of the in-between phase - a previously opening ocean basin beginning to close - "happening anywhere on Earth," Stern says. Now, thanks to new high-resolution surveys of the seafloor, scientists think they have evidence of that process starting in the Atlantic Ocean, off the coast of Portugal.

How passive margins like the eastern coast of North America transform into subduction zones that could eventually close ocean basins is a long-standing mystery. Some scientists have proposed that the weight of sediments accumulating along passive margins could cause the edge of a passive margin to begin to sink and eventually subduct, but the largest sediment basins on Earth - the Gulf of Mexico and the Bay of Bengal - show no evidence of such a process happening. And so far, other forces that may drive this passive-to-active-margin transformation have remained unknown. What is known is that new subduction zones must form to accommodate the young oceanic crust forming at mid-ocean ridges since tectonic processes are ultimately governed by a single constraint: the circumference of the Earth must remain the same.



The Atlantic Ocean currently has three subduction zones: in the Caribbean, the South Atlantic and the Mediterranean. A new one may be forming off the coast of Portugal.

In a new study in Geology, João Duarte, a geophysicist at Monash University in Melbourne, Australia, and colleagues at the University of Lisbon in Portugal have proposed that this transformation may occur due to a convergence of compressive forces. The process is related to a theory, first suggested in the early 1990s, that once subduction starts along one margin in a basin, subduction along others tends to follow. Currently, the Atlantic has three isolated subduction zones: the Lesser Antilles in the Caribbean, the Scotia Arc in the South Atlantic, and the Gibraltar Arc in the Mediterranean. Duarte and his colleagues think there may be a new subduction zone forming off the coast of Portugal in connection with the ongoing subduction of the Gibraltar Arc.

Using data from multibeam bathymetry and seismic reflection profiling studies, Duarte and his colleagues created a new map of the region and identified the main tectonic driving mechanisms: the westward movement of the Gibraltar Arc and the convergence of the African and Eurasian plates. Combined, the tectonic movements generate compressive stresses at the southwest Iberian passive margin off the coast of Portugal that could be forcing the plate downward to form a new subduction zone.

"This area is very complex and there have always been a lot of competing and apparently contradictory models," Duarte says. "Our model unifies previously contradictory models of this region in a consistent framework that accounts for all of the present structures."

Duarte says it's too early in the evolution of the new subduction zone for all the typical subduction features to have formed. "It's important to keep in mind that we don't have a fully developed and mature subduction zone here yet. What we have is a set of thrust faults that extend for 300 kilometers along the margin — exactly what you would expect to see just before a subduction zone initiates."

But Stern, who wasn't involved in the recent study, says he is unconvinced that thrust faults alone are sufficient evidence to declare the southwest Iberian margin a nascent subduction zone, mainly because it's just too early to tell, he says. There's no deep seismicity or volcanic arc yet — two hallmarks of subduction zones.

If the convergence continues the way Duarte and his colleagues suggest, the margin may take another 10 million to 20 million years to develop into a mature subduction zone, Duarte says. Whether this will lead to the closing of the Atlantic is "extremely speculative," Duarte says. Regardless, it won't happen any time soon.

"The Atlantic Ocean is about 200 million years old," Duarte says. "If the process is reversed [and the ocean basin closes], it's likely that it will take another 200 million years to close."

http://www.eurekalert.org/pub_releases/2013-10/osu-ssh100813.php

Study shows how infections in newborns are linked to later behavior problems

In animal study, inflammation stops cells from accessing iron needed for brain development

COLUMBUS, Ohio – Researchers exploring the link between newborn infections and later behavior and movement problems have found that inflammation in the brain keeps cells from accessing iron that they need to perform a critical role in brain development.

Specific cells in the brain need iron to produce the white matter that ensures efficient communication among cells in the central nervous system. White matter refers to white-colored bundles of myelin, a protective coating on the axons that project from the main body of a brain cell.

The scientists induced a mild E. coli infection in 3-day-old mice. This caused a transient inflammatory response in their brains that was resolved within 72 hours. This brain inflammation, though fleeting, interfered with storage and release of iron, temporarily resulting in reduced iron availability in the brain. When the iron was needed most, it was unavailable, researchers say.

"What's important is that the timing of the inflammation during brain development switches the brain's gears from development to trying to deal with inflammation," said Jonathan Godbout, associate professor of neuroscience at The Ohio State University and senior author of the study. "The consequence of that is this abnormal iron storage by neurons that limits access of iron to the rest of the brain."

The research is published in the Oct. 9, 2013, issue of the Journal of Neuroscience.

The cells that need iron during this critical period of development are called oligodendrocytes, which produce myelin and wrap it around axons. In the current study, neonatal infection caused neurons to increase their storage of iron, which deprived iron from oligodendrocytes.

In other mice, the scientists confirmed that neonatal E. coli infection was associated with motor coordination problems and hyperactivity two months later – the equivalent to young adulthood in humans. The brains of these same mice contained lower levels of myelin and fewer oligodendrocytes, suggesting that brief reductions in brain-iron availability during early development have long-lasting effects on brain myelination.

The timing of infection in newborn mice generally coincides with the late stages of the third trimester of pregnancy in humans. The myelination process begins during fetal development and continues after birth.

Though other researchers have observed links between newborn infections and effects on myelin and behavior, scientists had not figured out why those associations exist. Godbout's group focuses on understanding how immune system activation can trigger unexpected interactions between the central nervous system and other parts of the body.

"We're not the first to show early inflammatory events can change the brain and behavior, but we're the first to propose a detailed mechanism connecting neonatal inflammation to physiological changes in the central nervous system," said Daniel McKim, a lead author on the paper and a student in Ohio State's Neuroscience Graduate Studies Program.

The neonatal infection caused several changes in brain physiology. For example, infected mice had increased inflammatory markers, altered neuronal iron storage, and reduced oligodendrocytes and myelin in their brains. Importantly, the impairments in brain myelination corresponded with behavioral and motor impairments two months after infection.
Though it's unknown if these movement problems would last a lifetime, McKim noted that "since these impairments lasted into what would be young adulthood in humans, it seems likely to be relatively permanent."
The reduced myelination linked to movement and behavior issues in this study has also been associated with schizophrenia and autism spectrum disorders in previous work by other scientists, said Godbout, also an investigator in Ohio State's Institute for Behavioral Medicine Research (IBMR).
"More research in this area could confirm that human behavioral complications can arise from inflammation changing the myelin pattern. Schizophrenia and autism disorders are part of that," he said.
This current study did not identify potential interventions to prevent these effects of early-life infection. Godbout and colleagues theorize that maternal nutrition – a diet high in antioxidants, for example – might help lower the inflammation in the brain that follows a neonatal infection. "The prenatal and neonatal period is such an active time of development," Godbout said. "That's really the key – these inflammatory challenges during critical points in development seem to have profound effects. We might just want to think more about that clinically."
This work is the result of close collaboration between Godbout; Ning Quan and Michael Bailey of Ohio State's Division of Oral Biology and the IBMR; Dana McTigue of Ohio State's Department of Neuroscience and Center for Brain and Spinal Cord Repair; and Staci Bilbo of Duke University. Additional co-authors from Ohio State are Jacqueline Lieblein-Boff (now with Abbott Nutrition), Daniel McKim, Daniel Shea, Ping Wei, Zhen Deng and Caroline Sawicki.
The research was supported by Abbott Nutrition and the National Institutes of Health.

http://www.eurekalert.org/pub_releases/2013-10/uotw-fee100813.php

First ever evidence of a comet striking Earth

The first ever evidence of a comet entering Earth's atmosphere and exploding, raining down a shock wave of fire which obliterated every life form in its path, has been discovered by a team of South African scientists and international collaborators.

The discovery has not only provided the first definitive proof of a comet striking Earth, millions of years ago, but it could also help us to unlock, in the future, the secrets of the formation of our solar system.
"Comets always visit our skies – they're these dirty snowballs of ice mixed with dust – but never before in history has material from a comet ever been found on Earth," says Professor David Block of Wits University.
The comet entered Earth's atmosphere above Egypt about 28 million years ago. As it entered the atmosphere, it exploded, heating up the sand beneath it to a temperature of about 2 000 degrees Celsius, and resulting in the formation of a huge amount of yellow silica glass which lies scattered over a 6 000 square kilometre area in the Sahara. A magnificent specimen of the glass, polished by ancient jewellers, is found in Tutankhamun's brooch with its striking yellow-brown scarab.

A magnificent specimen of the glass, polished by ancient jewelers, is found in Tutankhamun's brooch with its striking yellow-brown scarab. Credit: http://en.wikipedia.org/wiki/File:Tutankhamun_pendant_with_Wadjet.jpg http://commons.wikimedia.org/wiki/Template:Copyrighted_free_use

The research, which will be published in Earth and Planetary Science Letters, was conducted by a collaboration of geoscientists, physicists and astronomers including Block, lead author Professor Jan Kramers of the University of Johannesburg, Dr Marco Andreoli of the South African Nuclear Energy Corporation, and Chris Harris of the University of Cape Town.
At the centre of the attention of this team was a mysterious black pebble found years earlier by an Egyptian geologist in the area of the silica glass. After conducting highly sophisticated chemical analyses on this pebble, the authors came to the inescapable conclusion that it represented the very first known hand specimen of a comet nucleus, rather than simply an unusual type of meteorite.
Kramers describes this as a moment of career defining elation. "It's a typical scientific euphoria when you eliminate all other options and come to the realisation of what it must be," he said.
The impact of the explosion also produced microscopic diamonds. "Diamonds are produced from carbon bearing material. Normally they form deep in the earth, where the pressure is high, but you can also generate very high pressure with shock. Part of the comet impacted and the shock of the impact produced the diamonds," says Kramers.

The team have named the diamond-bearing pebble "Hypatia" in honour of the first well known female mathematician, astronomer and philosopher, Hypatia of Alexandria.
Comet material is very elusive. Comet fragments have not been found on Earth before except as microscopic sized dust particles in the upper atmosphere and some carbon-rich dust in the Antarctic ice. Space agencies have spent billions to secure the smallest amounts of pristine comet matter.
"NASA and ESA (European Space Agency) spend billions of dollars collecting a few micrograms of comet material and bringing it back to Earth, and now we've got a radical new approach of studying this material, without spending billions of dollars collecting it," says Kramers.
The study of Hypatia has grown into an international collaborative research programme, coordinated by Andreoli, which involves a growing number of scientists drawn from a variety of disciplines. Dr Mario di Martino of Turin's Astrophysical Observatory has led several expeditions to the desert glass area.
"Comets contain the very secrets to unlocking the formation of our solar system and this discovery gives us an unprecedented opportunity to study comet material first hand," says Block.

http://www.sciencedaily.com/releases/2013/10/131008091433.htm

Liquorice Alleviates Troublesome Symptoms Following Intubation

In Traditional Chinese Medicine (TCM), liquorice is regarded as a "panacea.

A recent study by the University Department of Anaesthetics, General Intensive Care Medicine and Pain Therapy at the MedUni Vienna has now, for the first time, scientifically confirmed the healing properties of this natural substance.
In their study, researchers investigated patients who require a particularly thick tube (known as a double-lumen tube) following lung surgery and who consequently suffer frequent sore throats, hoarseness and coughs. The prescription of liquorice markedly reduced the frequency of post-operative symptoms. Even more importantly, patients were extremely happy and complained of significantly fewer side effects associated with anaesthesia, such as sore throats, coughs and hoarseness.
Study leader Kurt Rützler from the University Department of Anaesthetics, General Intensive Care Medicine and Pain Therapy at the MedUni Vienna cites another important advantage: "The side effects that normally occur are not only subjectively unpleasant for patients, but they can also have a negative impact on the success of their surgery. If a patient develops a cough after a lung operation with severe pain leading to reduced inspiration and expiration, this can cause an entire section of the lung to collapse."

Inexpensive medicine available without a prescription

As a result of the study, which has just been published in the science journal Anesthesia & Analgesia, liquorice is already being offered to all pre-operative patients at three European hospitals. One of the key advantages of liquorice lies in how simple it is to use. Liquorice is available in its pure form without a prescription from any pharmacy. "Patients can however also buy liquorice sticks or liquorice lozenges and achieve very similar beneficial effects to pure liquorice," says Rützler.
Further possible medical uses for liquorice being researched
Exactly how liquorice works is not yet fully understood. The team of researchers at the MedUni Vienna has managed to identify 17 sub-substances in liquorice, however. Some of these are believed in TCM to have particular effects. Researchers are now working on investigating these TCM beliefs on a more scientific basis. According to Rützler, of particular importance in this context is liquorice's anti-inflammatory effect and its positive impact on local wound healing, for example in maxillofacial surgery.

Kurt Ruetzler, Michael Fleck, Sabine Nabecker, Kristina Pinter, Gordian Landskron, Andrea Lassnigg, Jing You, Daniel I. Sessler. A Randomized, Double-Blind Comparison of Licorice Versus Sugar-Water Gargle for Prevention of Postoperative Sore Throat and Postextubation Coughing. Anesthesia & Analgesia, 2013; 117 (3): 614 DOI: 10.1213/ANE.0b013e318299a650
Medical University of Vienna (2013, October 8). Liquorice alleviates troublesome symptoms following intubation. ScienceDaily. Retrieved October 13, 2013, from http://www.sciencedaily.com-/releases/2013/10/131008091433.htm?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+sciencedaily+%28ScienceDaily%3A+Latest+Science+News%29

http://bit.ly/1aivNhz

Swifts stay airborne for six months at a time

Alpine swifts spend more than six consecutive months aloft

19:39 08 October 2013 by Andy Coghlan

Swifts are said to spend most of their lives airborne, but no one has ever proved this. Now, a study suggests there's some truth to it: alpine swifts spend more than six consecutive months aloft, not even resting after migrating to north Africa following their breeding season in Europe.

"Up to now, such long-lasting locomotive activity had been reported only for animals living in the sea," says Felix Liechti of the Swiss Ornithological Institute in Sempach.
Liechti and his colleagues attached 1.5-gram data loggers to three alpine swifts (Tachymarptis melba) at a Swiss breeding site, and recaptured the birds the following year. The loggers recorded the birds' acceleration and geographic location. The measurements suggest that for 200 days, all three swifts remained airborne while migrating to and wintering in Africa. Liechti says researchers have previously asserted but never proved that newborn common swifts spend three years aloft before landing for breeding.

Winging it **Varesvuo/NaturePL**

Truly amazing

"Amazing, truly amazing," says Carsten Egevang of the Greenland Institute of Natural Resources in Nuuk of Liechti's findings. "We knew that swifts stay on the wing for long periods, but 200 days is very impressive."
The birds survive on airborne plankton, and almost certainly sleep on the wing too, Liechti says. "It has been assumed that the birds 'sleep' only for seconds, or use only one half of the brain while the other half is resting," he says.
But some researchers think the swifts might not sleep at all. "Our group has shown that dolphins and killer whales remain active for at least 90 days without sleep and with greatly reduced sleep for up to 150 days after birth," says Jerry Siegel of the University of California at Los Angeles. He also cites recent work showing that sandpipers stay awake for weeks during breeding, and that dolphins can function without impaired performance for as long as 15 days without sleep.
"What all this work tells us is that when it is adaptive for animals to remain awake, evolution allows that, so I think the idea that swifts must sleep and are therefore 'sleep-flying' is incorrect," says Siegel.
Journal reference: Nature Communications, DOI: 10.1038/ncomms3554

http://www.medscape.com/viewarticle/812248?src=rss

High-Dose Flu Shot Shows Promise in Elderly

An increased dose of influenza vaccine stimulates a greater immune response than the standard dose in long-term care residents older than 65 years, according to a new study

Laird Harrison

SAN FRANCISCO - "The superiority of high-dose influenza vaccine was demonstrated for all influenza strains except A/H1N1 in 2012-2013," said Richard Zimmerman, MD, from the University of Pittsburgh in Pennsylvania.
Dr. Zimmerman presented the findings here at IDWeek 2013.
Standard influenza vaccines don't produce as good an immune response in the frail elderly as they do in younger, healthier populations, Andrew Pavia, MD, chief of pediatric infectious diseases at the University of Utah in Salt Lake City, who was not involved in the study, told *Medscape Medical News*.

When flu moves through a nursing home, there are often dozens of deaths.

"When flu moves through a nursing home, there are often dozens of deaths," he said. *Fluzone*, a high-dose influenza vaccine made by Sanofi Pasteur, was approved by the US Food and Drug Administration in 2009 for use in adults older than 65 years. The vaccine delivers 4 times the standard dose of antigen, and approval was based primarily on a study in healthy community-dwelling adults with a mean age of 73.
"It may not be possible to extrapolate these results to frail long-term care residents," said Dr. Zimmerman.
To find out how the high-dose vaccine would work in this population, Dr. Zimmerman and his team vaccinated 205 residents in various long-term care facilities, including skilled nursing, assisted living, dementia care, and independent living facilities during the 2011-12 and 2012-13 flu seasons.
The investigators randomly assigned these residents to receive either regular-dose or high-dose vaccine. Of the 169 participants who completed the study, 87 received the regular dose and 82 received the high dose.
These residents were all older than 65 years and required assistance with daily activities such as shopping and dressing. The mean age of those who completed the study was 87.
The patients reported no serious adverse reactions, said Dr. Zimmerman.

Flu Season Geometric Mean Antibody Titers Before and After Vaccination

Influenza Vaccine Strain	*Standard Dose*	*High Dose*	*P Value*
Before Vaccination			
A/California/07/2009	*33.6*	*23.1*	*0.130*
A/Victoria/63/2011	*6.1*	*7.4*	*0.07*
B/Wisconsin/1/2010	*9.4*	*7.9*	*0.20*
After Vaccination			
A/California/07/2009	*51.6*	*45.6*	*0.590*
A/Victoria/63/2011	*13.4*	*25.0*	*0.002*
B/Wisconsin/1/2010	*18.7*	*25.6*	*0.045*

The investigators measured the blood concentration of hemagglutination inhibition antibodies to 3 strains of influenza virus before the vaccinations and 1 month later. They found no significant differences between the 2 groups at baseline. A month later, the concentration of antibodies increased in all the subjects, but they generally increased more in those who received the high-dose vaccination.
Antibodies did not increase in response to the A/California/07/2009 strain vaccine in the 2012-13 season, possibly because 30% of the subjects participated in both seasons, and the A/H1N1 strains were identical those 2 seasons, explained Dr. Zimmerman.
He pointed out that the study had several limitations. The sample size was small, it was conducted over 2 years, only the patients were blinded to which vaccine they were getting, and it is not known how the antibody count correlates to actual resistance to influenza. Dr. Pavia said that this last question is crucial. "We know it produces high antibody titers, but does it produce less disease?" he asked.
In August, Sanofi Pasteur announced that a large community-based clinical trial had shown that the high-dose vaccine was 24.2% more effective in preventing influenza in adults 65 years and older than the standard vaccine.
Dr. Pavia said he is looking forward to the data from that trial, which Sanofi Pasteur has not yet released.
Nailing down the relative benefits of a higher-dose vaccine is important, he noted. Because vaccines can sometimes be in short supply, public health officials are always trying to find the smallest dose that can produce immunity. "This is important when you're talking about developing a vaccine in a hurry or in a developing country," said Dr. Pavia.
This study was funded by Sanofi Pasteur, and Dr. Zimmerman reports receiving grants from the company. Dr. Pavia has disclosed no relevant financial relationships.

http://www.sciencedaily.com/releases/2013/10/131008152049.htm

Where Does Dizziness Come From?

Johns Hopkins researchers say they have pinpointed a site in a highly developed area of the human brain that plays an important role in the subconscious recognition of which way is straight up and which way is down.

The finding, described online in the journal Cerebral Cortex, may help account for some causes of spatial disorientation and dizziness, and offer targets for treating the feelings of unsteadiness and "floating" people experience when the brain fails to properly integrate input from the body's senses.
Disabling dizziness can be a symptom of damage to the inner ear or other senses such as vision. But in many cases, the problem instead appears to stem from a disruption of the processes in the brain that translate input coming from the inner ears about the pull of gravity and the eyes about our visual sensations into what is known as upright perception. The human brain has an automatic capacity to know which way is up even when our heads and bodies are askew. Studies of people in zero-gravity conditions suggest that sensing gravity plays a role in the perception of upright and spatial orientation.
"Our brain has this amazing way of knowing where we are in space, whether we are upright or tilted at an angle, even if it is completely dark and we can't see anything around us," says Amir Kheradmand, M.D., a neurology instructor at the Johns Hopkins University School of Medicine who conducted the research. "This study suggests there's a small area of neural tissue in the parietal cortex substantially involved in this ability, giving us a place to start thinking about how we may be able to treat people with disorienting dizziness."
Kheradmand says he and his team focused their attention on the right parietal cortex because studies in stroke victims with balance problems suggested that damage to that part of the brain was centrally involved in upright perception.
Recruiting eight healthy subjects for the study, the Johns Hopkins team placed each person individually in a dark room and showed them lines illuminated on a screen. The researchers instructed the subjects to report the orientation of the lines by rotating a dial to the right, left or straight.
The subjects then received what is known as TMS (trans-cranial magnetic stimulation), which painlessly and noninvasively delivers electromagnetic currents to precise locations in the brain that can temporarily disrupt the function of the targeted area. TMS is considered safe and is approved by the U.S. Food and Drug Administration to treat some patients with depression by stimulating nerve cells in the region of the brain involved in mood control and depression.
For this part of the experiments, each subject had an electromagnetic coil placed against the scalp in a 2-centimeter wide location across the right parietal lobe, behind the ear. This spot was found initially by mapping a small cortical region of the parietal lobe in one subject. At the identified location, the subjects got 600 electromagnetic pulses over the course of 40 seconds. After each 40-second session, the subjects were again asked to show researchers which way each illuminated line on the screen was oriented. The results wore off

quickly and the subjects could again be tested on another day. Ultimately, the researchers found that each subject reported that his or her sense of being upright was skewed in the same way after TMS in the same spot in the parietal cortex: the supramarginal gyrus.
Kheradmand says the study's results raise the possibility that TMS could potentially be used to treat chronic dizziness. "If we can disrupt upright perception in healthy people using TMS, it might also be possible to use TMS to fix dysfunction in the same location in people with dizziness and spatial disorientation," he says.
"It's fascinating that we've gotten to the point that we can show that a subconscious perception can be altered using this simple, noninvasive technique," he adds. "We're excited that this could someday be a key to helping people who have dizziness and spatial disorientation to feel better."
A. Kheradmand, A. Lasker, D. S. Zee. Transcranial Magnetic Stimulation (TMS) of the Supramarginal Gyrus: A Window to Perception of Upright. Cerebral Cortex, 2013; DOI: 10.1093/cercor/bht267

http://www.medscape.com/viewarticle/812255?src=rss

Quality of Care May Vary Within a Hospital by Insurance Type

New data indicate that the quality of care patients receive in a given hospital may be linked to the type of insurance they have, and Medicare patients, researchers say, may be particularly at risk for lower-quality care.

Marcia Frellick

Christine S. Spencer, ScD, an associate professor in and executive director of the School of Health and Human Services in the College of Public Affairs, University of Baltimore, Maryland, and colleagues used the Agency for Healthcare Research and Quality's Inpatient Quality Indicators and applied them to 2006-2008 State Inpatient Database records from 1601 hospitals in 11 states.
The results of the study were published in the October issue of Health Affairs.
The authors examined the risk-adjusted mortality rates for 8 surgical procedures and 7 medical conditions and then compared the rates by patients' insurance status and type of insurance. They found that privately insured patients had lower rates in 12 of the 15 procedures or conditions.
For example, for hip fractures, Medicare patients had, on average, 5.85 more deaths per 1000 patients than privately insured patients at the same hospital. Mortality rates among Medicare patients were 104% higher than that for private insurance for hip replacements and 102% higher for esophageal resection.
With stroke, congestive heart failure, and pneumonia, privately insured patients fared worse than those in other categories. In the case of stroke, for example, there were an average of 9.08 fewer deaths per 1000 patients among Medicaid patients in comparison with privately insured patients at the same hospital.
Questions raised by the researchers include why there were differences that varied by payer for patients in the same hospital undergoing the same procedure, how the differences manifest themselves in a patient's care, whether privately insured patients have more access to cutting-edge technology or more individual care from physicians, and whether coding differences could explain discrepancies. For example, hospitals may have a financial incentive to report comorbidities that existed before hospitalization.
The authors note that the Affordable Care Act has taken a big step toward insurance for all but add that these findings suggest that policymakers will need to further examine why patients' quality of care differs across payers.
The researchers encourage requiring hospitals to report outcomes by payer status on quality performance scorecards to elevate transparency and higher-quality care.
Health Aff. 2013;32:1731-1739. Abstract

http://www.bbc.co.uk/news/health-24446292

Toddler brain scan gives language insight

The brain has a critical window for language development between the ages of two and four, brain scans suggest.

By Helen Briggs BBC News

Environmental influences have their biggest impact before the age of four, as the brain's wiring develops to process new words, say UK and US scientists. The research in The Journal of Neuroscience suggests disorders causing language delay should be tackled early. It also explains why young children are good at learning two languages.
The scientists, based at King's College London, and Brown University, Rhode Island, studied 108 children with normal brain development between the ages of one and six. They used brain scans to look at myelin - the insulation that develops from birth within the circuitry of the brain. To their surprise, they found the distribution of myelin is fixed from the age of four, suggesting the brain is most plastic in very early life.
Any environmental influences on brain development will be strongest in infanthood, they predict.

This explains why immersing children in a bilingual environment before the age of four gives them the best chance of becoming fluent in both languages, the research suggests. It also suggests that there is a critical time during development when environmental influence on cognitive skills may be greatest.
Dr Jonathan O'Muircheartaigh, from King's College London, led the study. He told the BBC: "Since our work seems to indicate that brain circuits associated with language are more flexible before the age of four, early intervention for children with delayed language attainment should be initiated before this critical age. "This may be relevant to many developmental disorders, such as autism, since delayed language is a common early trait."

Growing vocabulary

Early childhood is a time when language skills develop very rapidly. Babies have a vocabulary of up to 50 words at 12 months but by the age of six this has expanded to about 5,000 words.
Language skills are localised in the frontal areas of the left-hand side of the brain. The researchers therefore expected more myelin to develop in the left-hand side of the brain, as the children learned more language.
In fact, they found it remained constant, but had a stronger influence on language ability before the age of four, suggesting there is a crucial window for interventions in developmental disorders.
"This work is important as it is the first to investigate the relationship between brain structure and language across early childhood and demonstrate how this relationship changes with age," said Dr Sean Deoni from Brown University, a co-researcher on the study. "This is important since language is commonly altered or delayed in many developmental disorders, such as autism."
Commenting on the study, Prof Dorothy Bishop of the department of Developmental Neuropsychology at the University of Oxford said the research added important new information about early development of connections in brain regions important for cognitive functions. "There is suggestive evidence of links with language development but it is too early to be confident about functional implications of the findings," she said. "Ideally we would need a longitudinal study following children over time to track how structural brain changes relate to language function."
The study was funded by the National Institutes for Mental Health (US) and the Wellcome Trust (UK).

http://www.eurekalert.org/pub_releases/2013-10/uosc-4yo100913.php

40 years of federal nutrition research fatally flawed

University of South Carolina study shows flaws in NHANES data

Four decades of nutrition research funded by the Centers for Disease Control and Prevention (CDC) may be invalid because the method used to collect the data was seriously flawed, according to a new study by the Arnold School of Public Health at the University of South Carolina.
The study, led by Arnold School exercise scientist and epidemiologist Edward Archer, has demonstrated significant limitations in the measurement protocols used in the National Health and Nutrition Examination Survey (NHANES). The findings, published in PLOS ONE (The Public Library of Science), reveal that a majority of the nutrition data collected by the NHANES are not "physiologically credible," Archer said.
These results suggest that without valid population-level data, speculations regarding the role of energy intake in the rise in the prevalence of obesity are without empirical support, he said.
The NHANES is the most comprehensive compilation of data on the health of children and adults in the United States. The survey combines interviews of self-reported food and beverage consumption over 24 hours and physical examinations to assess the health and nutritional status of the US population. Conducted by the CDC and the U.S. Department of Agriculture, the NHANES is the primary source of data used by researchers studying the impact of nutrition and diet on health.
The study examined data from 28,993 men and 34,369 women, 20 to 74 years old, from NHANES I (1971 – 1974) through NHANES (2009 – 2010), and looked at the caloric intake of the participants and their energy expenditure, predicted by height, weight, age and sex. The results show that -- based on the self-reported recall of food and beverages -- the vast majority of the NHANES data "are physiologically implausible, and therefore invalid," Archer said.
In other words, the "calories in" reported by participants and the "calories out," don't add up and it would be impossible to survive on most of the reported energy intakes. This misreporting of energy intake varied among participants, and was greatest in obese men and women who underreported their intake by an average 25 percent and 41 percent (i.e., 716 and 856 Calories per-day respectively).
"Throughout its history, the NHANES survey has failed to provide accurate estimates of the habitual caloric consumption of the U.S. population," Archer said. "Although improvements were made to the NHANES measurement protocol after 1980, there was little improvement to the validity of U.S. nutritional surveillance."

These limitations "suggest that the ability to estimate population trends in caloric intake and generate public policy relevant to diet-health relationships is extremely limited," said Archer, who conducted the study with colleagues at the Arnold School.
"The nation's major surveillance tool for studying the relationships between nutrition and health is not valid. It is time to stop spending tens of millions of health research dollars collecting invalid data and find more accurate measures," he said.
To access the current study, please visit: http://dx.plos.org/10.1371/journal.pone.0076632.

http://www.eurekalert.org/pub_releases/2013-10/bumc-bib100913.php

BUSM identifies barriers to implementing complimentary medicine curricula into residency

Lack of time and trained faculty the greatest barriers to incorporating CAM and M training into family medicine residency curricula

Boston - Investigators at Boston University School of Medicine (BUSM) have identified that lack of time and a paucity of trained faculty are perceived as the most significant barriers to incorporating complementary and alternative medicine (CAM) and integrative medicine (IM) training into family medicine residency curricula and training programs.
The study results, which are published online in Explore: The Journal of Science and Healing, were collected using data from an online survey completed by 212 national residency program directors. The study was led by Paula Gardiner, MD, MPH, assistant professor of family medicine at BUSM and assistant director of integrative medicine at Boston Medical Center, and colleagues from the department of Family Medicine.
"This is a part of medicine that has significant impact on patient care," said Gardiner. "We need to minimize barriers to implementing CAM/IM curricula in order to address these competencies and promote a larger focus on patient centered care."
According to the current study a majority of family medicine residency program directors felt that CAM and IM were an important part of resident training and, of those, a majority was aware of these recommended competencies. However, a majority of directors also did not have specific learning goals around CAM and IM in their residency programs. Of those directors aware of the competencies, a minority had an adequate evaluation of CAM or IM in their program.
The survey respondents identified "strong" CAM/IM programs as those that incorporated at least one of the following modes of exposing residents to CAM or IM: didactics, clinical rotations or electives. "Weak" programs incorporated none of these modalities. Didactics were the most commonly employed techniques of the strong programs. There were significant differences between the strong and weak programs in perceived access to experts in CAM or IM and faculty training in these modalities.
The study was conducted via an online survey and consisted of six questions on CAM and IM with a focus on awareness, competencies, attitudes toward curricula, barriers to implementation and management techniques. Given the use of CAM and IM modalities by patients and practicing physicians future directions should include raising awareness around the proposed competencies and identifying solutions to minimize the barriers to incorporating these competencies in residency training programs.
This research was funded in part by a grant from the National Center for Complementary and Alternative Medicine. Study data was provided by the Council of Academic Family Medicine (CAFM) Educational Research Alliance (CERA) Steering Committee.

http://www.eurekalert.org/pub_releases/2013-10/ru-cnc100913.php

Carbon's new champion

Rice U. theorists calculate atom-thick carbyne chains may be strongest material ever

HOUSTON - Carbyne will be the strongest of a new class of microscopic materials if and when anyone can make it in bulk. If they do, they'll find carbyne nanorods or nanoropes have a host of remarkable and useful properties, as described in a new paper by Rice University theoretical physicist Boris Yakobson and his group. The paper appears this week in the American Chemical Society journal ACS Nano.
Carbyne is a chain of carbon atoms held together by either double or alternating single and triple atomic bonds. That makes it a true one-dimensional material, unlike atom-thin sheets of graphene that have a top and a bottom or hollow nanotubes that have an inside and outside.
According to the portrait drawn from calculations by Yakobson and his group:

Carbyne's tensile strength – the ability to withstand stretching – surpasses "that of any other known material" and is double that of graphene. (Scientists had already calculated it would take an elephant on a pencil to break through a sheet of graphene.)

It has twice the tensile stiffness of graphene and carbon nanotubes and nearly three times that of diamond.

Stretching carbyne as little as 10 percent alters its electronic band gap significantly.

If outfitted with molecular handles at the ends, it can also be twisted to alter its band gap. With a 90-degree end-to-end rotation, it becomes a magnetic semiconductor.

Carbyne chains can take on side molecules that may make the chains suitable for energy storage.

The material is stable at room temperature, largely resisting crosslinks with nearby chains.

That's a remarkable set of qualities for a simple string of carbon atoms, Yakobson said.

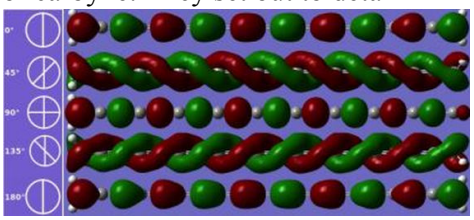
"You could look at it as an ultimately thin graphene ribbon, reduced to just one atom, or an ultimately thin nanotube," he said. It could be useful for nanomechanical systems, in spintronic devices, as sensors, as strong and light materials for mechanical applications or for energy storage. "Regardless of the applications," he said, "academically, it's very exciting to know the strongest possible assembly of atoms."

Based on the calculations, he said carbyne might be the highest energy state for stable carbon. "People usually look for what is called the 'ground state,' the lowest possible energy configuration for atoms," Yakobson said. "For carbon, that would be graphite, followed by diamond, then nanotubes, then fullerenes. But nobody asks about the highest energy configuration. We think this may be it, a stable structure at the highest energy possible."

Theories about carbyne first appeared in the 19th century, and an approximation of the material was first synthesized in the USSR in 1960. Carbyne has since been seen in compressed graphite, has been detected in interstellar dust and has been created in small quantities by experimentalists.

"I have always been interested in the stability of ultimately thin wires of anything and how thin a rod you could make from a given chemical," Yakobson said. "We had a paper 10 years ago about silicon in which we explored what happens to silicon nanowire as it gets thinner. To me, this was just a part of the same question."

The Rice researchers, led by Rice graduate student Mingjie Liu and postdoctoral researcher Vasilii Artyukhov, were aware of a number of papers that described one property or another of carbyne. They set out to detail carbyne with computer models using first-principle rules to determine the energetic interactions of atoms, Artyukhov said. "Our intention was to put it all together, to construct a complete mechanical picture of carbyne as a material," Artyukhov said. "The fact that it has been observed tells us it's stable under tension, at least, because otherwise it would just fall apart."



Nanoropes or nanorods of carbyne, a chain of carbon atoms, would be stronger than graphene or even diamond if they can be manufactured, according to new calculations by Rice University. Theoretical physicist Boris Yakobson said the material might find uses in electronics and for energy storage. **Vasilii Artyukhov/Rice University**

Yakobson said the researchers were surprised to find that the band gap in carbyne was so sensitive to twisting.

"It will be useful as a sensor for torsion or magnetic fields, if you can find a way to attach it to something that will make it twist," he said. "We didn't look for this, specifically; it came up as a side product."

"That's the good thing about studying things carefully," Artyukhov said.

Another finding of great interest was the energy barrier that keeps atoms on adjacent carbyne chains from collapsing into each other. "When you're talking about theoretical material, you always need to be careful to see if it will react with itself," Artyukhov said. "This has never really been investigated for carbyne."

The literature seemed to indicate carbyne "was not stable and would form graphite or soot," he said.

Instead, the researchers found carbon atoms on separate strings might overcome the barrier in one spot, but the rods' stiffness would prevent them from coming together in a second location, at least at room temperature.

"They would look like butterfly wings," Artyukhov said.

"Bundles might stick to each other, but they wouldn't collapse completely," Yakobson added. "That could make for a highly porous, random net that may be good for adsorption." Artyukhov said the nominal specific area of carbyne is about five times that of graphene.

When the team's paper became available this summer on arXiv, the scientific press and even some of the popular press were so excited over the calculations that they picked up on the paper and its implications before the team submitted it for peer review. Now that the complete paper is ready for public consumption, the researchers said they'll carry their investigation in new directions.

They're taking a more rigorous look at the conductivity of carbyne and are thinking about other elements as well. "We've talked about going through different elements in the periodic table to see if some of them can form one-dimensional chains," Yakobson said.

Rice graduate student Fangbo Xu and former postdoctoral researcher Hoonkyung Lee, now a professor at Konkuk University in South Korea, are co-authors of the paper. Yakobson is Rice's Karl F. Hasselmann Professor of Mechanical Engineering and Materials Science, a professor of chemistry and a member of the Richard E. Smalley Institute for Nanoscale Science and Technology.

The Air Force Office of Scientific Research and the Welch Foundation supported the research. Calculations were performed on the National Science Foundation-supported DaVinCI supercomputer, administered by Rice's Ken Kennedy Institute for Information Technology.
Read the abstract at http://pubs.acs.org/doi/abs/10.1021/nn404177r

http://phys.org/news/2013-10-outright-grants-cash-surprisingly-effective.html

Research finds outright grants of cash are surprisingly effective form of aid to the poor

Cash grants helped young people in Uganda become metalworkers, carpenters, tailors and hair stylists

Provided by Columbia University

The classic proverb says: If you give a man a fish, he will eat for a day. Teach him how to fish, and he will have food for a lifetime. Christopher Blattman's research suggests that if you just give the man cash, he will buy a fishing pole and learn how to fish himself.

Blattman, an assistant professor of international and public affairs and political science, recently completed a four-year study of a government-run program in northern Uganda that gave cash to groups of young people so they could learn a trade and start their own businesses. The results surprised him and convinced him that outright grants are the best way to give aid.

"I was very skeptical. I thought the money was bound to be wasted," Blattman recalled in a recent interview on campus. "But most people used the money responsibly and there were huge economic effects."

The data showed that after four years, most of those who received a cash grant were practicing a skilled trade, their income was up nearly 40 percent on average, and business assets increased 57 percent. "Astonishing numbers," Blattman said.

The program, funded by a loan from the World Bank, was designed to boost the Ugandan economy after 20 years of civil strife by encouraging young people—ages 16 to 35—to move from agriculture to skilled trades. The grants were only about $400 per person, the equivalent of a year's income for most people in the area. To get the cash, applicants had to form a group with others in their village and submit a proposal showing how they planned to use the money, but there was no follow-up to make sure they used it for that purpose.

Grant recipients became carpenters, metal workers, tailors and hair stylists. Some of the money—about 10 to 20 percent—went for training, either at an institute or as an apprentice to a local artisan, but most of it was used to purchase tools and raw materials. Some of those small businesses grew large enough to hire paid employees, improving the economic situation in an entire village.

"These were mostly farmers who had work 10 to 20 hours a week and earned about $1 a day," Blattman said. "They're still farming, but now they're getting five to 10 hours a week from their trade. That can make the difference between eating twice a day or three times, or sending your children to secondary school or not."

The study was done as a randomized control trial with Nathan Fiala of the German Institute for Economic Research and Sebastian Martinez of the Inter-American Development Bank. The World Bank wanted a rigorous evaluation of a program that had been in effect for several years. Of thousands of applicants, 535 groups, each with about 20 individuals, were deemed eligible for grants. About half were chosen by computerized lottery to get the cash and an equal number served as a control group. The Ugandan government is continuing the program.

Blattman also was involved in a separate study of a program run by an Italian humanitarian organization, AVSI, which gave $150 grants to 1,500 women in northern Uganda. Most of the women became traders, using the money to buy merchandise from nearby towns and villages and resell it. Doing so, they doubled their incomes to about $20 a month.

In that study, the women were divided into three groups that all received some training, which cost about $100 per recipient. One group had no follow-up, a second group had one follow-up visit from an aid worker to answer questions and provide support, and the third group had several follow-up visits.

The grant recipients who were followed and accountable for how they used the money did better than the others, but at a much higher cost—as much as $1,800 per recipient, including the grant, training and follow-up visits, compared with $250 without any follow-up. That's not cost effective, Blattman said. "The money could help five to 10 people instead of just one."

Blattman, who joined the Columbia faculty in 2012 after four years as an assistant professor at Yale, grew up in Canada. He earned his B.A. at the University of Waterloo and a Ph.D. in economics from the University of California, Berkeley. He did research on the impact of war and violence in Uganda for his dissertation, working with his wife, a psychologist who now is director of research and evaluation for the International Rescue Committee.His current research involves a program that gives unconditional grants and finds jobs for street youths in Ethiopia.

Programs that give cash grants work best in countries with a stable government where people don't have access to credit, he said, a description of half the developing countries in world. Unconditional grants have "a very high return on investment," Blattman said. "Most of the poor are deserving and use the money responsibly. They wouldn't otherwise be able to invest."

http://phys.org/news/2013-10-chinese-team-sprite-hangover.html

Chinese team finds drinking Sprite might help prevent hangover

Possible way for drinkers of alcoholic beverages to minimize their risk of developing a hangover

Phys.org - A team of Chinese researchers working at Sun Yat-Sen University has found a possible way for drinkers of alcoholic beverages to minimize their risk of developing a hangover and other negative side-effects: consume Sprite. In their paper published in the journal Food & Function, the team describes how they tested a host of beverages to determine which best boosts the production of an enzyme that breaks down acetaldehyde, a harmful chemical that is created as the body breaks down alcohol.

Human beings have likely been looking for ways to cure the negative side-effects of consuming alcohol since first stumbling across the fermentation process. Symptoms such as an aching head, dry mouth and sensitivity to noise have been the sad result of untold numbers of nights spent drinking. Unfortunately, none of the remedies discovered thus far have proven to be of much help. That may change soon, if the team in China is right. Drinking Sprite they say, just might build up a good enzyme that helps to get a bad chemical out of the body as quickly as possible.

The team in China based their study on other research that has found that when people drink an alcoholic beverage, the body undertakes a two-step process in dealing with the alcohol in it. First, an enzyme called alcohol dehydrogenase (ADH) sets to work to breaking the alcohol down into acetaldehyde. Next, another enzyme, called aldehyde dehydrogenase (ALDH) breaks it down further into acetate. It's the first step, apparently, that causes problems—it's acetaldehyde that causes the brain to swell leading to hangover pain. The team in China believes that chemicals that cause an increase in ALDH should help alleviate the problem by getting rid of the acetaldehyde faster—before it can cause brain swelling. But rather than working up a new drug, they looked at commercially available beverages to find out if any of them might do so naturally. They tested 57 different beverages ranging from teas to soft drinks—of all of those tested, Sprite (called Xue bi in China) performed the best.

The team hasn't yet begun testing the use of Sprite to prevent a hangover in actual human subjects just yet, but indicate they are making plans to do so. They may not have to, of course, as news of their research will almost certainly lead to widespread testing of the soft-drink as a hangover preventative technique by large numbers of drinkers worldwide.

More information: Effects of Herbal Infusion, Tea and Carbonated Beverage on Alcohol Dehydrogenase and Aldehyde Dehydrogenase Activities, Food Funct., 2013, Accepted Manuscript, DOI: 10.1039/C3FO60282F

Abstract

Various alcoholic beverages containing different concentrations of ethanol are widely consumed, and excessive alcohol consumption may result in serious health problem. The consumption of alcohol beverages is often accompanied by non-alcohol beverages, such as herbal infusion, tea and carbonated beverage to relieve drunk symptoms. The aim of this study was to supply new information on effects of these beverages on alcohol metabolism for nutritionists and the general public to reduce harm of excessive alcohol consumption. Effects of 57 kinds of herbal infusion, tea and carbonated beverages on alcohol dehydrogenase and aldehyde dehydrogenase activities were evaluated. Generally, effects of these beverages on alcohol dehydrogenase and aldehyde dehydrogenase activities are very different. The results suggested that some beverages should not be drunk after excessive alcohol consumption, and several beverages may be potential dietary supplement for the prevention and treatment of harm from excessive alcohol consumption.

http://nyti.ms/GLPEhW

By 2047, Coldest Years May Be Warmer Than Hottest in Past, Scientists Say

If greenhouse emissions continue their steady escalation, temperatures across most of the earth will rise to levels with no recorded precedent by the middle of this century, researchers said Wednesday.

By JUSTIN GILLIS

Scientists from the University of Hawaii at Manoa calculated that by 2047, plus or minus five years, the average temperatures in each year will be hotter across most parts of the planet than they had been at those locations in any year between 1860 and 2005.

To put it another way, for a given geographic area, “the coldest year in the future will be warmer than the hottest year in the past,” said Camilo Mora, the lead scientist on a paper published in the journal Nature. Unprecedented climates will arrive even sooner in the tropics, Dr. Mora’s group predicts, putting increasing stress on human societies there, on the coral reefs that supply millions of people with fish, and on the world’s greatest forests.

"Go back in your life to think about the hottest, most traumatic event you have experienced," Dr. Mora said in an interview. "What we're saying is that very soon, that event is going to become the norm."
The research comes with caveats. It is based on climate models, huge computer programs that attempt to reproduce the physics of the climate system and forecast the future response to greenhouse gases. Though they are the best tools available, these models contain acknowledged problems, and no one is sure how accurate they will prove to be at peering many decades ahead.
The models show that unprecedented temperatures could be delayed by 20 to 25 years if there is a vigorous global effort to bring emissions under control. While that may not sound like many years, the scientists said the emissions cuts would buy critical time for nature and for human society to adapt, as well as for development of technologies that might help further reduce emissions.
Other scientists not involved in the research said that slowing emissions would have a bigger effect in the long run, lowering the risk that the climate would reach a point that triggers catastrophic changes. They praised the paper as a fresh way of presenting information that is known to specialists in the field, but not by the larger public.
"If current trends in carbon dioxide emissions continue, we will be pushing most of the ecosystems of the world into climatic conditions that they have not experienced for many millions of years," said Ken Caldeira, a climate researcher at the Carnegie Institution for Science in Stanford, Calif.
The Mora paper is a rarity: a class project that turned into a high-profile article in one of the world's most prestigious scientific journals.
Dr. Mora is not a climate scientist; rather he is a specialist in using large sets of data to illuminate environmental issues. He assigned a class of graduate students to analyze forecasts produced by 39 of the world's foremost climate models. The models, whose results are publicly available, are operated by 21 research centers in 12 countries, and financed largely by governments.
Thousands of scientific papers have been published about the model results, but the students identified one area of analysis that was missing. The results are usually reported as average temperature changes across the planet. But that gives little sense of how the temperature changes in specific places might compare with historical norms. "We wanted to give people a really relatable way to understand climate," said Abby G. Frazier, a doctoral candidate in geography.
So Dr. Mora and his students divided the earth into a grid, with each cell representing 386 square miles. Averaging the results from the 39 climate models, they calculated a date they called "climate departure" for each location — the date after which all future years were predicted to be warmer than any year in the historical record for that spot on the globe.
The results suggest that if emissions of greenhouse gases remain high, then after 2047, more than half the earth's surface will experience annual climates hotter than anything that occurred between 1860 and 2005, the years for which historical temperature data and reconstructions are available. If assiduous efforts were made to bring emissions down, that date could be pushed back to 2069, the analysis found.
With the technique the Mora group used, it is possible to specify climate departure dates for individual cities. Under high emissions, climate departure for New York City will come in 2047, the paper found, plus or minus the five-year margin of error. But lower emissions would push that to 2072.
For Beijing, climate departure would come in 2046 under high emissions, or 2078 under lower emissions. The dates for Moscow are 2063 and 2092; for Washington, 2047 and 2071.
Perhaps the most striking findings are in the tropics. Climate variability there is much smaller than in high latitudes, and the extra heat being trapped by greenhouse gases will push the temperature beyond historical bounds much sooner, the research found. Under high emissions, the paper found a climate departure date of 2031 for Mexico City, 2029 for Jakarta and for Lagos, Nigeria, and 2033 for Bogotá, Colombia.
Many people perceive climate change to be most serious at the poles, and the largest absolute changes in temperature are already occurring in the Arctic and parts of Antarctica. But the Mora paper dovetails with previous research suggesting that the biggest risks to nature and to human society, at least in the near term, may actually be in the tropics.
People living in the tropics are generally poor, with less money to adapt to climate change than people in the mid-latitude rich countries that are burning the most carbon-based fuels and contributing most of the emissions. Plants and animals in the tropics also are accustomed to a narrow temperature range. Organisms that do not have the genetic capacity to adapt to rapid climatic changes will be forced to move, or will be driven to extinction, climate scientists say.
"I am certain there will be massive biological and social consequences," Dr. Mora said. "The specifics, I cannot tell you."

http://bit.ly/17yZ31S

Bedside scan can show embers of consciousness in comas

A SIMPLE bedside scan could reveal an active mind hidden inside an unresponsive body.

09 October 2013 by Nora Schultz

The method provides another tool for recognising consciousness in people who have been wrongly diagnosed as being in a vegetative state. Tests are also under way to use it to monitor people under general anaesthetic, to make sure they do not regain consciousness during an operation.

The technique builds on recent research into the nature of consciousness. "Information that is processed consciously typically recruits several brain regions at once," says Jean-Rémi King at the Brain and Spine Institute (ICM) in Paris, France. Other information that enters the brain triggers unconscious activity – for instance, the righting reflex that helps us retain balance when we are pushed – and it only tends to activate one brain area.

King and his colleague Jacobo Sitt, also at the ICM, reasoned that they could spot consciousness in people simply by playing them a series of beeps and then searching electroencephalogram (EEG) brain scan data for evidence that signals from different brain regions fluctuated in the same way as each other, suggesting that they were sharing information.

They performed their tests on 75 people in a vegetative state, 67 minimally conscious people, 24 people who had recently regained consciousness after a coma, and 14 healthy controls. By running the EEG data through statistics software, the researchers found differences between the patterns from people who were fully conscious, those in a vegetative state, and those who were minimally conscious (Current Biology, doi.org/n42).

"This adds another string to our bow of diagnostic tools that we can use to identify those patients who are aware, but unable to show it with their bodies," says Damian Cruse of Western University in London, Ontario, Canada. Cruse and his colleague, Adrian Owen, have recently begun communicating with such people by asking them questions while monitoring neural activity.

The technique developed by King and Sitt could work in situations where Cruse and Owen's methods cannot, because, as Cruse points out, it works even on people whose injuries prevent them from imagining responses to questions. "They simply listen to a series of beeps, and their brain does the rest," says Cruse.

Even listening might be unnecessary for the technique to work, says King. "The recording should probably even work without any external stimuli – although this still needs to be tested," he says.

That might make the approach particularly suitable for ensuring that people stay unconscious during operations. King and Sitt are now looking to adapt their method for constant monitoring of anaesthetised patients. Around 1 in every 500 people recovers some awareness while still under the knife, so having a reliable consciousness measure during surgery is important, says Sitt.

http://www.medscape.com/viewarticle/812333?src=rss

Once-a-Year Zoledronic Acid Preserves Bone in Elderly, Frail

A single annual injection with zoledronic acid is safe and effective for boosting skeletal integrity in women who are most at risk for fractures and least likely to receive osteoporosis treatment

Nancy A. Melville

BALTIMORE – A single annual injection with zoledronic acid (Zometa, Novartis) is safe and effective for boosting skeletal integrity in a population of women who are most at risk for fractures and least likely to receive osteoporosis treatment — the elderly and frail in long-term care, according to a new study presented here at the American Society for Bone and Mineral Research (ASBMR) 2013 Annual Meeting.

"Among concerns with zoledronic-acid treatment has been that the drug might not even help the frail and elderly improve bone density, but our findings show that there can indeed still be a response," said lead author Susan Greenspan, MD, a professor of medicine and director of the Osteoporosis Prevention and Treatment Center at the University of Pittsburgh Medical Center, Pennsylvania.

Zoledronic acid's benefits in strengthening bones in postmenopausal women have been well documented, but the new findings are important because pivotal clinical trials have typically excluded the elderly population, despite the fact that nearly 85% of people in long-term care facilities have osteoporosis and only about 5% receive treatment.

The study was the first step in determining zoledronic acid's effects on older, frail individuals, said Dr. Greenspan. The next issue to be considered is whether the drug prevents fractures in the population.

"Before we could do a fracture study we needed to show that bone density improved and that bone turnover goes down," she said. "That is what we saw — the improvement seen in this study is similar to what has been seen with a younger population in the pivotal trial."

Once-a-Year Injection Resolves Several Concerns

The 2-year, double-blind, randomized trial, Zoledronic Acid in Frail Elders to Strengthen Bone (ZEST), included 181 residents of a nursing home or assisted-living facility, with a mean age of 85.4 years. The women, who all had a life expectancy of at least 2 years, were not being treated with antiresorptive agents despite having osteoporosis and a vitamin-D level of 20 ng/dL or above.

They were randomized to a single dose of zoledronic acid 5 mg (n=89) or placebo (n=92), and all participants in both groups received daily calcium (1200 mg) and vitamin D (800 IU). Those in the treatment group had higher rates of diabetes, falls history, antiseizure medications, and slow gait speed.

Of the participants, 92% completed the study at 12 months and 67% continued until 24 months.

At the 12- as well as 24-month end points, the women in the treatment group showed significantly greater improvements in bone-mineral density (BMD) at the total hip, femoral neck, and spine, compared with the placebo group (all $P < 0.01$).

The 12-month absolute differences were 3.2 percentage points at the total hip and 1.8 at the spine.

The 2 groups showed no significant differences in terms of adverse events or deaths.

By only requiring 1 annual injection, zoledronic acid resolves several concerns in treating the elderly with bisphosphonates, including gastrointestinal and adherence issues, Dr. Greenspan told Medscape Medical News. "With oral bisphosphonates, patients need to be sitting up and fasting for at least 30 minutes, so with long-term care patients, that can mean that they need to be watched for 30 minutes, and if they have cognitive impairment, they may not be able to tell if discomfort is from the drug or not."

But Some May Still Not Be Candidates for Drug

But Dr. Greenspan cautioned that some elderly and frail patients may still not be candidates for zoledronic acid, due to concerns about its effects on renal function.

"Renal function can go down as you get older, and you can't have poor renal function or be on dialysis to use this medication, so patients' kidney function should be checked" before prescribing, she noted.

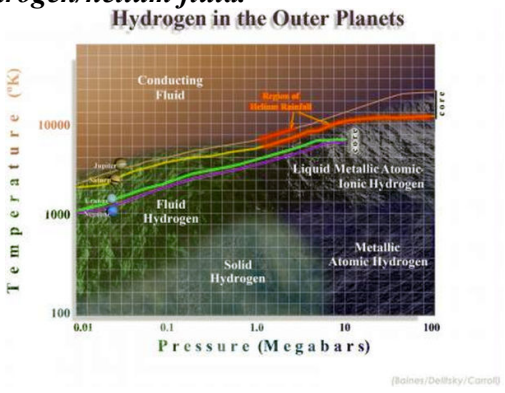
"Furthermore, about 20% of people will get an acute-phase reaction to zoledronic acid over 1 or 2 days, with flulike symptoms including headaches and fever, so that's another concern, because it might not be clear in this population whether it's related to the medicine or...is the flu, a heart attack, or an infection," she concluded.

Dr. Greenspan has reported no relevant financial relationships.

http://phys.org/news/2013-10-diamonds-sky-scientists-jupiter-saturn.html

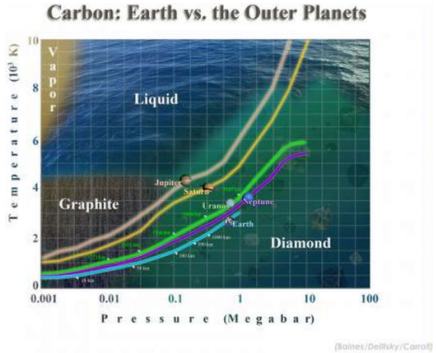
Diamonds in the sky: Scientists find Jupiter and Saturn are awash in diamonds

Recent work by planetary scientists has indicated that the deep atmospheres of Jupiter and Saturn may contain chunks of diamond floating in a liquid hydrogen/helium fluid.



Planetary scientists Mona L. Delitsky of California Specialty Engineering in Pasadena, California, and Kevin H. Baines of the University of Wisconsin-Madison have compiled recent data about the phase diagram of carbon and combined them with newly published adiabats (pressure-temperature diagrams) for Jupiter and Saturn to calculate that diamond will be stable in the deep interiors. Further, at altitudes below the regions where diamond is stable, the pressures and temperatures will be so large as to melt the diamond into liquid, creating diamond rain or liquid diamond.

Recent publications by Nettelmann et al. (2008, 2011) have reported improved adiabats based on new equations of state for the materials inside of Jupiter and Saturn, and new experiments by researchers at Sandia Laboratories and Lawrence Livermore National Laboratory using shockwave techniques (notably those of Knudson et al. 2008 and Eggert et al. 2010) have given clear boundaries for the different phases of carbon.



Delitsky and Baines are reporting that elemental carbon such as soot or graphite generated in Saturn's enormous lightning storms will descend into the planet and will be crushed into diamonds at deep altitudes and then melted into liquid diamond near the cores of the planets.

While it has been known for 30 years that diamond may be stable in the cores of Uranus and Neptune, Jupiter and Saturn were thought to be too hot or to not have conditions suitable for precipitation of solid diamond. The cores of Uranus and Neptune are too cold to melt diamond. The new data available has confirmed that at depth, diamonds may be floating around inside of Saturn, some growing so large that they could perhaps be called

"diamondbergs."
In a recent book, Alien Seas, (Springer 2013), edited by renowned space artist Michael Carroll, a chapter by Baines and Delitsky entitled "The Seas of Saturn" was published. Using this new accurate data, a story about robot mining ships plying the deep interior of Saturn in the far distant future and collecting chunks of diamond was described. The artwork (see images, below) shows robot hands reaching out to capture diamonds and collect them for transport to Earth. Because of this new information, theorists Delitsky and Baines report that "diamonds are forever on Uranus and Neptune and not on Jupiter and Saturn."
Provided by California Specialty Engineering

http://www.eurekalert.org/pub_releases/2013-10/ip-pfc101013.php

Pulp friction cleans up 'Brockovich' chemical

A byproduct of the manufacture of pulp using the sulfite process for making paper, sodium lignosulfonate, can be used to immobilize and soak up toxic chromium compounds from soil and water, according to research published in the International Journal of Innovation and Sustainable Development.

Konstantin Volchek and Carl Brown of Environment Canada, and Dario Velicogna of Velicogna Consultants Inc in Ottawa, have carried out two successful parallel tests of efficacy on a laboratory scale. The first involved removal of chromium ions from water using reagent binding and membrane separation and the second was the stabilization of chromium ions in the soil using chemical soil flushing. Lignosulfonates can bind hexavalent chromium and allow it to be removed from contaminated water by subsequent membrane filtration. The soil tests showed that lignosulfonates can reduce the mobility of chromium so that it becomes trapped within the soil matrix; in the field this would reduce the risk of it leaching from a contaminated site into the underlying water table or waterways.
Chromium has many uses in industry but its accidental and even deliberate release into the environment has led to widespread contamination of soil and water. However, chromium salts are also naturally present in rock and soil at relatively high concentration in certain parts of Greece, Italy and the USA. Chromium(III), which carry a 3+ electrical charge and chromium(VI) 6+ charge are the most stable and so the most common. Cr(III) is not very soluble and although it has some toxicity it is the highly soluble and so mobile Cr(VI) that is a significant cause for environmental and health concerns. Cr(VI) ions are both toxic and cancer causing.
There are various technologies that might be used to extract chromium(VI) ions from contaminated soil or water. However, these usually require the addition of expensive chemicals to allow the heavy metal ions to be extracted or immobilized. A much more sustainable approach would be to use a reagent that was just as effective or more so and that was itself a waste product from industry. Sodium salts of lignosulfonates from the paper industry offer such an alternative, the researchers say.
"Inexpensive, effective and easy to use reagents that reduce chromium toxicity and mobility would make a remediation technology more attractive and competitive," Volchek and colleagues reports. The lignosulfonate first reduces toxic Cr(VI) ions to the less soluble and less hazardous Cr(III) and these bind strongly to the lignosulfonate molecules and can then be removed by membrane filtration.
"Evaluation of sodium lignosulfonate for the remediation of chromium-contaminated soil and water" in Int. J. Innovation and Sustainable Development, 2013, 7, 289-302

http://www.eurekalert.org/pub_releases/2013-10/ucl-eha101013.php

European hunter-gatherers and immigrant farmers lived side-by-side for more than 2,000 years

Hunter-gatherers and immigrant farmers lived side-by-side for more than 2,000 years in Central Europe, before the hunter-gatherer communities died out or were absorbed into the farming population.

In a paper published today in Science, researchers describe their analysis of DNA and isotopes from human bones found in the 'Blätterhöhle' cave near Hagen in Germany, where both hunter-gatherers and farmers were buried.
The team, led by anthropologist Professor Joachim Burger of the Johannes Gutenberg University, Germany, used stable isotopes to determine their diet, DNA to investigate how they were related, and radiocarbon to establish how old the bones were.
"It is commonly assumed that the European hunter-gatherers disappeared soon after the arrival of farmers", said Dr Ruth Bollongino, lead author of the study. "But our study shows that the descendants of the first European humans maintained their hunter-gatherer way of life, and lived in parallel with the immigrant farmers, for at least 2,000 years. The hunter-gathering way of life only died out in Central Europe around 5,000 years ago, much later than previously thought."

"Until around 7,500 years ago all central Europeans were hunter-gatherers," said Professor Mark Thomas, professor of evolutionary genetics at UCL, and a co-author of the study. "They were the descendants of the first wave of our species to arrive in Europe, around 45,000 years ago. They survived the last Ice Age and the warming that started around 10,000 years ago. And now it seems they also survived the initial wave of farmers spreading across Europe from the southeast of the continent."
Previous genetic studies by Professors Burger and Thomas showed that agriculture was brought to Central Europe by immigrant farmers around 7,500 years ago. From that time on, little trace of hunter-gathering can be seen in the archaeological record, and it was widely assumed that the hunter-gatherers rapidly died out or were absorbed into the farming populations.
"Although there is some archaeological evidence of interactions between immigrant agriculturalists and local hunter-gatherers, its extent and duration has remained something of a mystery," said Professor Thomas. "But our study now shows that the hunter-gatherers stayed in close proximity to farmers, had contact with them for thousands of years, and buried their dead in the same cave.
"This contact was not without consequences, because hunter-gatherer women sometimes married into the farming communities, while no genetic lines of farmer women have been found in hunter-gatherers", explained Burger. "This pattern of marriage is known from many studies of human populations in the modern world. Farmer women regarded marrying into hunter-gatherer groups as social demotion."
For a long time the team were unable to make sense of the findings. "It was only through the analysis of isotopes in the human remains, performed by our Canadian colleagues, that the pieces of the puzzle began to fit," states Bollongino.
She added: "The results showed that the hunter-gatherers sustained themselves in Central and Northern Europe on a very specialized diet that included fish, among other things, until 5,000 years ago. And what is more, the hunter-gatherers living at the same time as the farmers were genetically more similar to the pre-farming hunter-gatherers than to the contemporaneous farmers."
The team also pursued the question of what impact both groups had on the gene pool of modern Europeans. Adam Powell, mathematician and specialist in demographic modeling at the JGU Institute of Anthropology, who obtained his PhD with Professor Thomas at UCL, explained: "While neither hunter-gatherers nor farmers are to be regarded as the sole ancestors of today's Europeans, it is the mixing of both populations that potentially represents the ancestry of modern-day Europeans."
It seems that the hunter-gatherers' lifestyle lasted at least until around 5000 years ago in Central Europe. However, some of the prehistoric farmers had hunter-gatherers as ancestors, and their genes are still found in Central Europeans today.
1. For more information or to speak to Dr Marc Jones, please contact Clare Ryan in the UCL Media Relations Office on tel: +44 (0)20 3108 3846, mobile: +44 (0)7747 565 056, out of hours +44 (0)7917 271 364, e-mail: clare.ryan@ucl.ac.uk.
2. '2000 Years of Parallel Societies in Stone Age Central Europe' will be published online in Science on 10 October 2013. Journalists can obtain copies of the paper by contacting the UCL Media Relations Office.
Science contact

http://wapo.st/1gtYqP6

Stone Age farmers, hunters kept their distance

Polarization — right and left, red state and blue state, etc. — wasn't invented yesterday. Ask the scientists studying the bones of prehistoric Europeans. Hundreds of skeletal remains , many from a newly discovered cave in Germany, have produced a startling reminder of the power of social boundaries.

By Joel Achenbach, Published: October 11

When farmers showed up from the Near East about 7,500 years ago, eager to grow their grains in the soil of Central Europe, they were met by indigenous hunters and gatherers. The locals, apparently, did not welcome them with open arms.
Two new scientific techniques, ingeniously paired together, suggest that for some 2,000 years, these distinct groups refused to mesh and would rarely cross their cultural boundaries to find a mate.
At first, the indigenous people largely disappeared from the scene altogether, fleeing to the north to continue their traditional mode of life. But even when they drifted back and became neighbors with the farmers, they remained to a large extent a breed apart.
"We don't really know who set up those social boundaries, so we don't know if it was the farmers who didn't mix with the hunter gatherers or if it was the hunter-gatherers who wanted to stay by themselves," said Ruth Bollongino, a biologist at the University of Mainz and the lead author "2000 Years of Parallel Societies in Stone Age Central Europe," one of two new papers on Neolithic Europe published online Thursday by the journal Science. "Or maybe its both groups that wanted to keep their own identity."

This is an old story. Think of the plot of "Shane," in which the ranchers do battle with the "sodbusters." Recall the tensions between "the farmer and the cowman" in the musical "Oklahoma!"
Exactly how cultures clashed in prehistoric times is necessarily a foggy subject, given that no one had a written language and archeologists must piece together the story from broken pottery, tools, bones and charcoal.
But new research techniques are clarifying that story. The analysis of mitochondrial DNA from skeletal remains allows scientists to study migration patterns and lineages. Moreover, scientists can tell what people ate by studying variations in the carbon, sulfur and nitrogen isotopes in their teeth and bones. They can tell, for example, if a diet was heavy in fish or heavy in grains.
An enduring debate for decades has been whether agriculture arose in Europe through "cultural diffusion," in which the techniques of farming and animal husbandry were adopted by the indigenous population from distant sources, or whether an entirely new population of people rolled into that part of the world and pushed out the natives. The second paper published Thursday in Science, reporting an analysis of hundreds of skeletal remains from multiple sites in Central Europe, provides evidence for the second scenario, which likely involved some degree of unpleasantness.
"There's certainly a big culture clash at that time," said Wolfgang Haak, a geneticist at the University of Adelaide and co-author of that paper. "Farmers are probably loud, noisy and stinky at the same time. They come with domestic farm animals and just take over the place."
Spencer Wells, explorer-in-residence at the National Geographic Society, and project director of the Genographic Project, a human-migration research effort that contributed to the second paper, called the new findings "a huge insight."
"In my opinion, certainly for the case of Europe, it's going to be the nail in the coffin of this cultural diffusion idea," he said.
The "parallel societies" evidence is based on skeletal remains found in a cave near the German city of Hagen. The cave, called Blätterhöhle, or Leaf Cave, has a long, narrow entrance, and was not discovered until 2004. Excavators found more than 400 skeletal remains. The DNA evidence showed that some people were descendants of hunter-gatherers and some were from the farming lineage.
Then came the surprise. Bollongino assumed that she and her colleagues would wind up writing a paper about the mixing of these populations. But instead, the isotopic analysis showed that the people from the hunter-gatherer lineage were still living that way, with a diet relying heavily on fish, and the people from the farming lineage continued to be farmers. Everyone stuck to their way of life and rarely interbred.
"It wasn't until we saw the isotopes that we realized we were going to have to rewrite the paper completely," Bollongino said. "They shared the same burial place for something between 400 and 600 years, so it would be very hard to explain that they did not know each other. We believe that they were close neighbors and had contact with each other and traded with each other. But still they didn't mix."
The moral of the story?
"Apparently most humans need to have some kind of identity, or some kind of group that they belong to and they feel part of. I think keeping up this identity also means that you do not admix with people from other groups, from other cultures," she said.

http://www.eurekalert.org/pub_releases/2013-10/uoo-khu100913.php

Kissing helps us find the right partner -- and keep them

What's in a kiss? A study by Oxford University researchers suggests kissing helps us size up potential partners and, once in a relationship, may be a way of getting a partner to stick around.

'Kissing in human sexual relationships is incredibly prevalent in various forms across just about every society and culture,' says Rafael Wlodarski, the DPhil student who carried out the research in the Department of Experimental Psychology at Oxford University. 'Kissing is seen in our closest primate relatives, chimps and bonobos, but it is much less intense and less commonly used.
'So here's a human courtship behaviour which is incredibly widespread and common and, in extent, is quite unique. And we are still not exactly sure why it is so widespread or what purpose it serves.'
To understand more, Rafael Wlodarski and Professor Robin Dunbar set up an online questionnaire in which over 900 adults answered questions about the importance of kissing in both short-term and long-term relationships.
Rafael Wlodarski explains: 'There are three main theories about the role that kissing plays in sexual relationships: that it somehow helps assess the genetic quality of potential mates; that it is used to increase arousal (to initiate sex for example); and that it is useful in keeping relationships together. We wanted to see which of these theories held up under closer scrutiny.'

The researchers report their findings in two papers, one in the journal Archives of Sexual Behavior and the second in the journal Human Nature. They were funded by the European Research Council.
The survey responses showed that women rated kissing as generally more important in relationships than men. Furthermore, men and women who rated themselves as being attractive, or who tended to have more short-term relationships and casual encounters, also rated kissing as being more important.
In humans, as in all mammals, females must invest more time than men in having offspring - pregnancy takes nine months and breast-feeding may take up to several years. Previous studies have shown women tend to be more selective when initially choosing a partner. Men and women who are more attractive, or have more casual sex partners, have also been found to be more selective in choosing potential mates. As it is these groups which tended to value kissing more in their survey responses, it suggests that kissing helps in assessing potential mates.
It has been suggested previously that kissing may allow people to subconsciously assess a potential partner through taste or smell, picking up on biological cues for compatibility, genetic fitness or general health.
'Mate choice and courtship in humans is complex,' says Professor Robin Dunbar. 'It involves a series of periods of assessments where people ask themselves "shall I carry on deeper into this relationship?" Initial attraction may include facial, body and social cues. Then assessments become more and more intimate as we go deeper into the courtship stages, and this is where kissing comes in.'
He adds: 'In choosing partners, we have to deal with the "Jane Austen problem": How long do you wait for Mr Darcy to come along when you can't wait forever and there may be lots of you waiting just for him? At what point do you have to compromise for the curate?
'What Jane Austen realised is that people are extremely good at assessing where they are in the "mating market" and pitch their demands accordingly. It depends what kind of poker hand you've been dealt. If you have a strong bidding hand, you can afford to be much more demanding and choosy when it comes to prospective mates. 'We see some of that coming out in the results of our survey, suggesting that kissing plays a role in assessing a potential partner,' Professor Dunbar explains.
Past research has also found that women place greater value on activities that strengthen long-term relationships (since raising offspring is made easier with two parents present).
In the current study, the team found that kissing's importance changed for people according to whether it was being done in long-term or short-term relationships. Particularly, it was rated by women as more important in long-term relationships, suggesting that kissing also plays an important role in mediating affection and attachment among established couples.
While high levels of arousal might be a consequence of kissing (particularly as a prelude to sex), the researchers say it does not appear to be a driving factor that explains why we kiss in romantic relationships.
Other findings included:

In short relationships, survey participants said kissing was most important before sex, less so during sex, was less important again after sex and was least important at other times. In committed relationships, where forming and maintain a lasting bond is an important goal, kissing was equally important before sex and at times not-related to sex.

More frequent kissing in a relationship was linked to the quality of a relationship, while this wasn't the case for having more sex. However, people's satisfaction with the amount of both kissing and sex did tally with the quality of that relationship.

In a companion paper in the journal Human Nature, the researchers report that women's attitudes to romantic kissing also depend on where in their menstrual cycle and their relationship they are. Women valued kissing most at initial stages of a relationship when they were in the part of their cycle when they are most likely to conceive. Previous studies have shown that hormonal changes associated with the menstrual cycle can change a woman's preferences for a potential mate. When chances of conceiving are highest, women seem to prefer men who display supposed signals of underlying genetic fitness, such as masculinized faces, facial symmetry, social dominance, and genetic compatibility. It appears that kissing a romantic potential partner at this time helps women assess the genetic quality of a potential mate, the researchers say.

In total, just over 900 adults aged between 18 and 63 took part in the online survey, with around 55% in a long-term relationship at that time. 308 men and 594 women answered questions like: 'How important do you think kissing is at the very initial stages of a relationship?' or 'How important do you think kissing is with a committed long-term partner immediately before sex/during sex/after sex/at all other times?'
The researchers began the work by considering that there could be three possible functions for kissing: it plays a role in assessing a potential mate, it could mediate the attachment felt between established couples, and it could be important in raising levels of arousal leading to sex.
They used differences between men and women, in being in short- or long-term relationships, and with people who might be more attractive or tended to have more relationships, to tease out which of these hypotheses might best explain why we kiss. They explain the patterns of people's survey responses fit with the first two hypotheses but there is little evidence that arousal is an important driver for why we kiss, although it could well be a consequence of kissing.

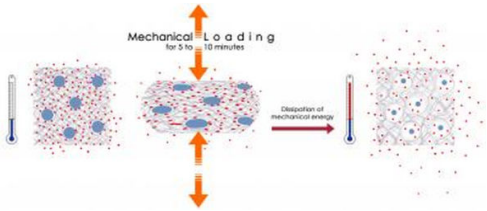
http://www.eurekalert.org/pub_releases/2013-10/epfd-cdc101013.php

Cartilage damage could be repaired

Scientists develop new method to regenerate cartilage

Unlike our bones, the cartilage inside our joints is not vascularized (i.e., it has no blood vessels). This is one reason why cartilage does not heal well after an injury. In athletes in particular, joint injuries often result in cartilage degeneration and arthritis. The process is chronic and irreversible, and to this day, no effective treatment exists.

EPFL scientists Dominique Pioletti and Harm-Anton Klok have developed a hydrogel that promotes cartilage regeneration. In a joint, cartilage-producing cells only respond to treatment if they are mechanically stimulated at the same time, for example in the knee joint when a person is walking. To exploit this fact, the scientists created a hydrogel that delivers a therapeutic drug to the cells only when they are undergoing repetitive movement. The results of their work, which is part of the "Smart Materials" Swiss National Research Project (PNR 62), have been published in the journal Biomaterials.



Heated by movement, nanostructures in the hydrogel matrix let go of the drugs it contains. **EPFL**

Targeted and timed delivery

The cells that produce cartilage in a joint are called chondrocytes. When a joint is at rest, its chondrocytes are mostly inactive. However, when the same joint is moving, its chondrocytes activate receptors that are sensitive to growth factors produced by the body. At the same time, the chondrocytes become sensitive to treatments that help them regenerate damaged cartilage. "The receptors involved only appear after 5-20 minutes of repetitive movement," says Prof. Pioletti. "We therefore had to develop a way to time the release of the medication."

When a knee joint is in movement, friction generates heat. The method developed by the EPFL scientists is based on this concept. The viscous hydrogel matrix is designed to deliver the drugs it carries only when it reaches a certain threshold temperature, that is, after a specific number of repeated movements. Technically, the matrix contains liposomal nanoparticles as well as a therapeutic agent, TGF-beta growth factor. The matrix heats up during repeated movements. After 5-10 minutes, under the effect of the heat, the diameter of the nanoparticles decreases by a third, causing gaps to form in the matrix through which the growth factor can flow out into the target area. This mechanism thus makes it possible to time the release of the drug, delivering it at the most optimal moment to help the joint regenerate its cartilage.

A minimally invasive procedure

One way of implementing this approach in the future would involve arthroscopically implanting the matrix at the site of the damaged cartilage. Then, via targeted physical therapy, the joint would be mobilized to maximize the effect of the medicine.

More work has to be done before the team's innovative method actually reaches the market. At present, the team has proven the concept from a mechanical standpoint, having successfully delivered a colored dye used in place of the growth factor, but the technique still needs to be fine-tuned. "Several doctors have shown an interest in our approach," says Prof Pioletti, "and now we need to find partners and improve the method for in vivo tests."

http://www.eurekalert.org/pub_releases/2013-10/ez-nar101013.php

New antiviral response discovered in mammals

Evidence that RNAi does indeed contribute to mammalian antiviral defence

Many viral infections are nipped in the bud by the innate immune response. This involves specific proteins within the infected cell that recognize the virus and trigger a signalling cascade – the so-called interferon response. This activates a protective mechanism in neighbouring cells and often results in the death of the primarily infected cell.

In plants and invertebrates another mechanism is known to function in antiviral immune response: the so-called RNA interference (RNAi) pathway. RNAi uses an intermediate of the viral proliferation process to build a weapon against the virus. Although RNAi also exists in mammals, researchers have until now thought it to be involved in other cellular processes required for gene regulation but not in antiviral immunity. Evidence that RNAi does indeed contribute to mammalian antiviral defence is now published in Science by Olivier Voinnet, professor for RNA biology at ETH Zurich, and his colleagues.

Small interfering RNAs as specific antiviral weapons

The researchers infected mouse embryonic stem cells with two viruses, the encephalomyocarditis virus (EMCV) and the Nodamura virus (NoV). Subsequently, they were able to detect short RNA molecules of about

22 nucleotides in length within the cells. The sequence of these RNA clearly corresponded to the viral genome and they displayed all the characteristics of the main effector molecules of RNAi called the small interfering or siRNAs. This provided evidence that the virus infection had activated the RNAi machinery of mammalian cells. The trigger for RNAi is an unusual RNA molecule that arises when the viral genome is copied: a long, double-stranded RNA molecule. This double-stranded RNA is cut into shorter pieces to produce siRNAs, which subsequently serve as a homing device. Since they are derived from the viral RNA and thus correspond perfectly to its sequence, they guide molecular scissor proteins to the viral RNA. The latter is subsequently cut into harmless pieces. Thus, the virus can no longer proliferate.

Ideal protection for progenitor cells

Voinnet provides two reasons why the role of RNAi in antiviral immunity in mammals has been overlooked for so long: first, studies conducted in plants (notably by the Voinnet group) and later in invertebrates have shown that many viruses have developed counter-defences to inhibit the RNAi machinery of infected cells. If such counter-defences existed also in mammalian viruses, they would likely mask antiviral RNAi. Second, most scientists have looked for antiviral RNAi in differentiated cells in which the interferon response makes up the majority of the innate immune response. In contrast, Voinnet and his colleagues have focused on stem cells. Stem and presumably progenitor cells cannot produce an interferon response and thus do not possess a classical innate immunity. This makes sense, says Voinnet, as the interferon response results in the death of the infected cell. Since whole differentiated cell populations arise from the progenitor cells, they would be eliminated along with the latter. Similarly, virus infections in a stem cell would be very detrimental, as all its descendant cell lineages would be infected as well. "RNAi is therefore perfectly suited to protect progenitor cells from viruses. It may actually be the only form of immunity these cells can mount against viruses," Voinnet says. He adds: "However, I would not want to put into people's mind that antiviral RNAi operates only in stem and progenitor cells: we show in our paper that we can detect it in differentiated stem cells as well, although at a significantly lower level."

"Beauty in simplicity"

In order to provide further evidence for a function of RNAi in mammalian antiviral immunity, the researchers modified the Nodamura Virus genetically to eliminate what they thought was its counter-defence mechanism against RNAi. Subsequently, they infected mouse stem cells with the modified virus and observed that the cells could fend off this virus much better than the original NoV. Moreover, only upon infection with the engineered virus did the scientists detect siRNAs derived from the virus genome. These results show that RNAi is the mechanism that held NoV at bay, but this mechanism became only visible when the RNAi antagonist encoded by NoV was removed. "Thus, identical frameworks of antiviral defence and counter-defence operate in mammals, plants and invertebrates," Voinnet concludes.

Work conducted in parallel and published back-to-back by Voinnet's colleague and collaborator Shou Wei Ding (University of Riverside, USA) show that siRNAs could be also detected in tissues of newborn mice infected with the modified NoV. Remarkably these siRNAs were identical to those found by Voinnet and colleagues in cultured mouse stem cells and they provided the suckling mice a near-complete immunity against the virus. "This was important proof to show that antiviral RNAi exists in a living organism and not just in stem cell cultures," explains Voinnet.

Thus, the researchers have revealed an important and so far hidden part of innate immunity in mammals. "The beauty of this system is its simplicity, and, we can now say it, its universality," says Voinnet. "The RNAi machinery is part of the cells' normal life, but it acquires its function as an antiviral weapon thanks to the RNA that is produced by the virus to be eliminated. Since the specificity of the response is provided by the virus itself, the mechanism can basically adapt to any virus. Immunity could not be more innate than that!" he concludes.

Maillard PV, Ciaudo C, Marchais A, Li Y, Jay F, Din SW, Voinnet O: "Antiviral RNA Interference in Mammalian Cells", Science, October 11, 2013, DOI (after publication): http://www.sciencemag.org/lookup/doi/10.1126/science.1241930.

http://www.eurekalert.org/pub_releases/2013-10/cp-ekw100313.php

Elephants know what it means to point, no training required

Elephants spontaneously get the gist of human pointing and can use it as a cue for finding food

When people want to direct the attention of others, they naturally do so by pointing, starting from a very young age. Now, researchers reporting in Current Biology, a Cell Press publication, on October 10 have shown that elephants spontaneously get the gist of human pointing and can use it as a cue for finding food. That's all the more impressive given that many great apes fail to understand pointing when it's done for them by human caretakers, the researchers say.

"By showing that African elephants spontaneously understand human pointing, without any training to do so, we have shown that the ability to understand pointing is not uniquely human but has also evolved in a lineage of animal very remote from the primates," says Richard Byrne of the University of St Andrews, noting that elephants are part of an ancient African radiation of animals, including the hyrax, golden mole, aardvark, and manatee. "What elephants share with humans is that they live in an elaborate and complex network in which support, empathy, and help for others are critical for survival. It may be only in such a society that the ability to follow pointing has adaptive value, or, more generally, elephant society may have selected for an ability to understand when others are trying to communicate with them, and they are thus able to work out what pointing is about when they see it."

Byrne and study first author Anna Smet were studying elephants whose "day job" is taking tourists on elephant-back rides near Victoria Falls, in southern Africa. The animals were trained to follow certain vocal commands, but they weren't accustomed to pointing.

"Of course, we always hoped that our elephants would be able to learn to follow human pointing, or we'd not have carried out the experiments," Smet says. "What really surprised us is that they did not apparently need to learn anything. Their understanding was as good on the first trial as the last, and we could find no sign of learning over the experiment."

Elephants that were more experienced with humans, or those born in captivity, were no better than less-experienced, wild-born individuals when it came to following pointing gestures. Byrne and Smet say it is possible that elephants may do something akin to pointing as a means of communicating with each other, using their long trunk. Elephants do regularly make prominent trunk gestures, but it remains to be seen whether those motions act in elephant society as "points."

The findings help to explain how it is that humans have been able to rely on wild-caught elephants as work animals, for logging, transport, or war, for thousands of years. Elephants have a natural capacity to interact with humans even though—unlike horses, dogs, and camels—they have never been bred or domesticated for that role. Elephants seem to understand us humans in a way most other animals don't.

"Elephants are cognitively much more like us than has been realized, making them able to understand our characteristic way of indicating things in the environment by pointing," Byrne says. "This means that pointing is not a uniquely human part of the language system."

Current Biology, Smet et al.: "African elephants can use human pointing cues to find hidden food."

http://www.eurekalert.org/pub_releases/2013-10/cp-hau100313.php

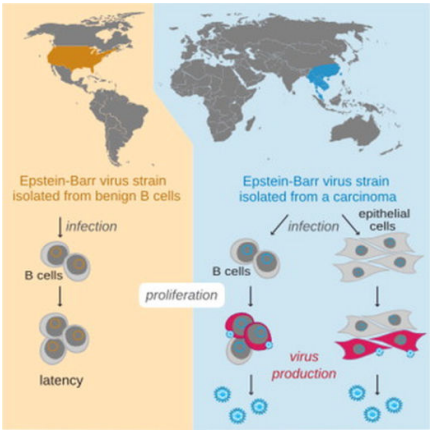
How a ubiquitous herpesvirus sometimes leads to cancer

You might not know it, but most of us are infected with the herpesvirus known as Epstein-Barr virus (EBV). For most of us, the virus will lead at worst to a case of infectious mononucleosis, but sometimes, and especially in some parts of the world, those viruses are found in association with cancer. Now, researchers reporting in the Cell Press journal Cell Reports on October 10 have found that the difference between a relatively harmless infection and a cancer-causing one lies at least partly in the viral strain itself.

The results offer some of the first evidence for the existence of distinct EBV subtypes with very different public health risks. The researchers say that vaccination or other strategies for preventing EBV infection will need to be designed with these most pathogenic, cancer-causing strains in mind.

"EBV is an important but neglected pathogen," said Henri-Jacques Delecluse of the German Cancer Research Centre in Heidelberg, Germany. "We have made an important step in recognizing that EBV is actually a family of viruses that have different properties, some of which are very likely to cause disease. So, the consequences of being infected with EBV might be different, depending on the strain one carries."

Delecluse and his colleagues made the discovery by sequencing the DNA of a viral strain dubbed M81 isolated from a Chinese patient with nasopharyngeal carcinoma (NPC). Their analyses revealed that M81 is highly similar to other viruses isolated from NPCs and profoundly different from Western strains in terms of its ability to infect and replicate within cells.



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The M81 strain can infect epithelial cells and multiply spontaneously at a very high level in all cells it infects, including B lymphocytes, the cells in which the viruses hide, the researchers report. It remains to be seen exactly how infected epithelial cells become cancerous.
"Our results have made me radically change my strategy to address the problem of EBV-associated diseases," Delecluse said. "The current view is that the virus is essentially the same all over the world and that local conditions explain the different consequences of EBV infection. We now show that the type of EBV also plays an important role. By concentrating on the potentially pathogenic EBV strains, we will soon better understand how EBV causes diseases, and this will also help [in] designing prevention strategies."
Cell Reports, Tsai et al.: "Spontaneous lytic replication and epitheliotropism define an Epstein-Barr virus strain found in carcinomas."

http://www.bbc.co.uk/news/health-24462699

Alzheimer's breakthrough hailed as 'turning point'

The discovery of the first chemical to prevent the death of brain tissue in a neurodegenerative disease has been hailed as the "turning point" in the fight against Alzheimer's disease.

More work is needed to develop a drug that could be taken by patients. But scientists say a resulting medicine could treat Alzheimer's, Parkinson's, Huntington's and other diseases. In tests on mice, the Medical Research Council showed all brain cell death from prion disease could be prevented.
Prof Roger Morris, from King's College London, said: "This finding, I suspect, will be judged by history as a turning point in the search for medicines to control and prevent Alzheimer's disease." He told the BBC a cure for Alzheimer's was not imminent but: "I'm very excited, it's the first proof in any living animal that you can delay neurodegeneration. "The world won't change tomorrow, but this is a landmark study."

Cells starve

The research team at the Medical Research Council Toxicology Unit, based at the University of Leicester, focused on the natural defence mechanisms built into brain cells.
When a virus hijacks a brain cell it leads to a build-up of viral proteins. Cells respond by shutting down nearly all protein production in order to halt the virus's spread.
However, many neurodegenerative diseases involve the production of faulty or "misfolded" proteins. These activate the same defences, but with more severe consequences.

Neurodegeneration

A neurodegenerative disease is one in which the cells of the brain and spinal cord are lost
The functions of these cells include decision making and control of movements
These cells are not easily regenerated, so the effects of diseases can be devastating
Neurodegenerative diseases include Alzheimer's, Parkinson's, multiple sclerosis and Huntington's
Source: London Brain Centre

The misfolded proteins linger and the brain cells shut down protein production for so long that they eventually starve themselves to death. This process, repeated in neurons throughout the brain, can destroy movement or memory or even kill, depending on the disease. This process is thought to take place in many forms of neurodegeneration, so safely disrupting it could treat a wide range of diseases.
The researchers used a compound which prevented those defence mechanisms kicking in and in turn halted neurodegeneration.
The study, published in Science Translational Medicine, showed mice with prion disease developed severe memory and movement problems. They died within 12 weeks.
However, those given the compound showed no sign of brain tissue wasting away.
Lead researcher Prof Giovanna Mallucci told the BBC news website: "They were absolutely fine, it was extraordinary. "What's really exciting is a compound has completely prevented neurodegeneration and that's a first. "This isn't the compound you would use in people, but it means we can do it and it's a start."
She said the compound offered a "new pathway that may well give protective drugs" and the next step was for drug companies to develop a

Analysis

It is rare to get cautious scientists keen to describe a study in mice as a turning point in treating Alzheimer's.
It is early science, a lot can go wrong between a drug for mice and a drug for humans and the only published data is for prion disease, not even Alzheimer's.
So why the excitement?
It is the first time that any form of neurodegeneration has been completely halted, so it is a significant landmark.
It shows that the process being targeted has serious potential.
If this can be successfully developed, which is not guaranteed, the prize would be huge.
In Parkinson's the alpha-synuclein protein goes wrong, In Alzheimer's it's amyloid and tau, in Huntington's it's the Huntingtin protein. But the errant protein is irrelevant here as the researchers are targeting the way a cell deals with any misfolded protein.
It means one drug could cure many diseases and that really would be something to get excited about.

medicine for use in humans.

'Very dramatic'

Prof Mallucci's lab is also testing the compound on other forms of neurodegeneration in mice but the results have not yet been published. Side effects are an issue. The compound also acted on the pancreas, meaning the mice developed a mild form of diabetes and lost weight. Any human drug would need to act only on the brain. However, this gives scientists and drug companies a starting point.

David Allsop, professor of neuroscience at Lancaster University described the results as "very dramatic and highly encouraging" but cautioned that more research was needed to see how the findings would apply to diseases such as Alzheimer's and Parkinson's.

Dr Eric Karran, the director of research at the charity Alzheimer's Research UK, said: "Targeting a mechanism relevant to a number of neurodegenerative diseases could yield a single drug with wide-reaching benefits, but this compound is still at an early stage. "It will be important for these findings to be repeated and tested in models of other neurodegenerative diseases, including Alzheimer's disease."

http://www.sciencedaily.com/releases/2013/10/131010092427.htm

'Peanut Butter' Test Can Help Diagnose Alzheimer's Disease, Researchers Find

Researchers have found that patients in the early stages of Alzheimer's disease have an asymmetry in their ability to detect smells, with the left nostril becoming weaker than the right.

A dollop of peanut butter and a ruler can be used to confirm a diagnosis of early stage Alzheimer's disease, University of Florida Health researchers have found.

Jennifer Stamps, a graduate student in the UF McKnight Brain Institute Center for Smell and Taste, and her colleagues reported the findings of a small pilot study in the Journal of the Neurological Sciences.

Stamps came up with the idea of using peanut butter to test for smell sensitivity while she was working with Dr. Kenneth Heilman, the James E. Rooks distinguished professor of neurology and health psychology in the UF College of Medicine's department of neurology.

She noticed while shadowing in Heilman's clinic that patients were not tested for their sense of smell. The ability to smell is associated with the first cranial nerve and is often one of the first things to be affected in cognitive decline. Stamps also had been working in the laboratory of Linda Bartoshuk, the William P. Bushnell presidentially endowed professor in the College of Dentistry's department of community dentistry and behavioral sciences and director of human research in the Center for Smell and Taste.

"Dr. Heilman said, 'If you can come up with something quick and inexpensive, we can do it,'" Stamps said.

She thought of peanut butter because, she said, it is a "pure odorant" that is only detected by the olfactory nerve and is easy to access.

In the study, patients who were coming to the clinic for testing also sat down with a clinician, 14 grams of peanut butter -- which equals about one tablespoon -- and a metric ruler. The patient closed his or her eyes and mouth and blocked one nostril. The clinician opened the peanut butter container and held the ruler next to the open nostril while the patient breathed normally. The clinician then moved the peanut butter up the ruler one centimeter at a time during the patient's exhale until the person could detect an odor. The distance was recorded and the procedure repeated on the other nostril after a 90-second delay.

The clinicians running the test did not know the patients' diagnoses, which were not usually confirmed until weeks after the initial clinical testing.

The scientists found that patients in the early stages of Alzheimer's disease had a dramatic difference in detecting odor between the left and right nostril -- the left nostril was impaired and did not detect the smell until it was an average of 10 centimeters closer to the nose than the right nostril had made the detection in patients with Alzheimer's disease. This was not the case in patients with other kinds of dementia; instead, these patients had either no differences in odor detection between nostrils or the right nostril was worse at detecting odor than the left one.

Of the 24 patients tested who had mild cognitive impairment, which sometimes signals Alzheimer's disease and sometimes turns out to be something else, about 10 patients showed a left nostril impairment and 14 patients did not. The researchers said more studies must be conducted to fully understand the implications.

"At the moment, we can use this test to confirm diagnosis," Stamps said. "But we plan to study patients with mild cognitive impairment to see if this test might be used to predict which patients are going to get Alzheimer's disease."

Stamps and Heilman point out that this test could be used by clinics that don't have access to the personnel or equipment to run other, more elaborate tests required for a specific diagnosis, which can lead to targeted

treatment. At UF Health, the peanut butter test will be one more tool to add to a full suite of clinical tests for neurological function in patients with memory disorders.
One of the first places in the brain to degenerate in people with Alzheimer's disease is the front part of the temporal lobe that evolved from the smell system, and this portion of the brain is involved in forming new memories.
"We see people with all kinds of memory disorders," Heilman said. Many tests to confirm a diagnosis of Alzheimer's disease or other dementias can be time-consuming, costly or invasive. "This can become an important part of the evaluation process."
Jennifer J. Stamps, Linda M. Bartoshuk, Kenneth M. Heilman. A brief olfactory test for Alzheimer's disease. Journal of the Neurological Sciences, 2013; 333 (1-2): 19 DOI: 10.1016/j.jns.2013.06.033

http://www.eurekalert.org/pub_releases/2013-10/uog-shp100813.php

Study: Herbal products omit ingredients, contain fillers

Consumers of natural health products beware. The majority of herbal products on the market contain ingredients not listed on the label, with most companies substituting cheaper alternatives and using fillers, according to new research from the University of Guelph.

The study, published today in the open access journal BMC Medicine, used DNA barcoding technology to test 44 herbal products sold by 12 companies. Only two of the companies provided authentic products without substitutions, contaminants or fillers. Overall, nearly 60 per cent of the herbal products contained plant species not listed on the label.
Researchers detected product substitution in 32 per cent of the samples. More than 20 per cent of the products included fillers such as rice, soybeans and wheat not listed on the label.
"Contamination and substitution in herbal products present considerable health risks for consumers," said lead author Steven Newmaster, an integrative biology professor and botanical director of the Guelph-based Biodiversity Institute of Ontario (BIO), home of the Canadian Centre for DNA Barcoding.
"We found contamination in several products with plants that have known toxicity, side effects and/or negatively interact with other herbs, supplements and medications."
One product labelled as St. John's wort contained Senna alexandrina, a plant with laxative properties. It's not intended for prolonged use, as it can cause chronic diarrhea and liver damage and negatively interacts with immune cells in the colon.
Several herbal products contained Parthenium hysterophorus (feverfew), which can cause swelling and numbness in the mouth, oral ulcers, and nausea. It also reacts with medications metabolized by the liver.
One ginkgo product was contaminated with Juglans nigra (black walnut), which could endanger people with nut allergies.
Unlabelled fillers such as wheat, soybeans and rice are also a concern for people with allergies or who are seeking gluten-free products, Newmaster said. "It's common practice in natural products to use fillers such as these, which are mixed with the active ingredients. But a consumer has a right to see all of the plant species used in producing a natural product on the list of ingredients."
Until now, verifying what's inside capsules or tablets has posed challenges, Newmaster said. His research team developed standard methods and tests using DNA barcoding to identify and authenticate ingredients in herbal products.
"There is a need to protect consumers from the economic and health risks associated with herbal product fraud. Currently there are no standards for authentication of herbal products."
Medicinal herbs now constitute the fastest-growing segment of the North American alternative medicine market, with more than 29,000 herbal substances sold, he said.
More than 1,000 companies worldwide make medicinal plant products worth more than $60 billion a year. About 80 per cent of people in developed countries use natural health products, including vitamins, minerals and herbal remedies.
Canada has regulated natural health products since 2004. Regulators face a backlog of licence applications, and thousands of products on the market lack a full product licence. Globally, regulatory problems involving natural health products continue to affect consistency and safety, Newmaster said.
"The industry suffers from unethical activities by some of the manufacturers."
The study also involved research associate Subramanyam Ragupathy, U of G student Meghan Gruric and Sathishkumar Ramalingam of the Bharathiar University in India.
This research was supported by Genome Canada through the Ontario Genomics Institute; the Canada Foundation for Innovation; International Science and Technology Partnership Canada; and the Social Sciences and Humanities Research Council.

http://www.wired.com/wiredscience/2013/10/absurd-creature-6-foot-salamander/

Absurd Creature of the Week: The Human-Sized Salamander That Smells Like Pepper

A salamander in the rivers of China and Japan that dwarfs its American cousin

By Matt Simon

***Hugs!* Image: NGT / National Geographic Creative**

In the rivers of China and Japan dwells a salamander so huge that it positively dwarfs its American cousin, the massive 2.5-foot "snot otter" (which, as it happens, is what they called me in high school). This is the giant salamander, a remarkable human-sized amphibian that has remained almost unchanged for millions of years, hiding on river bottoms and hoovering up fish into its gaping maw. It smells like pepper, it's astonishingly quick, and it makes noises that sound a bit like a child. A really funny-looking child.

The giant salamander smells like pepper, it's astonishingly quick, and it makes noises that sound a bit like a child. A really funny-looking child. There are actually two species of giant salamander, one in China, which can clock in at 6 feet, and a smaller version in Japan, which grows to 5 feet. But how can an amphibian that typically fits in the palm of your hand get so astoundingly large? By being a big baby.

"They're what we call neotenic animals," said evolutionary biologist David Wake of the University of California, Berkeley. These creatures often grow huge because they don't become sexually mature until they get very large.

"So what happens is that as they grow bigger and bigger and bigger, they approach more and more what you would consider to be a perfect stage, a full adult stage. But they never really get there," said Wake.

(Neoteny, by the way, is why we find things like Lil Bub and Mickey Mouse so cute. A big head and eyes in an adult recall the features of a juvenile (.pdf), which to humans bring to mind our own babies, who we tend to want to care for. This could explain why we give preferential treatment to preserving adorable species over ugly ones, though sadly this isn't the case with our treatment of the less-than-adorable giant salamander, which is nearing extinction.)

So try as you might to get the perpetually expanding giant salamander to tell you what it wants to be when it grows up, you're not going to get an answer. But in the meantime, we know for sure that it enjoys being a top predator in its ecosystem. Because unlike its snot otter cousin, the giant salamander is big enough to take down large fish. It may have poor eyesight, but the creature can pinpoint prey with its keen sense of smell and special receptors on its skin that pick up vibrations in the water. Then something called the gape-and-suck method kicks in.

"They greatly expand the throat region," said Wake, "and then they pop the mouth open, and this causes suction, which drags in water" and anything swimming in it. They actually displace their jaw in the process, and it all happens in a fraction of a second. And while the teeth that line the giant salamander's jaw may be relatively small, it has more on the roof of its mouth, according to Wake.

When they're not inhaling fish, male giant salamanders will make long horizontal burrows, called dens, according to herpetologist David Blackburn of the California Academy of Sciences. "They have these huge salamanders that will actually defend these dens, and the reason those dens are important is because females lay eggs in them. And so they're basically defending nest sites."

These males are called, of all things, den-masters, which sounds like something straight out of Dungeons & Dragons, except in real life salamanders don't use swords and magic and whatnot. Well, unless you count smelling like pepper as being magical. In Japan the giant salamander is actually called the pepper fish, because when threatened, it produces a white fluid that smells as such, according to Blackburn. (In China it's known as the infant fish, due to its vocalizations supposedly sounding like the voice of a child.)

Their skin is also remarkable in that it can absorb oxygen, in addition to what the salamander gets by occasionally breathing air. And its characteristic skin folds, says Blackburn, provide increased surface area for such an exchange.

Strangely, we knew about giant salamanders from the fossil record before scientists ever described a living specimen. Andrias scheuchzeri, an almost identical cousin of extant species, was one of the first-ever scientifically recognized fossils, according to Wake.

"It was called by the discoverer Homo diluvii testis, because it was all flattened out and had big large eyes, and they thought it was the skeleton of a human," said Wake. "And they said this was a remnant of a human who was caught in the flood, Noah's flood." Homo diluvii testis means "human witness of the deluge," and today, the giant salamanders' genus is Andrias, meaning "image of a man."

And to welcome giant salamanders into the league of humans, we're treating them exactly as we do each other: like crap. The giant salamander is seriously threatened, its populations decimated by habitat destruction, pollution, and the folk medicine trade. But ironically the giant salamander's salvation could come, at least in part, from its methodical destruction.
"Both the Chinese and Japanese species are critically endangered," said Blackburn, "most especially the Chinese populations … they occur in very small places in the wild now. But they're bred for food. [Giant salamander meat] can be something like $50 a pound. So there's a big industry around raising these in captivity."
So remember, if you love something, set it free. Unless it happens to be a critically endangered species and you prefer to express your love by going ahead and just eating it.

http://www.sciencedaily.com/releases/2013/10/131011135235.htm

Two Forms of Parkinson's Disease Identified

Why can the symptoms of Parkinson's disease vary so greatly from one patient to another?

A consortium of researchers, headed by a team from the Laboratoire CNRS d'Enzymologie et Biochimie Structurales, is well on the way to providing an explanation.
Parkinson's disease is caused by a protein known as alpha-synuclein, which forms aggregates within neurons, killing them eventually.
The researchers have succeeded in characterizing and producing two different types of alpha-synuclein aggregates. Better still, they have shown that one of these two forms is much more toxic than the other and has a greater capacity to invade neurons. This discovery takes account, at the molecular scale, of the existence of alpha-synuclein accumulation profiles that differ from one patient to the next. These results, published on October 10 in Nature Communications, represent a notable advance in our understanding of Parkinson's disease and pave the way for the development of specific therapies targeting each form of the disease.
Parkinson's disease, which is the second most frequent neurodegenerative disease after Alzheimer's, affects some 150,000 people in France.
According to those suffering from the disease, it can manifest itself in the form of uncontrollable shaking (in 60% of patients) or by less-localized symptoms such as depression, behavioral and motor disorders. These differences in symptoms point to different forms of Parkinson's disease.
This condition, for which no curative treatment currently exists, is caused by the aggregation in the form of fibrillar deposits of alpha-synuclein, a protein that is naturally abundant at neuron junctions. These misfolded alpha-synuclein aggregates propagate between neurons.
When they invade a new neuron, they are capable of recruiting normal alpha-synuclein and adding it to the deposit. For this reason, many researchers advocate that the alpha-synuclein of the aggregates should be considered as an infectious protein, in other words a prion. Highly toxic, the alpha-synuclein deposits end up by triggering a process of apoptosis, i.e. cell death.
The researchers have shown that there is not just one single type of aggregate. They succeeded in producing two types of aggregate that only differ in how the protein stacks up. At the millionth of a millimeter scale, the first form of aggregate resembles spaghetti, whereas the second form is long and flat, recalling the shape of wider pasta such as linguine.
he team of scientists then tried to determine whether these structural differences result in functional differences. To find out, they placed the two types of aggregates in contact with neuronal cells in culture. They discovered that the capacity of the "spaghetti" form to bind to and penetrate cells is notably greater than that of the "linguine" form.
The "spaghetti" form is also considerably more toxic and rapidly kills the infected cells. This form has shown itself to be capable of resisting the cell mechanisms responsible for eliminating it, whereas the "linguine" form is, to a certain extent, controlled by the cell.
The researchers are convinced that the existence of at least two forms of alpha-synuclein aggregates explains why doctors are faced with different Parkinson's diseases depending on the patient.
Experiments on mice are currently underway to confirm this hypothesis. Furthermore, the scientists consider that analysis of the type of aggregate could lead to an efficient diagnosis method, which would make it possible in particular to assess the virulence of the disease for each patient.
Finally, they hope that by refining the characterization of the structure of the aggregates, it will be possible to develop targeted therapeutic strategies for each variant in order to slow down the propagation of abnormal alpha-synuclein within the brain.

Luc Bousset, Laura Pieri, Gemma Ruiz-Arlandis, Julia Gath, Poul Henning Jensen, Birgit Habenstein, Karine Madiona, Vincent Olieric, Anja Böckmann, Beat H. Meier, Ronald Melki. Structural and functional characterization of two alpha-synuclein strains. Nature Communications, 2013; 4 DOI: 10.1038/ncomms3575

http://bit.ly/17oVuMw

Neurons Fire Backward in Sleep

Unusual brain cell activity may underlie memory strengthening

By Erica Westly | Saturday, October 12, 2013 | 2

Researchers have long known that sleep is important for forming and retaining memories, but how this process works remains a mystery. A study published in March suggests that strange electrical activity, involving neurons that fire backward, plays a role.

Neuronal activity typically requires sensory input—for example, a taste or smell—that gets received by neurons' dendrites and then transmitted as an electrochemical message to other cells via long axons. Yet the brain is mostly closed off to sensory input during sleep. Instead evidence suggests that during sleep, neurons are controlled by electrical impulses that ripple through the brain like waves. In 2011 researchers found that these waves of electricity cause neurons in the hippocampus, the main brain area involved with memory, to fire backward during sleep, sending an electrical signal from their axons to their own dendrites rather than to other cells. The new work, published in the Proceedings of the National Academy of Sciences USA, confirmed this unusual behavior and suggested that firing in reverse weakens the dendrites' ability to receive input from other neurons.

Weakening neural connections may serve a dual purpose, says R. Douglas Fields, a laboratory chief at the National Institutes of Health and co-author of the study with neuroscientist Olena Bukalo and other colleagues. The authors suggest that firing backward helps to strengthen the electrical signals of neighboring cells, necessary to solidify memories, as well as freeing up space in the brain to store new memories on waking.

This study was conducted in samples taken from rat brains, but sleep is thought to induce backward firing in human neurons, too. In fact, Fields says, this bizarre electrical behavior may underlie the positive effects of deep-brain stimulation, which, though not well understood, has been shown to improve the symptoms of Parkinson's disease and other neurological disorders.

http://www.eurekalert.org/pub_releases/2013-10/gumc-ias100813.php

In a surprise finding, gene mutation found linked to low-risk bladder cancer

An international research team led by scientists from Georgetown Lombardi Comprehensive Cancer Center has discovered a genetic mutation linked to low-risk bladder cancer.

WASHINGTON - The investigators identified STAG2 as one of the most commonly mutated genes in bladder cancer, particularly in tumors that do not spread. Their findings are reported online today in Nature Genetics. The finding suggests that checking the status of the gene may help identify patients who might do unusually well following cancer treatment, says the study's senior investigator, cancer geneticist Todd Waldman, MD, PhD, a professor of oncology at Georgetown Lombardi.

"Most bladder cancers are superficial tumors that have not spread to other parts of the body, and can therefore be easily treated and cured. However, a small fraction of these superficial tumors will recur and metastasize even after treatment," he says.

Because clinicians have been unable to definitively identify those potentially lethal cancers, all bladder cancers patients — after surgery to remove tumors — must undergo frequent endoscopic examinations of their bladder to look for signs of recurrence, says Waldman. This procedure, called cystoscopy, can be uncomfortable and is expensive.

"Our data show that STAG2 is one of the earliest initiating gene mutations in 30-40 percent of superficial or 'papillary-type' bladder tumors, and that these tumors are unlikely to recur," says David Solomon, MD, PhD, a lead author on the study. Solomon is a graduate of the Georgetown MD/PhD program and is currently a pathology resident at the University of California, San Francisco.

"We have developed a simple test for pathologists to easily assess the STAG2 status of these tumors, and are currently performing a larger study to determine if this test should enter routine clinical use for predicting the likelihood that a superficial bladder cancer will recur," Solomon says.

For the study, the researchers examined 2,214 human tumors from virtually all sites of the human body for STAG2 inactivation and found that STAG2 was most commonly inactivated in bladder cancer, the fifth most common human cancer. In follow up work, they found that 36 percent of low risk bladder cancers — those that never invaded the bladder muscle or progressed — had mutated STAG2. That suggests that testing the STAG2 status of the cancer could help guide clinical care, Waldman says. "A positive STAG2 mutation could mean that patient is at lower risk of recurrence."

The researchers also found that 16 percent of the bladder cancers that did spread, or metastasize, had mutated STAG2.

STAG2 mutations have been found in a number of cancers, and this finding in bladder cancer adds new information, he says.

Contributing co-authors include researchers from the University of California, San Francisco; the University of Texas MD Anderson Cancer Center; Weill Cornell College of Medicine; the National Cancer Institute, the National Human Genome Research Institute; Johns Hopkins University School of Medicine; the University of Colorado Cancer Center; Hospital Kassel (Germany); University Hospital Ulm (Germany); Hospital Am Eichert (Germany); and Leiden University Medical Center (Netherlands).

This work was supported by National Institutes of Health grants (R01CA169345, R01CA159467, and R21CA143282), and the MD Anderson Cancer Center Bladder Cancer SPORE grant (P50CA091846).

A provisional patent application has been filed by Georgetown University for the technology described in this paper, on which Waldman, David A. Solomon, and Jung-Sik Kim are the inventors.

http://www.sciencedaily.com/releases/2013/10/131013121732.htm

When Med Students' iPad Use for Instruction Goes Up, Personal Use Goes Down

With the entry of "Millenials" into medical residency programs across the country, institutions have started to examine ways to improve programs to correspond with that generation's learning behaviors and preferences.

A study presented at the ANESTHESIOLOGY™ 2013 annual meeting found that Millennial residents use their iPad® to enhance their educational experience. Surprisingly, as residents increased use of their iPad® for educational purposes, their personal iPad® use decreased significantly.

"Millenials" (also called Generation Y) is a name given to the generation born between 1982 and 2004, following Baby Boomers and Generation X.

"Millennial learners are more tech savvy and prefer a variety of active learning methods," said Marcia B. Henry, Ph.D., clinical research coordinator with the Department of Anesthesiology at Tulane University School of Medicine, New Orleans. "Based on these characteristics, we need to incorporate new teaching strategies and develop curricula using more multimedia and Internet sources."

In the study, Apple iPad® 2 tablets were purchased by 22 residents using textbook funds. An anonymous, eight-question survey was e-mailed to the residents after the first and sixth month of iPad® use.

The study's most surprising result was a 50 percent decrease in personal iPad® use by the residents. More than 88 percent of the residents used the iPad® for tangible educational purposes such as reading textbooks, accessing journal articles and purchasing educational applications.

Based on this information, resident curriculums should take advantage of multimedia, Internet learning, social media resources and other technology in more innovative ways, perhaps resulting in fewer lectures. The authors further noted that the role of clinical faculty may change from information disseminators to that of helping residents apply information to resolve clinical problems. The study authors also noted that the potential for immediate and expedited communication between residents and faculty mentors via technology could improve point-of-care and clinical outcomes.