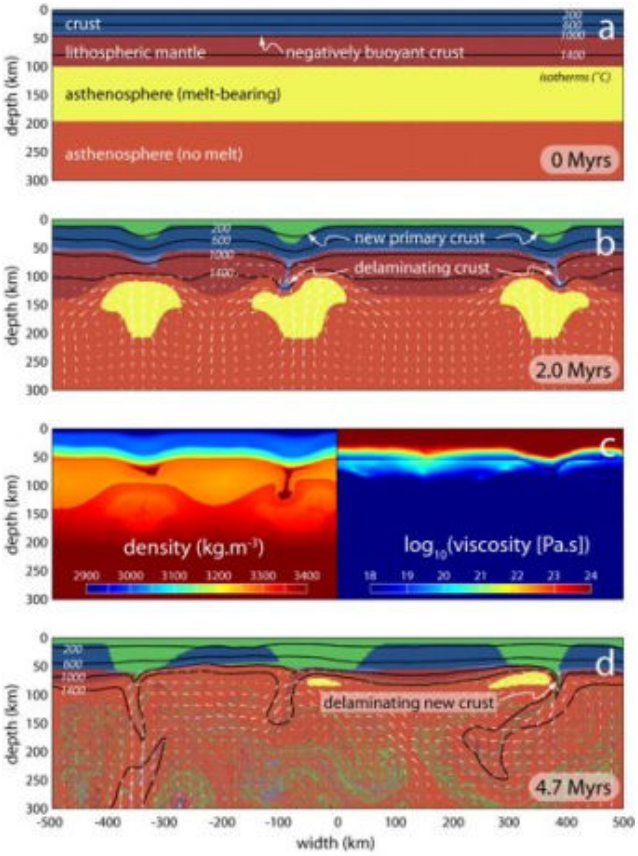
http://phys.org/news/2013-12-earth-crust-unstable-archean-eon.html

Earth's crust was unstable in the Archean eon and dripped down into the mantle

Earth's mantle temperatures during the Archean eon, which commenced some 4 billion years ago, were significantly higher than they are today.

According to recent model calculations, the Archean crust that formed under these conditions was so dense that large portions of it were recycled back into the mantle. This is the conclusion reached by Dr. Tim Johnson who is currently studying the evolution of the Earth's crust as a member of the research team led by Professor Richard White of the Institute of Geosciences at Johannes Gutenberg University Mainz (JGU). According to the calculations, this dense primary crust would have descended vertically in drip form. In contrast, the movements of today's tectonic plates involve largely lateral movements with oceanic lithosphere recycled in subduction zones. The findings add to our understanding of how cratons and plate tectonics, and thus also the Earth's current continents, came into being.



Computer simulation of the processes in the Earth's mantle **Institute of Geosciences, JGU**

Because mantle temperatures were higher during the Archean eon, the Earth's primary crust that formed at the time must have been very thick and also very rich in magnesium. However, as Johnson and his co-authors explain in their article recently published in Nature Geoscience, very little of this original crust is preserved, indicating that most must have been recycled into the Earth's mantle. Moreover, the Archean crust that has survived in some areas such as, for example, Northwest Scotland and Greenland, is largely made of tonalite–trondhjemite–granodiorite complexes and these are likely to have originated from a hydrated, low-magnesium basalt source. The conclusion is that these pieces of crust cannot be the direct products of an originally magnesium-rich primary crust. These TTG complexes are among the oldest features of our Earth's crust. They are most commonly present in cratons, the oldest and most stable cores of the current continents.

With the help of thermodynamic calculations, Dr. Tim Johnson and his collaborators at the US-American universities of Maryland, Southern California, and Yale have established that the mineral assemblages that formed at the base of a 45-kilometer-thick magnesium-rich crust were denser than the underlying mantle layer. In order to better explore the physics of this process, Professor Boris Kaus of the Geophysics work group at Mainz University developed new computer models that simulate the conditions when the Earth was still relatively young and take into account Johnson's calculations.

These geodynamic computer models show that the base of a magmatically over-thickened and magnesium-rich crust would have been gravitationally unstable at mantle temperatures greater than 1,500 to 1,550 degrees Celsius and this would have caused it to sink in a process called 'delamination'. The dense crust would have dripped down into the mantle, triggering a return flow of mantle material from the asthenosphere that would have melted to form new primary crust. Continued melting of over-thickened and dripping magnesium-rich crust, combined with fractionation of primary magmas, may have produced the hydrated magnesium-poor basalts necessary to provide a source of the tonalite–trondhjemite–granodiorite complexes. The dense residues of these processes, which would have a high content of mafic minerals, must now reside in the mantle.

More information: Tim E. Johnson et al. Delamination and recycling of Archaean crust caused by gravitational instabilities, Nature Geoscience 7, 47–52. Published online 1 December 2013. DOI: 10.1038/ngeo2019

http://www.eurekalert.org/pub_releases/2013-12/uoc--hga122613.php

High good and low bad cholesterol levels are healthy for the brain, too

High levels of "good" cholesterol and low levels of "bad" cholesterol are correlated with lower levels of the amyloid plaque deposition in the brain that is a hallmark of Alzheimer's disease

SACRAMENTO, Calif. - High levels of "good" cholesterol and low levels of "bad" cholesterol are correlated with lower levels of the amyloid plaque deposition in the brain that is a hallmark of Alzheimer's disease, in a pattern

that mirrors the relationship between good and bad cholesterol in cardiovascular disease, UC Davis researchers have found.
"Our study shows that both higher levels of HDL — good — and lower levels of LDL — bad — cholesterol in the bloodstream are associated with lower levels of amyloid plaque deposits in the brain," said Bruce Reed, lead study author and associate director of the UC Davis Alzheimer's Disease Center.
The relationship between elevated cholesterol and increased risk of Alzheimer's disease has been known for some time, but the current study is the first to specifically link cholesterol to amyloid deposits in living human study participants, Reed said.
"Unhealthy patterns of cholesterol could be directly causing the higher levels of amyloid known to contribute to Alzheimer's, in the same way that such patterns promote heart disease," he said.
The study, "Associations Between Serum Cholesterol Levels and Cerebral Amyloidosis," is published online today in JAMA Neurology.
In the United States, cholesterol levels are measured in milligrams (mg) of cholesterol per deciliter (dL) of blood. For HDL cholesterol, a level of 60 mg/dl or higher is best. For LDL cholesterol, a level of 70 mg/dL or lower is recommended for people at very high risk of heart disease.
Charles DeCarli, director of the Alzheimer's Disease Center and an author of the study, said it is a wake-up call that, just as people can influence their late-life brain health by limiting vascular brain injury through controlling their blood pressure, the same is true of getting a handle on their serum cholesterol levels. "If you have an LDL above 100 or an HDL that is less than 40, even if you're taking a statin drug, you want to make sure that you are getting those numbers into alignment," DeCarli said. "You have to get the HDL up and the LDL down."
The study was conducted in 74 diverse male and female individuals 70 years and older who were recruited from California stroke clinics, support groups, senior facilities and the Alzheimer's Disease Center. They included three individuals with mild dementia, 33 who were cognitively normal and 38 who had mild cognitive impairment.
The participants' amyloid levels were obtained using a tracer that binds with amyloid plaques and imaging their brains using PET scans. Higher fasting levels of LDL and lower levels of HDL both were associated with greater brain amyloid — a first-time finding linking cholesterol fractions in the blood and amyloid deposition in the brain. The researchers did not study the mechanism for how cholesterol promotes amyloid deposits.
Recent guidelines instituted by the American College of Cardiology, the American Heart Association and the National Heart, Lung, and Blood Institute have suggested abandoning guidelines for LDL targets. Reed said that recommendation may be an instance in which the adage that "what's good for the heart is good for the brain" does not apply.
"This study provides a reason to certainly continue cholesterol treatment in people who are developing memory loss regardless of concerns regarding their cardiovascular health," said Reed, a professor in the UC Davis Department of Neurology.
"It also suggests a method of lowering amyloid levels in people who are middle aged, when such build-up is just starting," he said. "If modifying cholesterol levels in the brain early in life turns out to reduce amyloid deposits late in life, we could potentially make a significant difference in reducing the prevalence of Alzheimer's, a goal of an enormous amount of research and drug development effort."
The study's other authors are Sylvia Villeneuve and William Jagust of UC Berkeley and Wendy Mack and Helena C. Chui of UCLA.
The research was supported by grants P01 AG12435, AG034570 and P30 AG10129 from the National Institute on Aging of the National Institutes of Health. Villeneuve received support from the Canadian Institutes of Health.

http://www.eurekalert.org/pub_releases/2013-12/osu-mcs123013.php

Most clinical studies on vitamins flawed by poor methodology

Most large, clinical trials of vitamin supplements, including some that have concluded they are of no value or even harmful, have a flawed methodology that renders them largely useless in determining the real value of these micronutrients, a new analysis suggests.

CORVALLIS, Ore. – Many projects have tried to study nutrients that are naturally available in the human diet the same way they would a powerful prescription drug. This leads to conclusions that have little scientific meaning, even less accuracy and often defy a wealth of other evidence, said Balz Frei, professor and director of the Linus Pauling Institute at Oregon State University, in a new review published in the journal Nutrients.
These flawed findings will persist until the approach to studying micronutrients is changed, Frei said. Such changes are needed to provide better, more scientifically valid information to consumers around the world who often have poor diets, do not meet intake recommendations for many vitamins and minerals, and might greatly benefit from something as simple as a daily multivitamin/mineral supplement.

Needed are new methodologies that accurately measure baseline nutrient levels, provide supplements or dietary changes only to subjects who clearly are inadequate or deficient, and then study the resulting changes in their health. Tests must be done with blood plasma or other measurements to verify that the intervention improved the subjects' micronutrient status along with biomarkers of health. And other approaches are also needed that better reflect the different ways in which nutrients behave in cell cultures, lab animals and the human body.
The new analysis specifically looked at problems with the historic study of vitamin C, but scientists say many of the observations are more broadly relevant to a wide range of vitamins, micro nutrients and studies.
"One of the obvious problems is that most large, clinical studies of vitamins have been done with groups such as doctors and nurses who are educated, informed, able to afford healthy food and routinely have better dietary standards than the public as a whole," said Frei, an international expert on vitamin C and antioxidants.
"If a person already has adequate amounts of a particular vitamin or nutrient, then a supplement will probably provide little or no benefit," Frei said. "That's common sense. But most of our supposedly scientific studies take results from people with good diets and healthy lifestyles and use them to conclude that supplements are of no value to anyone."
Vitamin or mineral supplements, or an improved diet, will primarily benefit people who are inadequate or deficient to begin with, OSU researchers said. But most modern clinical studies do not do baseline analysis to identify nutritional inadequacies and do not assess whether supplements have remedied those inadequacies. As a result, any clinical conclusion made with such methodology is pretty much useless, they said.
An optimal diet, rich in fruits and vegetables, can provide most of the nutrients needed for good health – which critics say is reason enough not to use supplements. LPI researchers say that misses a pretty obvious point – that most Americans do not have an optimal diet.
"More than 90 percent of U.S. adults don't get the required amounts of vitamins D and E for basic health," Frei said. "More than 40 percent don't get enough vitamin C, and half aren't getting enough vitamin A, calcium and magnesium. Smokers, the elderly, people who are obese, ill or injured often have elevated needs for vitamins and minerals. "It's fine to tell people to eat better, but it's foolish to suggest that a multivitamin which costs a nickel a day is a bad idea."
Beyond that, many scientists studying these topics are unaware of ways in which nutrients may behave differently in something like a cell culture or lab animal, compared to the human body. This raises special challenges with vitamin C research in particular. "In cell culture experiments that are commonly done in a high oxygen environment, vitamin C is unstable and can actually appear harmful," said Alexander Michels, an LPI research associate and lead author on this report. "And almost every animal in the world, unlike humans, is able to synthesize its own vitamin C and doesn't need to obtain it in the diet. That makes it difficult to do any lab animal tests with this vitamin that are relevant to humans."
Many studies have found that higher levels of vitamin C intake are associated with a reduced incidence of chronic disease, including coronary heart disease, stroke, diabetes, hypertension and some types of cancer. The levels of vitamins needed for optimal health also go beyond those needed to merely prevent deficiency diseases, such as scurvy or rickets.
Even though such studies often significantly understate the value of vitamin supplements, the largest and longest clinical trial of multivitamin/mineral supplements found a total reduction of cancer and cataract incidence in male physicians over the age of 50. It suggested that if every adult in the U.S. took such supplements it could prevent up to 130,000 cases of cancer each year, Frei said.
"The cancer reduction would be in addition to providing good basic health by supporting normal function of the body, metabolism and growth," he said. "If there's any drug out there that can do all this, it would be considered unethical to withhold it from the general public. But that's basically the same as recommending against multivitamin/mineral supplements."
Editor's Note: The study this story is based on is available online: http://bit.ly/1lbi4PB

http://www.eurekalert.org/pub_releases/2013-12/afot-tam123013.php

Toward a molecular explanation for schizophrenia

Tel Aviv University researchers find inhibition of a basic cellular process may contribute to the mysterious disease

Surprisingly little is known about schizophrenia. It was only recognized as a medical condition in the past few decades, and its exact causes remain unclear. Since there is no objective test for schizophrenia, its diagnosis is based on an assortment of reported symptoms. The standard treatment, antipsychotic medication, works less than half the time and becomes increasingly ineffective over time.
Now, Prof. Illana Gozes – the Lily and Avraham Gildor Chair for the Investigation of Growth Factors, the director of the Adams Super Center for Brain Studies at the Sackler Faculty of Medicine, and a member of the

Sagol School of Neuroscience at Tel Aviv University – has discovered that an important cell-maintenance process called autophagy is reduced in the brains of schizophrenic patients. The findings, published in Nature's Molecular Psychiatry, advance the understanding of schizophrenia and could enable the development of new diagnostic tests and drug treatments for the disease.

"We discovered a new pathway that plays a part in schizophrenia," said Prof. Gozes. "By identifying and targeting the proteins known to be involved in the pathway, we may be able to diagnose and treat the disease in new and more effective ways."

Graduate students Avia Merenlender-Wagner, Anna Malishkevich, and Zeev Shemer of TAU, Prof. Brian Dean and colleagues of the University of Melbourne, and Prof. Galila Agam and Joseph Levine of Ben Gurion University of the Negev and Beer Sheva's Psychiatry Research Center and Mental Health Center collaborated on the research.

Mopping up

Autophagy is like the cell's housekeeping service, cleaning up unnecessary and dysfunctional cellular components. The process – in which a membrane engulfs and consumes the clutter – is essential to maintaining cellular health. But when autophagy is blocked, it can lead to cell death. Several studies have tentatively linked blocked autophagy to the death of brain cells seen in Alzheimer's disease.

Brain-cell death also occurs in schizophrenics, so Prof. Gozes and her colleagues set out to see if blocked autophagy could be involved in the progression of that condition as well. They found RNA evidence of decreased levels of the protein beclin 1 in the hippocampus of schizophrenia patients, a brain region central to learning and memory. Beclin 1 is central to initiating autophagy - its deficit suggests that the process is indeed blocked in schizophrenia patients. Developing drugs to boost beclin 1 levels and restart autophagy could offer a new way to treat schizophrenia, the researchers say. "It is all about balance," said Prof Gozes. "Paucity in beclin 1 may lead to decreased autophagy and enhanced cell death. Our research suggests that normalizing beclin 1 levels in schizophrenia patients could restore balance and prevent harmful brain-cell death."

Next, the researchers looked at protein levels in the blood of schizophrenia patients. They found no difference in beclin 1 levels, suggesting that the deficit is limited to the hippocampus. But the researchers also found increased levels of another protein, activity-dependent neuroprotective protein (ADNP), discovered by Prof. Gozes and shown to be essential for brain formation and function, in the patients' white blood cells. Previous studies have shown that ADNP is also deregulated in the brains of schizophrenia patients.

The researchers think the body may boost ADNP levels to protect the brain when beclin 1 levels fall and autophagy is derailed. ADNP, then, could potentially serve as a biomarker, allowing schizophrenia to be diagnosed with a simple blood test.

An illuminating discovery

To further explore the involvement of ADNP in autophagy, the researchers ran a biochemical test on the brains of mice. The test showed that ADNP interacts with LC3, another key protein regulating autophagy – an interaction predicted by previous studies. In light of the newfound correlation between autophagy and schizophrenia, they believe that this interaction may constitute part of the mechanism by which ADNP protects the brain.

Prof. Gozes discovered ADNP in 1999 and carved a protein fragment, NAP, from it. NAP mimics the protein nerve cell protecting properties. In follow-up studies Prof. Gozes helped develop the drug candidate davunetide (NAP). In Phase II clinical trials, davunetide (NAP) improved the ability of schizophrenic patients to cope with daily life. A recent collaborative effort by Prof. Gozes and Dr. Sandra Cardoso and Dr. Raquel Esteves showed that NAP improved autophagy in cultures of brain-like cells. The current study further shows that NAP facilitates the interaction of ADNP and LC3, possibly accounting for NAP's results in schizophrenia patients. The researchers hope NAP will be just the first of their many discoveries to improve understanding and treatment of schizophrenia.

http://www.medscape.com/viewarticle/818483?src=rss

NSAID Halts Progression in Familial Amyloid Polyneuropathy

Treatment with the diflunisal for 2 years in patients with hereditary transthyretin-type familial amyloid polyneuropathy (ATTR-FAP) reduces the rate of progression of neurological impairment

Pauline Anderson

Treatment with the nonsteroidal anti-inflammatory drug (NSAID) diflunisal for 2 years in patients with hereditary transthyretin-type familial amyloid polyneuropathy (ATTR-FAP) reduces the rate of progression of neurological impairment and preserves quality of life compared with placebo, a new study has determined.

ATTR-FAP is a genetic disease caused by aggregation of variant transthyretin. Untreated, patients with this disorder develop progressive neurological deficits, dying 10 to 15 years after disease presentation. The standard

treatment is a liver transplant, but transplants are costly, organs are sometimes unavailable, and this option is not offered to older patients and those with advanced disease.

The new double-blind study is "pivotal," according to the authors, led by John L. Berk, MD, from the Amyloidosis Center, Departments of Medicine and Neurology, Boston University School of Medicine, Massachusetts. Not only does it demonstrate that diflunisal inhibits progression of polyneuropathy in patients with ATTR-FAP, using several measures, but it is the first randomized clinical trial involving a broad cross-section of the spectrum of disease and the most prevalent genotypes for ATTR, the authors write.

The study was published in the December 25 issue of *JAMA*.

Old Drugs Repurposed

A National Institutes of Health mission is to repurpose old drugs. Diflunisal is a generic agent that had lost its clinical relevance, but a previous phase 1 study showed that at a dose of 250 mg twice daily, the drug kinetically stabilizes circulating TTR tetramers, inhibiting release of the TTR monomer required for amyloidogenesis.

This new study enrolled 130 patients with ATTR-FAP from 8 centers in England, Italy, Japan, Sweden, and the United States. The participants were randomly assigned to receive either 250 mg of diflunisal twice daily or placebo.

The primary study endpoint was the Neuropathy Impairment Score plus 7 nerve tests (NIS+7), a composite scale that assesses, in part, muscle weakness, sensory loss, and decreased muscle stretch reflexes. A 2-point change in NIS+7 score identifies a minimal clinically detectable change in polyneuropathy progression.

At the end of 2 years, patients taking diflunisal exhibited significantly less progression of polyneuropathy than those taking placebo. The change in NIS+7 score from baseline was 26.3 points (95% confidence interval [CI], 20.2 - 32.4 points) in the placebo group and 8.2 points (95% CI, 2.9 - 13.6 points) in the diflunisal group, a between-group difference of 18.0 points (95% CI, 9.9 - 26.2 points; $P < .001$)

Attrition was a prominent feature of the study and occurred unequally across treatment groups (40 patients from the placebo group and 27 from the treatment group discontinued the study). Disease progression was the predominant cause for dropping out of the study.

To address the uneven attrition issue, the researchers performed several sensitivity analyses, including last observation carried forward, "worse-case scenario," and dichotomous responder analyses. Multiple imputation analysis estimated a difference in change between the placebo and diflunisal groups of 16.3 points (95% CI, 8.1 - 24.5 points; $P < .001$). Such a difference, said the authors, signals a clinically meaningful diflunisal effect.

Walking Unaided

"Confining neurological deficits to lower limb muscle function, a 16-point NIS+7 difference might represent a 50% decline of knee extensor and flexor strength plus ankle dorsiflexion in the placebo group with no change occurring in the treatment group, approximating the ability to rise from a chair or walk unaided."

The magnitude of polyneuropathy progression measured by the NIS+7 in the placebo group (25 points) far exceeded the progression reported in patients with diabetes (1.70 points) found in a previous study, "quantifying the devastating nature of ATTR-FAP," the authors write.

The findings extended across TTR mutations, sex, neuropathy severity, and major study sites. The results suggest that the diflunisal effect may extend to patients with advanced polyneuropathy, a population often deemed ineligible for orthotopic liver transplantations, said the authors.

Importantly, the drug affected not only the progression of neuropathy but also the quality of life for patients with FAP, "a critical element when considering the effect of new treatments," they write.

Diflunisal was well-tolerated. Gastrointestinal, renal, cardiac, and blood-related adverse events occurred in similar numbers by treatment group. Adverse events in the musculoskeletal and general disorders categories occurred more frequently in the diflunisal group, but drug-related adverse events did not differ between groups. There were no differences in serious adverse events.

The study is important in part because it provides invaluable natural history data on the rate of neurological disease progression in an inclusive and heterogeneous ATTR-FAP population that will be the foundation of future trials designs, said the authors.

The study was supported by grants from the National Institute of Neurological Diseases and Stroke, the Orphan Products Division of the US Food and Drug Administration, the Young Family Amyloid Research Fund, and the National Center for Advancing Translational Sciences, National Institutes of Health. Merck Sharp and Dohme Inc supplied study drug. Dr. Berk and 4 coauthors have received honoraria from Alnylam, ISIS, and Pfizer Pharmaceuticals. One coauthor has received support from Pfizer for activities as chairman of the Transthyretin Amyloidosis Outcome Survey, ISIS, and Alnylam Pharmaceuticals. One coauthor has received honoraria from Pfizer. One coauthor reports financial holdings in FoldRx Pharmaceuticals Inc. The other authors have disclosed no relevant financial relationships.

JAMA. 2013;30:2658-2667. Abstract

http://www.eurekalert.org/pub_releases/2013-12/uons-ncs121913.php

Cloud mystery solved: Global temperatures to rise at least 4°C by 2100

Cloud impact on climate sensitivity unveiled

Global average temperatures will rise at least 4°C by 2100 and potentially more than 8°C by 2200 if carbon dioxide emissions are not reduced according to new research published in Nature. Scientists found global climate is more sensitive to carbon dioxide than most previous estimates. The research also appears to solve one of the great unknowns of climate sensitivity, the role of cloud formation and whether this will have a positive or negative effect on global warming. "Our research has shown climate models indicating a low temperature response to a doubling of carbon dioxide from preindustrial times are not reproducing the correct processes that lead to cloud formation," said lead author from the University of New South Wales' Centre of Excellence for Climate System Science Prof Steven Sherwood.

"When the processes are correct in the climate models the level of climate sensitivity is far higher. Previously, estimates of the sensitivity of global temperature to a doubling of carbon dioxide ranged from 1.5°C to 5°C. This new research takes away the lower end of climate sensitivity estimates, meaning that global average temperatures will increase by 3°C to 5°C with a doubling of carbon dioxide." The key to this narrower but much higher estimate can be found in the real world observations around the role of water vapour in cloud formation.

Observations show when water vapour is taken up by the atmosphere through evaporation, the updraughts can either rise to 15 km to form clouds that produce heavy rains or rise just a few kilometres before returning to the surface without forming rain clouds. When updraughts rise only a few kilometres they reduce total cloud cover because they pull more vapour away from the higher cloud forming regions. However water vapour is not pulled away from cloud forming regions when only deep 15km updraughts are present.

The researchers found climate models that show a low global temperature response to carbon dioxide do not include enough of this lower-level water vapour process. Instead they simulate nearly all updraughts as rising to 15 km and forming clouds.

When only the deeper updraughts are present in climate models, more clouds form and there is an increased reflection of sunlight. Consequently the global climate in these models becomes less sensitive in its response to atmospheric carbon dioxide. However, real world observations show this behaviour is wrong.

When the processes in climate models are corrected to match the observations in the real world, the models produce cycles that take water vapour to a wider range of heights in the atmosphere, causing fewer clouds to form as the climate warms. This increases the amount of sunlight and heat entering the atmosphere and, as a result, increases the sensitivity of our climate to carbon dioxide or any other perturbation.

The result is that when water vapour processes are correctly represented, the sensitivity of the climate to a doubling of carbon dioxide - which will occur in the next 50 years – means we can expect a temperature increase of at least 4°C by 2100.

"Climate sceptics like to criticize climate models for getting things wrong, and we are the first to admit they are not perfect, but what we are finding is that the mistakes are being made by those models which predict less warming, not those that predict more," said Prof. Sherwood. "Rises in global average temperatures of this magnitude will have profound impacts on the world and the economies of many countries if we don't urgently start to curb our emissions.

http://www.eurekalert.org/pub_releases/2013-12/nrr-pta123113.php

PLGA tubes are superior to autologous nerve graft for repaired sciatic nerve

The viscoelasticity of natural and artificial biomaterials can be suitable for human physiological function by matching stress relaxation and creep properties.

Dr. Chengdong Piao and colleagues from Second Hospital, Jilin University in China prepared sciatic nerve injury models by creating a 10 mm defect in sciatic nerve specimens harvested from fresh corpses, and defects were repaired by anastomosis with nerve autografts and poly(lactic-co-glycolic acid) (PLGA) tubes. They found that stress relaxation and creep testing showed that at 7 200 seconds, the sciatic nerve anastomosed by PLAG tubes exhibited a greater decrease in stress and increase in strain than those anastomosed by nerve autografts, suggesting that PLGA exhibits good viscoelasticity to meet the biomechanical requirements for a biomaterial used to repair sciatic nerve injury. Their study was published in the Neural Regeneration Research (Vol. 8, No. 33, 2013).

Article: " Viscoelasticity of repaired sciatic nerve by poly(lactic-co-glycolic acid) tubes," by Chengdong Piao1, Peng Li2, Guangyao Liu3, Kun Yang4 (1 Department of Orthopedics, Second Hospital, Jilin University, Chuangchun 130028, Jilin Province, China; 2 Department of Engineering Mechanics, Nanling Campus, Jilin University, Chuangchun 130022, Jilin Province, China; 3 Department of Orthopedics, China-Japan Union Hospital of Jilin University, Chuangchun 130031, Jilin

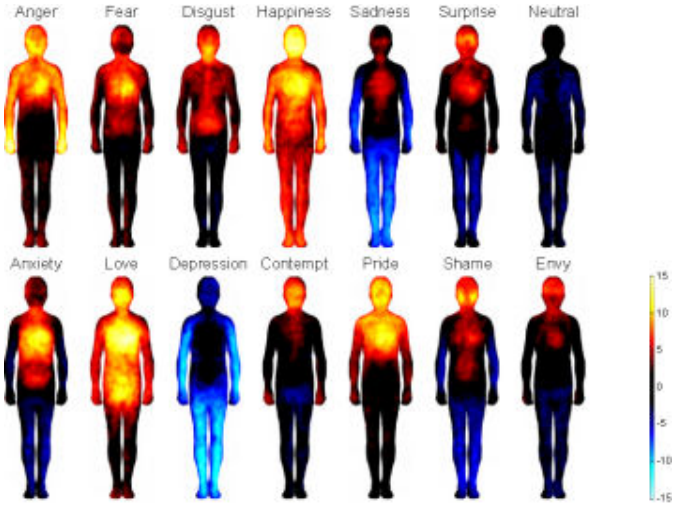
Province, China; 4 Base Department, Aviation University of the Air Force of China, Chuangchun 130022, Jilin Province, China)
Piao CD, Li P, Liu GY, Yang K. Viscoelasticity of repaired sciatic nerve by poly(lactic-co-glycolic acid) tubes. Neural Regen Res. 2013;8(33):3131-3138.

http://www.eurekalert.org/pub_releases/2013-12/au-frt123113.php

Finnish research team reveals how emotions are mapped in the body

Researchers Aalto University have revealed how emotions are experienced in the body

Emotions adjust our mental and also bodily states to cope with the challenges detected in the environment. These sensations arising from the bodily changes are an important feature of our emotional experiences. For example, anxiety may be experienced as pain in the chest, whereas falling in love may trigger warm, pleasurable sensations all over the body. New research from Aalto University reveals, how emotions are literally experienced through the body.



Different emotions are associated with discernible patterns of bodily sensations. **Aalto University and Turku PET Centre.**

The researchers found that the most common emotions trigger strong bodily sensations, and the bodily maps of these sensations were topographically different for different emotions. The sensation patterns were, however, consistent across different West European and East Asian cultures, highlighting that emotions and their corresponding bodily sensation patterns have a biological basis.

Emotions adjust not only our mental, but also our bodily states. This way the prepare us to react swiftly to the dangers, but also to the opportunities such as pleasurable social interactions present in the environment. Awareness of the corresponding bodily changes may subsequently trigger the conscious emotional sensations, such as the feeling of happiness, tells assistant professor Lauri Nummenmaa from Aalto University.

The findings have major implications for our understanding of the functions of emotions and their bodily basis. On the other hand, the results help us to understand different emotional disorders and provide novel tools for their diagnosis.

The research was carried out on line, and over 700 individuals from Finland, Sweden and Taiwan took part in the study. The researchers induced different emotional states in their Finnish and Taiwanese participants. Subsequently the participants were shown with pictures of human bodies on a computer, and asked to colour the bodily regions whose activity they felt increasing or decreasing.

The research was funded by European Research Council (ERC), The Academy of Finland and the Aalto University (aivoAALTO project)
The results were published on 31 December (U.S. Eastern time) in the scientific journal Proceedings of The National Academy of Sciences of The United States of America (PNAS).
Original publication: http://www.pnas.org/content/early/2013/12/26/1321664111.full.pdf+html?with-ds=yes

http://www.eurekalert.org/pub_releases/2013-12/uoc-ruh123013.php

Researchers use Hubble Telescope to reveal cloudy weather on alien world

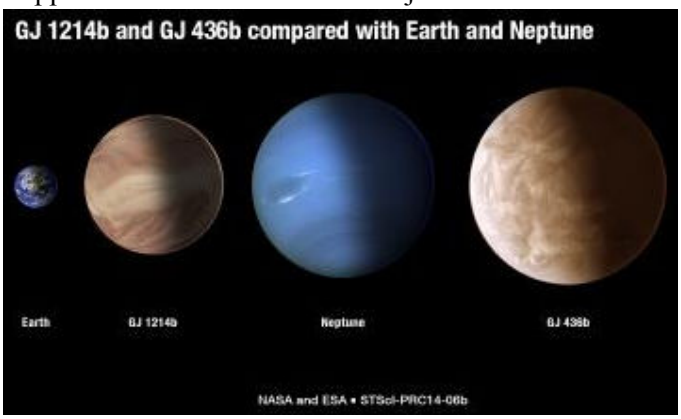
Weather forecasters on exoplanet GJ 1214b would have an easy job. Today's forecast: cloudy. Tomorrow: overcast. Extended outlook: more clouds.

A team of scientists led by researchers in the Department of Astronomy and Astrophysics at the University of Chicago report they have definitively characterized the atmosphere of a super-Earth class planet orbiting another star for the first time. The scrutinized planet, which is known as GJ1214b, is classified as a super-Earth type planet because its mass is intermediate between those of Earth and Neptune. Recent searches for planets around other stars ("exoplanets") have shown that super-Earths like GJ 1214b are among the most common type of planets in the Milky Way galaxy. Because no such planets exist in our Solar System, the physical nature of super-Earths is largely unknown.

Previous studies of GJ 1214b yielded two possible interpretations of the planet's atmosphere. Its atmosphere could consist entirely of water vapor or some other type of heavy molecule, or it could contain high-altitude clouds that prevent the observation of what lies underneath.

But now a team of astronomers led by UChicago's Laura Kreidberg and Jacob Bean have detected clear evidence of clouds in the atmosphere of GJ 1214b from data collected with the Hubble Space Telescope. The

Hubble observations used 96 hours of telescope time spread over 11 months. This was the largest Hubble program ever devoted to studying a single exoplanet.
The researchers describe their work as an important milestone on the road to identifying potentially habitable, Earth-like planets beyond our Solar System. The results appear in the Jan. 2 issue of the journal Nature.
"We really pushed the limits of what is possible with Hubble to make this measurement," said Kreidberg, a third-year graduate student and first author of the new paper. "This advance lays the foundation for characterizing other Earths with similar techniques."
"I think it's very exciting that we can use a telescope like Hubble that was never designed with this in mind, do these kinds of observations with such exquisite precision, and really nail down some property of a small planet orbiting a distant star," explained Bean, an assistant professor and the project's principal investigator.



This rendering shows the size of GJ 1214b and another, larger exoplanet compared to Earth and Neptune.
NASA & ESA, STScI-PRC14-06b

GJ 1214b is located just 40 light-years from Earth, in the direction of the constellation Ophiuchus. Because of its proximity to our solar system and the small size of its host star, GJ 1214b is the most easily observed super-Earth. It transits, or passes in front of its parent star, every 38 hours, giving scientists an opportunity to study its atmosphere as starlight filters through it.
Kreidberg, Bean and their colleagues used Hubble to precisely measure the spectrum of GJ 1214b in near-infrared light, finding what they consider definitive evidence of high clouds blanketing the planet. These clouds hide any information about the composition and behavior of the lower atmosphere and surface.
The planet was discovered in 2009 by the MEarth Project, which monitors two thousand red dwarf stars for transiting planets. The planet was next targeted for follow-up observations to characterize its atmosphere. The first spectra, which were obtained by Bean in 2010 using a ground-based telescope, suggested that the planet's atmosphere either was predominantly water vapor or hydrogen-dominated with high-altitude clouds.
More precise Hubble observations made in 2012 and 2013 allowed the team to distinguish between these two scenarios. The news is about what they didn't find. The Hubble spectra revealed no chemical fingerprints whatsoever in the planet's atmosphere. This allowed the astronomers to rule out cloud-free atmospheres made of water vapor, methane, nitrogen, carbon monoxide, or carbon dioxide.
The best explanation for the new data is that there are high-altitude clouds in the atmosphere of the planet, though their composition is unknown. Models of super-Earth atmospheres predict clouds could be made out of potassium chloride or zinc sulfide at the scorching temperatures of 450 degrees Fahrenheit found on GJ 1214b.
"You would expect very different kinds of clouds to form than you would expect, say, on Earth," Kreidberg said.
The launch of NASA's next major space telescope, the 6.5m James Webb Space Telescope (JWST), later this decade should reveal more about such worlds, Kreidberg said. "Looking forward, JWST will be transformative," she said. "The new capabilities of this telescope will allow us to peer through the clouds on planets like GJ 1214b. But more than that, it may open the door to studies of Earth-like planets around nearby stars."
Citation: "Clouds in the atmosphere of the super-Earth exoplanet GJ 1214b," by Laura Kreidberg, Jacob L. Bean, Jean-Michel Désert, Björn Benneke, Drake Deming, Kevin B. Stevenson, Sara Seager, Zachory Berta-Thompson, Andreas Seifahrt, & Derek Homeier.
Funding: National Aeronautics and Space Administration, National Science Foundation, Alfred P. Sloan Foundation, and European Research Council.

http://nyti.ms/1a0dNNh

Vitamin E Slows Decline of Some Alzheimer's Patients in Study

Vitamin E supplements, in doses higher than those normally available on store shelves, may help slow decline in people with Alzheimer's, a new study suggests

By PAM BELLUCK

Does vitamin E help people with Alzheimer's disease? For years, scientists have been trying to find out, guessing that the vitamin's antioxidant properties might be beneficial. But the results from clinical trials have been mixed and - following a report that high doses of vitamin E may increase the risk of death - cautionary.

Now a study suggests that vitamin E supplements may be good for some Alzheimer's patients after all. The benefit was not huge, but for a devastating disease that has proved almost impervious to treatment, it was notable. The study, published in Wednesday's issue of JAMA, The Journal of the American Medical Association, found that over a little more than two years, high-dose vitamin E slowed the decline of people with mild to moderate Alzheimer's by about six months on average.

Vitamin E did not delay cognitive or memory deterioration, however. Instead, it seemed to temporarily protect something many patients consider especially valuable: their ability to perform daily activities like putting on clothes and feeding themselves. Compared with other study participants, people who took vitamin E also required about two fewer hours of help from caregivers per day, the researchers said.

"Is it really going to dramatically alter the lives of Alzheimer's patients? That's unclear," said Dr. Scott Small, director of Columbia University's Alzheimer's Disease Research Center, who was not involved in the study. "But it might improve patients' ability to bathe themselves and dress themselves."

Notably, in this study, high-dose vitamin E appeared safe. Many doctors had stopped suggesting it to Alzheimer's patients after a 2005 analysis suggested that high doses could increase the risk of mortality. That analysis looked at vitamin E's effect on patients with various diseases, not just Alzheimer's.

"We were concerned about safety, and we didn't find a safety problem," said Dr. Maurice Dysken, a professor of psychiatry at the University of Minnesota, who led the new study.

Still, experts, including the authors, said the new study did not mean that high-dose vitamin E should be taken by everyone with dementia or everyone hoping to prevent it. The study found benefit only in people with mild to moderate Alzheimer's, a result that echoes research in 1997 showing that vitamin E could delay functional decline for about seven months in people with moderately severe Alzheimer's.

But other studies have found that vitamin E failed to delay dementia in people without symptoms or with mild cognitive impairment, which may precede Alzheimer's.

"It was dead stone cold in the M.C.I. trial," said the leader of that study, Dr. Ronald Petersen, director of the Mayo Clinic's Alzheimer's center. "You couldn't have found a closer match to placebo."

Dr. Denis Evans, a professor of internal medicine at Rush University, who wrote an editorial accompanying the new study, cautioned against extrapolating the results to anyone without mild to moderate Alzheimer's. "Does this mean that all of us who don't want to develop Alzheimer's should rush out and purchase a bottle of vitamin E?" he said. "Oh, please don't."

The study involved 613 veterans, mostly men, from 14 Department of Veterans Affairs hospitals around the country. The veterans were already taking drugs like Aricept for mild to moderate Alzheimer's. One group received 2,000 I.U.'s of vitamin E daily, much higher than the amount available in a typical supplement. Other groups received memantine (a dementia drug used in medications like Namenda), vitamin E plus memantine or a placebo. "What we hoped was that memantine would have benefit, vitamin E would have benefit, and combined it would have double the effect," Dr. Dysken said. That did not happen.

Only vitamin E showed a statistically significant effect. Memantine was no better than the placebo at preventing decline, and, inexplicably, the combination of memantine and vitamin E did not work either.

There were other confusing results. While vitamin E helped people retain their ability to perform daily functions longer, it did not significantly slow their cognitive decline, the defining feature of Alzheimer's. "That they found differences in functional measures and not the cognitive measure gives you pause," Dr. Petersen said.

Some studies have focused more on measures of function than on cognitive scores because the ability to maintain daily routines can matter more to patients and their families. Functional abilities decline for a wide variety of reasons related to aging, not necessarily to Alzheimer's, noted Dr. Evans. Most experts say a truly effective Alzheimer's treatment will improve both function and cognition.

The new study also underscores the complexity of Alzheimer's. Experts could not explain why vitamin E would work in fully developed Alzheimer's, for example, but not earlier. In many conditions, treatments ease symptoms at the early stages but lose effectiveness as diseases strengthen. Dr. Evans and others said doctors should now consider discussing vitamin E supplements with patients with mild to moderate Alzheimer's disease. But, Dr. Evans said, "2,000 I.U.'s is a lot, and I wouldn't recommend it unless there's some oversight" by a doctor. Dr. Small said that while he would not "twist the patient's arm to take vitamin E, in the absence of anything else that's dramatic, I would certainly raise this with patients."

Dr. Petersen said he might mention it after trying the other treatments he recommends. "It's not a slam-dunk; it's not a home run," he said. "It does give some credence to the notion that high-dose vitamin E might be doing something. It gives doctors and patients another option to use as the disease progresses."

http://bit.ly/1anmldn

Triple-Threat Method Sparks Hope for Nuclear Fusion Energy

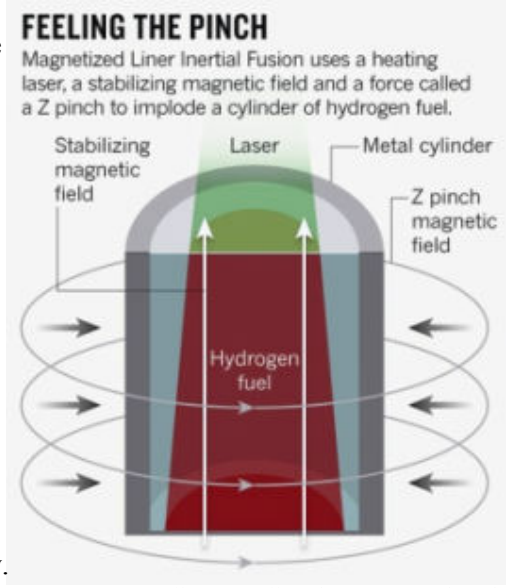
The secrets to its success are lasers, magnets and a big pinch

By W. Wayt Gibbs and Nature magazine | Tuesday, December 31, 2013 | 31

The Z machine at Sandia National Laboratories in New Mexico discharges the most intense pulses of electrical current on Earth. Millions of amperes can be sent towards a metallic cylinder the size of a pencil eraser, inducing a magnetic field that creates a force — called a Z pinch — that crushes the cylinder in a fraction of a second.

Since 2012, scientists have used the Z pinch to implode cylinders filled with hydrogen isotopes in the hope of achieving the extreme temperatures and pressures needed for energy-generating nuclear fusion. Despite their efforts, they have never succeeded in reaching ignition — the point at which the energy gained from fusion is greater than the energy put in.

But after tacking on two more components, physicists think they are at last on the right path. Researchers working on Sandia's Magnetized Liner Inertial Fusion (MagLIF) experiment added a secondary magnetic field to thermally insulate the hydrogen fuel, and a laser to preheat it (see 'Feeling the pinch'). In late November, they tested the system for the first time, using 16 million amperes of current, a 10-tesla magnetic field and 2 kilojoules of energy from a green laser.



Source: Sandia National Lab.

"We were excited by the results," says Mark Herrmann, director of the Z machine and the pulsed-power science center at Sandia. "We look at it as confirmation that it is working like we think it should."

The experiment yielded about 10^{10} high-energy neutrons, a measure of the number of fusion reactions achieved. This is a record for MagLIF, although it still falls well short of ignition. Nevertheless, the test demonstrates the appeal of such pulsed-power approaches to fusion. "A substantial gain is more likely to be achieved at an early date with pulsed power," says nuclear physicist David Hammer of Cornell University in Ithaca, New York, who co-wrote a 2013 US National Research Council assessment of approaches to fusion energy.

With its relatively slim US$5-million annual budget, MagLIF is a David next to two fusion Goliaths: the $3.5-billion National Ignition Facility (NIF) at Lawrence Livermore National Laboratory in California, and the €15-billion (US$20-billion) ITER experiment under construction in France. (Sandia has about $80 million to operate the Z machine each year, but it serves other experiments in addition to MagLIF.) The NIF squashes fuel capsules using nearly 2 megajoules of laser energy, and ITER will use 10,000 tons of superconducting magnets in a doughnut-shaped 'tokamak' to hold a plasma in place to coax self-sustaining fusion.

Both of the big projects have run into problems. After a concerted two-year effort, NIF fell well short of achieving ignition by a 2012 deadline. Its fusion yields have since increased markedly — nearly 10^{16} neutrons were created in a recent shot, Herrmann says — but the more than $300-million-a-year program faces further budget cuts in 2014. Meanwhile, delays and budget overruns have become the norm at ITER. The facility is not expected to begin operations until 2027 — 11 years later than initially planned.

In addition to being cheaper, MagLIF seems to have technical advantages. The laser not only preheats the hydrogen fuel, but also makes it more conductive — and thereby more susceptible to the Z pinch. Furthermore, in a paper published late last year, MagLIF physicists showed evidence suggesting that the applied secondary magnetic field, as well as insulating the fuel, may have the happy side effect of stabilizing the cylinder as it implodes (T. J. Awe *et al. Phys. Rev. Lett.* **111,** 235005; 2013). If so, that would cut down on hydrodynamic instabilities, which can disperse the energy and fuel before fusion can get going, says Stephen Slutz, a Sandia physicist who proposed the MagLIF system in 2009.

In the next few years, MagLIF scientists plan to turn up all three dials at their disposal. They can boost the Z machine to up to 27 million amperes; they can ramp up the magnetic field to as high as 30 tesla; and they plan to upgrade the laser to 8 kilojoules. They also aim to switch from fuel made of the hydrogen isotope deuterium to fuel containing both deuterium and another isotope, tritium — which should also lift yields. By 2015, they hope to achieve a yield of 10^{16} neutrons, or about 100 kilojoules — enough to show that ignition is within reach. It could be crucial to make progress quickly. The US National Nuclear Security Administration, the division of the Department of Energy that funds the NIF, the Z machine and other laser fusion efforts, plans to deliver an

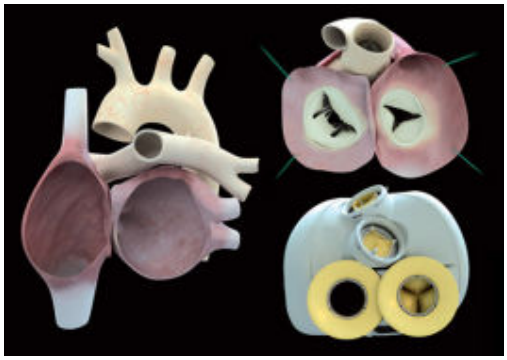
assessment to Congress in 2015 about the future of these technologies. If MagLIF hits its 100-kilojoule goal, it could bolster an argument for upgrading the Z machine to 60 million amperes or more, which simulations suggest would be sufficient to reach ignition. “We’re all hoping that they will, in fact, find success with their early shots to justify the construction of a larger machine,” says Hammer.

http://bit.ly/19ALKWM

Replacement artificial heart keeps first patient alive

13:49 31 December 2013 by Niall Firth

If you stayed awake during biology in school, you might recognise the shapes at the left and top right of this image: they are models of the heart. The object at lower right, looking like a cross between a tape dispenser and a second-world-war gas mask, will be less familiar.



(Image: Carmat)

Developed by French firm Carmat, this is an artificial heart designed for people whose hearts are so weak that they can no longer pump enough blood to sustain life. It was implanted in its first human patient on 18 December 2013 at the Georges Pompidou European Hospital in Paris.

The device replaces the real heart and is meant to keep patients going while they wait for a donor: Carmat claims it can be used for up to five years. Lithium-ion batteries outside the body keep it pumping, while sensors monitor and automatically control blood flow to adapt to the patient's activity.

Biomaterials in the artificial heart help to prevent the body from rejecting it. It is about three times larger than the natural organ, so it fits only about 65 per cent of patients. It would fit 86 per cent of men, though, because they have larger chest cavities.

So far, the operation seems to have been a success: the patient is said to be awake and talking to his family, and in a statement issued to Reuters, the hospital said the device is working well. "The artificial heart is functioning normally, automatically catering to the body's needs without any manual adjustment necessary," the surgeons said.

http://phys.org/news/2013-12-percent-mass-fish-attributed-natural.html

Study: 50 percent of mass fish kills attributed to natural causes

An analysis of mass fish kills in WA has found that more than 50 per cent can be attributed to natural causes.

Department of Fisheries fish kill incident co-ordinator Kylie Chatfield looked into more than 300 fish kills in WA since 1997.

Ms Chatfield found that the majority were the result of natural phenomenon such as algae, reduced oxygen levels, salinity, pH, strandings and life-cycle events. She says about eight per cent of fish kills were the result of chemicals, which could include things like agricultural pesticides and phosphates and sewage.

She says an even smaller proportion were caused by disease but they had the potential to have a large impact on a single species. This includes the pilchard herpesvirus that wiped out about 70 per cent of the Australian pilchard population in the 1990s.

Last year there were 34 fish kills, the third highest since records began in 1997, and so far this year there have been 24. The most fish kills was in 2008, when 36 were recorded, followed by 35 in 2004. More than half of all fish kills occurred in the metropolitan area and more than 80 per cent were in inland waters.

Ms Chatfield says one of the clearest cut cases in recent years was a fish kill in the Swan-Canning River last year that was dubbed the "100 days of Karlodinium". Thousands of fish died between May and July and cells of the algae Karlodinium veneficum could actually be seen under the microscope clogging the gills.

Jo Bannister, the Department of Fisheries incident co-ordinator for the event, says algae levels of over 100,000 cells per millilitre were recorded at places in the river at the time of the fish kill.

"They were stuck to the tips of the gills filaments, which directly affects the gills by blocking the respiratory surface so the fish can't breathe," she says. "They also produce a toxin, they're called karlotoxins, and they also damage the gill tissue."

Ms Chatfield says fish kills are often the result of several factors and the cause of many remains unknown because good samples were not collected in time or a definitive answer could not be reached from the evidence available.

She hopes to overlay fish kill events with other data such as weather, soil types and land usage to learn more about the conditions that caused them.

http://bit.ly/1dcViSZ

Eye Reflections in Photos Could Help Solve Crimes

In crimes in which the victims are photographed, such as hostage taking or child sex abuse, reflections in the eyes could help identify perpetrators.

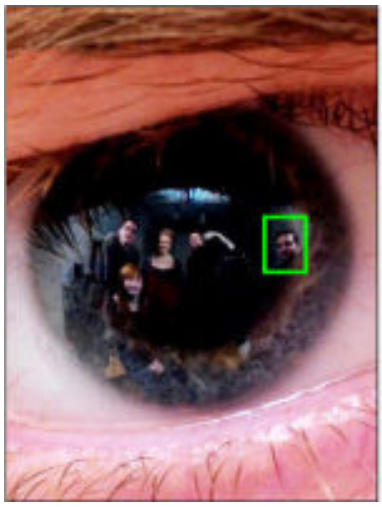
Dec 31, 2013 10:30 AM ET // by FoxNews.com/Science

Eyes are supposed to be windows to the soul -- but they make even better mirrors. And what they reflect will astonish you.

Researchers studying the incredible level of detail in modern digital photographs were able to pick out the tiny reflections of faces hidden in the eyes of the subject. By zooming in on the subject's eyes in high-resolution, passport-style photographs, they were able to pick out the faces and accurately identify them.

Hackers Vs. Criminals

Darren Kitchen, hacker and host of tech show Hak5, says why hacking isn't the same thing as cyber crime.



University Of Glasgow

"The pupil of the eye is like a black mirror," said Rob Jenkins, of the Department of Psychology at the University of York. "To enhance the image, you have to zoom in and adjust the contrast. A face image that is recovered from a reflection in the subject's eye is about 30,000 times smaller than the subject's face."

Working with Christie Kerr, of the School of Psychology, University of Glasgow, Jenkins recovered the images of bystanders that were as small as 27 pixels across (1 megapixel is about a million pixels). Yet when presented to panelists in a face-matching task, observers were able to match the diminutive faces 71 percent of the time. When the faces were familiar ones, people recognized identity correctly 84 percent of the time.

"Our findings thus highlight the remarkable robustness of human face recognition, as well as the untapped potential of high-resolution photography," Jenkins said.

The pictures were taken with a high-end, 39-megapixel Hasselblad camera, snapped while the onlookers were close to the subject and the room well lit. But with smartphones that pack increasingly better digital sensors, even ordinary photos may soon capture a similar level of detail.

The Nokia Lumia 1020 has a 41-megapixel camera, for example; AT&T sells the phone for just $199.99.

The researchers say that in crimes in which the victims are photographed, such as hostage taking or child sex abuse, reflections in the eyes of the photographic subject could help to identify perpetrators.

Images of people retrieved from cameras seized as evidence during criminal investigations may be used to piece together networks of associates or to link individuals to particular locations.

They published their work in the open access journal PLoS ONE.

http://www.sciencedaily.com/releases/2013/12/131231094349.htm?

Subsituting Bone With Synthetic Materials

Hydroxylapatite, when obtained synthetically it conserves its properties and could work as a bone substitute

When Lucia Téllez Jurado and her research team at the National Polytechnic Institute (IPN) were working in the synthesis of diverse materials, they realized that the Hydroxylapatite, medullar component of the bone, when obtained synthetically and "giving" it some characteristics, could be used as a bone substitute.

"We are in an early stage of research where we design materials and test compounds, for example the Hydroxylapatite, when obtained synthetically it conserves its properties and could work as a bone substitute because, according to our studies, doesn't cause toxicity in the human body."

Téllez Jurado, from the Laboratory of Heavy Materials of Metallurgic Engineer at the Superior School of Chemical Engineering and Extractive Industries (ESIQUE) of the IPN, indicates that the material has been synthetized and small powder has been obtained (nanometrics); with it molds would be made that could turn out fragile, for which it would be necessary to add other substances giving them mechanical resistance.

Hydroxylapatite obtained synthetically is a fragile "ceramic." Collagen and organic matter are what give resistance to bones. That is why the polytechnic research aims to process this material along with others to give it strength.

The work at IPN is looking for a material with optimal properties that could be applied on a large bone like the femur or fingers. However, the materials -depending on their properties- can be destined to other body parts.
"We are interested in obtaining a material that complies with mechanical characteristics so it can be implanted or used as a substitute for a broken bone when no other option is available."
The proposal of the IPN is to create a material than could be reabsorbed, generates bone and the rest could be degraded by the human body.
Is important to highlight that Hydroxylapatite is a widely studied material, employed as a biomaterial and can be obtained from animal skeletons or synthetically. Another of its applications is as a filter for heavy metals.
Téllez Jurado concludes with the idea of finding the best material to substitute or cover broken bone. "We are going to test several materials, checking their mechanical compositions so it has the required characteristics and works in humans. If someone has a fracture the technology must be applied without causing further damage."

http://www.eurekalert.org/pub_releases/2014-01/smh-ttt123013.php

Tripling tobacco taxes worldwide would avoid 200 million tobacco deaths

Controlling tobacco marketing is also key to helping people quit smoking

TORONTO - Tripling taxes on cigarettes around the world would reduce the number of smokers by one-third and prevent 200 million premature deaths from lung cancer and other diseases this century, according to a review published today in the New England Journal of Medicine.
Such a large tax increase would double the street price of cigarettes in some countries and narrow the price gap between the cheapest and most expensive cigarettes, which would encourage people to stop smoking rather than switch to a cheaper brand and help young people not to start.
This would be especially effective in low- and middle-income countries, where the cheapest cigarettes are relatively affordable and where smoking rates continue to rise, said Dr. Prabhat Jha, director of the Centre for Global Health Research of St. Michael's Hospital and a professor in the Dalla Lana School of Public Health at the University of Toronto. But it would also be effective in rich countries, he said, noting that France halved cigarette consumption between 1990 and 2005 by raising taxes well above inflation.
"Death and taxes are inevitable, but they don't need to be in that order," Dr. Jha said. "A higher tax on tobacco is the single most effective intervention to lower smoking rates and to deter future smokers."
Countries around the world agreed at the United Nations General Assembly and the World Health Organization's 2013 Assembly to decrease the prevalence of smoking by about one-third by 2025 to reduce premature deaths from cancer and other chronic diseases by 25 per cent.
Tobacco causes about 200,000 deaths a year of people under 70 in Canada and the United States (120,000 men and 80,000 women). Doubling cigarette prices would prevent about 70,000 of those deaths and provide new revenue that governments could spend on health care. Dr. Jha said that even while higher tobacco taxes would reduce consumption, they would still generate an additional $100 billion U.S. a year for a total of $400 billion.
"Worldwide, around a half-billion children and adults under the age of 35 are already – or soon will be – smokers and on current patterns few will quit," said Professor Sir Richard Peto of the University of Oxford, the co-author.
"So there's an urgent need for governments to find ways to stop people starting and to help smokers give up. This study demonstrates that tobacco taxes are a hugely powerful lever and potentially a triple win – reducing the numbers of people who smoke and who die from their addiction, reducing premature deaths from smoking and yet, at the same time, increasing government income. All governments can take action by regularly raising tobacco taxes above inflation, and using occasional steep tax hikes starting with their next budget. Young adult smokers will lose about a decade of life if they continue to smoke – they've so much to gain by stopping."
Controlling tobacco marketing is also key to helping people quit smoking. An independent review in the United Kingdom concluded that plain packaging would reduce the appeal of cigarettes, a switch that is expected before the next election. Australia changed to plain packaging in 2011, a measure New Zealand plans to follow.
Dr. Jha and Sir Richard noted that the 21st-century hazards of smoking have been reliably documented only in the past year, when several researchers published papers showing that men and women who started smoking when they were young and continued throughout adulthood had two or three times the mortality rate of non-smokers. An average of 10 years of life is lost from smoking. Many of those killed are still in middle age, meaning on average they lose about 20 years of life expectancy.
Both Dr. Jha and Sir Richard published papers last year showing that people who quit smoking when they are young can regain almost all of the decade of life they might otherwise have lost.

http://bit.ly/1g38gGa

GPS satellites suggest Earth is heavy with dark matter

Analysis of GPS satellite orbits hints that Earth is heavier than thought, perhaps due to a halo of dark matter

02 January 2014 by Anil Ananthaswamy

GPS is handy for finding a route, but it might be able to solve fundamental questions in physics too. An analysis of GPS satellite orbits hints that Earth is heavier than thought, perhaps due to a halo of dark matter.

Dark matter is thought to make up about 80 per cent of the universe's matter, but little else is known about it, including its distribution in the solar system. Hints that the stuff might surround Earth come from observations of space probes, several of which changed their speeds in unexpected ways as they flew past Earth. In 2009, Steve Adler of the Institute of Advanced Studies in Princeton, New Jersey, showed how dark matter bound by Earth's gravity could explain these anomalies.

Ben Harris at the University of Texas at Arlington wondered if dark matter might also affect satellites. "The nice thing about GPS satellites is that we know their orbits really, really well," he says. From nine months of data on the satellites in the GLONASS, GPS and Galileo groups, he calculated Earth's mass as "felt" by each one.

At a meeting of the American Geophysical Union in San Francisco in December, he reported an average figure that was between 0.005 and 0.008 per cent greater than the value for Earth's mass established by the International Astronomical Union. A disc of dark matter around the equator 191 kilometres thick and 70,000 km across can explain this, he says.

Harris has yet to account for perturbations to the satellites' orbits due to relativity, and the gravitational pull of the sun and moon. What's more, preliminary data from NASA's Juno probe, also presented at the AGU meeting, suggests its speed was as expected as it flew by Earth, casting doubt on the earlier anomalies.

But if Harris's explanation is correct, satellites could reveal properties of dark matter, such as whether its particles interact with each other.

http://bit.ly/1iwdIp7

Designer plants have vital fish oils in their seeds

Biofuel crop genetically modified to produce components of fish oils beneficial for cardiovascular health

02 January 2014 by Andy Coghlan

MOVE over, cod liver oil. A biofuel crop related to cabbages, called camelina, has been genetically modified to produce components of fish oils beneficial for cardiovascular health. The approach could relieve some of the pressure on the oceans.

The flesh of oily fish such as mackerel and salmon, plus the livers of white fish such as cod, are good sources of omega-3 fatty acids. The most important ones are eicosapentaenoic acid (EPA) – known to reduce the risk of heart disease – and docosahexaenoic acid (DHA) – a lack of which has been linked to visual and cognitive problems.

Breast milk is a good source of both, and our bodies can make small amounts of EPA from another omega-3 called alpha-linolenic acid (ALA) found in nuts and vegetable oil, which is then converted into DHA.

The richest source of these fatty acids is fish. However, they do not produce the acids themselves. In the wild, they get them from eating smaller fish that have eaten algae, the only organisms that can make appreciable amounts of EPA and DHA. Farmed fish are fed fishmeal enriched with fish oil containing these fatty acids.

Every year, around a million tonnes of oil is extracted from ground-up fish. A tenth of this goes to make fish-oil capsules and the rest is given to farmed fish. But supplies are limited and unsustainable, says Douglas Tocher of the Institute of Aquaculture at the University of Stirling, UK.

Now Johnathan Napier and colleagues at Rothamsted Research in Harpenden, UK, have created an alternative, sustainable source of EPA and DHA. They took seven genes that algae use to produce these fatty acids and inserted them into the genome of Camelina sativa, a plant chosen because its seeds are already rich in ALA. The seeds of the modified plant yielded oil that, when purified, contained around 12 per cent EPA and 14 per cent DHA – the same proportions as in fish oil (The Plant Journal, doi.org/qn8).

Napier says that if all goes to plan, the plant oil could be available commercially within 10 years. It could then help replace the fish oil used in capsules or fed to farmed fish. "We're never going to replace that 1 million tonnes a year from the sea, but if we could supply even 10 per cent, we would significantly take the pressure off fish stocks," he says. Tocher says that modified camelina should make it possible for people to consume the World Health Organization's recommended daily intake of 400 to 1000 milligrams of EPA and DHA. Without the plants, "if everyone ate that much, there would only be enough to supply about half the population, through capsules, fish or both", he says.

http://bit.ly/19Qb60n

Dogs Have a Butt Compass, Poop Facing N/S Pole

A paper in* Frontiers in Zoology *claims that dogs can sense the Earth's magnetic field, and preferentially align to it when pooping.

Jan 2, 2014 01:38 PM ET // by Tracy Staedter

It's all starting to make sense. For years I wondered why my dog spins in a circle before depositing her daily double. But now I think I have a clue as to why. Scientists at the Czech University of Life Sciences in Prague have found that, like other animals, dogs are sensitive to Earth's magnetism.

Dogs prefer to do their duty with their bodies aligned along the north-south axis, particularly under calm magnetic field conditions, report Hynek Burda, et al. in a study published in the Frontiers of Zoology. The field can fluctuate and I can't help but wonder if it's on those unstable days that my dog circles round and round like a housefly on a windowsill.

The scientists came to their conclusion after measuring the direction of the body axes of 70 dogs, representing 37 different breeds, as they were making a deposit — the dogs, not the scientists. The researchers observed both number ones and number twos over a two-year period.

After sorting the data according to the geomagnetic conditions, among other technical variables, the team concluded that dogs were predictably sensitive to Earth magnetism and showed sensitivity to changes in polarity, rather than intensity of the magnetic field.

Next time your dog poops, take note of the direction and report back.

http://www.eurekalert.org/pub_releases/2014-01/wuis-ord010214.php

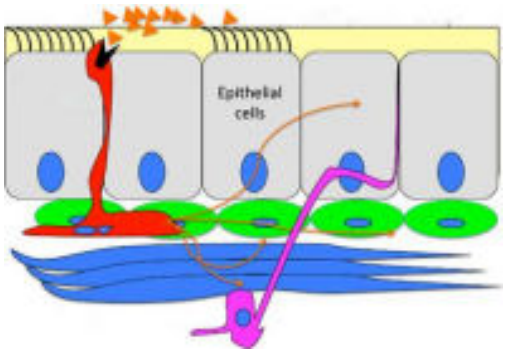
Odor receptors discovered in lungs

They're just like those in your nose but instead of conjuring up a cup of coffee they might make you cough

Your nose is not the only organ in your body that can sense cigarette smoke wafting through the air. Scientists at Washington University in St. Louis and the University of Iowa have showed that your lungs have odor receptors as well. Unlike the receptors in your nose, which are located in the membranes of nerve cells, the ones in your lungs are in the membranes of neuroendocrine cells. Instead of sending nerve impulses to your brain that allow it to "perceive" the acrid smell of a burning cigarette somewhere in the vicinity, they trigger the flask-shaped neuroendocrine cells to dump hormones that make your airways constrict.

The newly discovered class of cells expressing olfactory receptors in human airways, called pulmonary neuroendocrine cells, or PNECs, were found by a team led by Yehuda Ben-Sharar, PhD, assistant professor of biology and medicine at Washington University in St. Louis, and including colleagues Steven L. Brody and Michael J. Holtzman of the Washington University School of Medicine, and Michel J. Welsh of the Lucille A. Carver College of Medicine at the University of Iowa.

"We forget," said Ben-Shahar, "that our body plan is a tube within a tube, so our lungs and our gut are open to the external environment. Although they're inside us, they're actually part of our external layer. So they constantly suffer environmental insults," he said, "and it makes sense that we evolved mechanisms to protect ourselves." In other words, the PNECs, described in the March issue of the American Journal of Respiratory Cell and Molecular Biology, are sentinels, guards whose job it is to exclude irritating or toxic chemicals.



The cells might be responsible for the chemical hypersensitivity that characterizes respiratory diseases, such chronic obstructive pulmonary disease (COPD), and asthma. Patients with these diseases are told to avoid traffic fumes, pungent odors, perfumes and similar irritants, which can trigger airway constriction and breathing difficulties.

A diagram of the airway lining suggests how the pulmonary neuroendocrine cells (red) trigger a response to inhaled chemicals. When a chemical (orange triangle) docks on a receptor (black) they dump secretory chemicals (thin orange arrows), which have an immediate but localized effect on muscles (blue) and nerves (pink), possibly triggering responses such as a cough. **Ben-Shahar**

The odor receptors on the cells, might be a therapeutic target, Ben-Shahar suggests. By blocking them, it might be possible to prevent some attacks, allowing people to cut down on the use of steroids or bronchodilators.

Every breath you take

When a mammal inhales, volatile chemicals flow over two patches of specialized epithelial tissue high up in the nasal passages. These patches are rich in nerve cells with specialized odorant-binding molecules embedded in their membranes.

If a chemical docks on one of these receptors, the neuron fires, sending impulses along the olfactory nerve to the olfactory bulb in the brain, where the signal is integrated with those from hundreds of other similar cells to conjure the scent of old leather or dried lavender.
Aware that airway diseases are characterized by hypersensitivity to volatile stimuli, Ben-Shahar and his colleagues realized that the lungs, like the nose, must have some means of detecting inhaled chemicals.
Earlier a team at the University of Iowa, where Ben-Shahar was a postdoctoral research associate, had searched for genes expressed by patches of tissue from lung transplant donors. They found a group of ciliated cells that express bitter taste receptors. When offending substances were detected, the cilia beat more strongly to sweep them out of the airway. This result was featured on the cover of the August 28, 2009 issue of Science.
But since people are sensitive to many inhaled substances, not just bitter ones, Ben-Shahar decided to look again. This time he found that these tissues also express odor receptors, not on ciliated cells but instead on neuroendocrine cells, flask-shaped cells that dump serotonin and various neuropeptides when they are stimulated. This made sense. "When people with airway disease have pathological responses to odors, they're usually pretty fast and violent," said Ben-Shahar. "Patients suddenly shut down and can't breath and these cells may explain why."
Ben-Shahar stresses the differences between chemosensation in the nose and in the lung. The cells in the nose are neurons, he points out, each with a narrowly tuned receptor, and their signals must be woven together in the brain to interpret our odor environment.
The cells in the airways are secretory not neuronal cells and they may carry more than one receptor, so they are broadly tuned. Instead of sending nerve impulses to the brain, they flood local nerves and muscles with serotonin and neuropeptides. "They are possibly designed," he said, "to elicit a rapid, physiological response if you inhale something that is bad for you."
The different mechanisms explain why cognition plays a much stronger role in taste and smell than in coughing in response to an irritant. It is possible, for example, to develop a taste for beer. But nobody learns not to cough; the response is rapid and largely automatic.
The scientists suspect these pulmonary neurosecretory cells contribute to the hypersensitivity of patients with Chronic Obstructive Pulmonary Disease (COPD) to airborne irritants. COPD is a group of diseases including emphysema that are characterized by coughing, wheezing, shortness of breath and chest tightness.
When the scientists looked at the airway tissues from patients with COPD they discovered that they had more of these neurosecretory cells than airway tissues from healthy donors.

Of mice and men

As a geneticist Ben-Shahar would like to go farther, knocking out genes to make sure that the derangement of neurosecretory cells isn't just correlated with airway diseases but instead suffices to produce it.
But there is a problem. "For example, a liver from a mouse and a liver from a human are pretty similar, they express the same types of cells. But the lungs from different mammalian species are often very different; you can see it at a glance," Ben-Shahar said.
"Clearly. "Ben-Shahar said, "primates have evolved distinct cell lineages and signaling systems for respiratory-specific functions. " This makes it challenging to unravel the biomolecular mechanisms of respiratory diseases.
Still, he is hopeful that the PNEC pathways will provide targets for drugs that would better control asthma, COPD and other respiratory diseases. They would be welcome. There has been a steep rise in these diseases in the past few decades, treatment options have been limited, and there are no cures,

http://www.eurekalert.org/pub_releases/2014-01/uow-gib010214.php

Genetically identical bacteria can behave in radically different ways

Uneven distribution of certain mechanisms during cell division creates diversity that can enhance a bacterial population's survival

Although a population of bacteria may be genetically identical, individual bacteria within that population can act in radically different ways. This phenomenon is crucial in the bacteria's struggle for survival. The more diversity a population of bacteria has, the more likely it will contain individuals able to take advantage of a new opportunity or overcome a new threat, including the threat posed by an antibiotic.
In a recent study, researchers at the University of Washington showed that when a bacterial cell divides into two daughter cells there can be an uneven distribution of cellular organelles. The resulting cells can behave differently from each other, depending on which parts they received in the split.
"This is another way that cells within a population can diversify. Here we've shown it in a bacterium, but it probably is true for all cells, including human cells," said Dr. Samuel Miller, UW professor of microbiology, genome sciences, and medicine and the paper's senior author.

Bridget Kulasekara, who obtained a Ph.D in the UW Molecular and Cellular Biology Program, was the paper's lead author. Other contributors included: Hemantha Kulasekara, Matthias Christen, and Cassie Kamischke, who work in Miller's lab, and Paul Wiggins, UW assistant professor of physics and bioengineering. The paper appears in the online journal eLife.In an earlier paper, Miller and his colleagues showed that when bacteria divided, the concentration of an important regulatory molecule, called cyclic diguanosine monophosphate (c-di-GMP). was unevenly distributed between the two progeny. c-di-GMP is a second messenger molecule. That finding was published in the journal Science in 2010.

Second messenger molecules transmit signals from sensors or receptors on the cell's external membrane to targets within the cell, where they can rapidly alter a wide variety of cellular functions, such as metabolism and mobility. The ability to respond to external stimuli quickly is important for the bacteria's survival. For instance, to stay alive, a bacterium must not hesitate to swim towards nutrients or away from toxins. This directional movement of microorganisms, spurred by the presence of a helpful or harmful substance, is known as chemotaxis. "The effect of second messengers is almost immediate," said Miller. "They allow bacteria to change their behavior within seconds."

To detect the difference in c-di-GMP levels between cells, the researchers used a technique called Förster resonance energy transfer microscopy, or FRET microscopy. This allowed them to measure nanomolar changes of the concentration of c-di-GMP within individual bacteria as the changes happened second by second.

Different concentrations of c-di-GMP can have a profound influence on a cell's behavior. For example, in the bacteria Pseudomonas aeruginosa, cells with high levels of c-di-GMP tend to remain still, adhere to surfaces and form colonies. Those with low levels, on the other hand, tend to actively swim about by using a corkscrew-shaped propeller located at one end of the bacterium. In the latest study, the Miller and his colleagues worked out the molecular mechanism behind the difference in c-di-GMP concentrations seen between daughter cells.

When Pseudomonas cells divide, they pinch in half to create two daughter cells. Although the cells are genetically identical, only one daughter cell can inherit the bacterium's single propeller. The other cell can synthesize its own propeller, but immediately after division the two cells are quite different.

What Miller and his coworkers report in the eLife paper is that the daughter cell that inherits the propeller also inherits an enzyme that is closely associated with the propeller that degrades c-di-GMP, as well as the organelle involved in directing movement toward or away from stimuli that activates this enzyme.

Together these two organelles work in concert to lower the concentration of c-di-GMP and control swimming. "What we have shown is that the uneven inheritance of organelles is another way cells have to create diversity and increase the chances of the survival of its species," Miller said.

He added that his team's findings may help explain how bacteria resist antibiotic treatments by always having some cells in their populations be in a slow-growing, resting state. Since antibiotics target fast-growing cells, these resting cells are more likely to survive the treatment. The findings might also help explain how some bacteria are able to adhere to and colonize surfaces such as urinary catheters, intravenous lines and heart valves.

In ongoing research, Miller's team is trying to get a better understanding of the signals that can change second messenger concentrations very quickly and is screening compounds that could interfere with or alter those signals. Such compounds could be used to combat drug resistance, for instance, or inhibit a bacterium's ability to adhere to surfaces and form slime-like colonies, called biofilms, that are highly resistant to antibiotics.

The new paper, as well as the earlier study, which appeared in the journal Science in 2010, are both available free online. Kulasekara et al. c-di-GMP heterogeneity is generated by the chemotaxis machinery to regulate flagellar motility. ELife. 2013;2:e01402. Chisten M et al. Asymmetrical Distribution of the Second Messenger c-di-GMP upon Bacterial Cell Division. Science. 2010; 328(5983):1295-1297 DOI: 10.1126/science.1188658

The research was funded by the National Institute of Allergy and Infectious Diseases (Grant number: 5U54AI057141-09) the National Science Foundation Graduate Research Fellowship (Grant number 2007047910) and the National Institutes of Health (Grant number 1R21NS067579-0).

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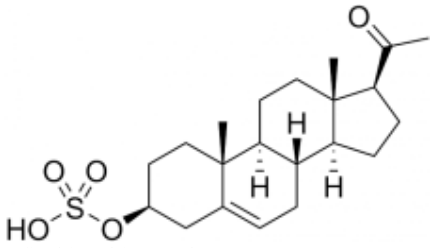
Molecule discovered that protects the brain from cannabis intoxication

Pregnenolone, a molecule produced by the brain, acts as a natural defence mechanism against the harmful effects of cannabis

Two INSERM research teams led by Pier Vincenzo Piazza and Giovanni Marsicano (INSERM Unit 862 "Neurocentre Magendie" in Bordeaux) recently discovered that pregnenolone, a molecule produced by the brain, acts as a natural defence mechanism against the harmful effects of cannabis in animals. Pregnenolone prevents THC, the main active principle in cannabis, from fully activating its brain receptor, the CB1 receptor, that when overstimulated by THC causes the intoxicating effects of cannabis. By identifying this mechanism, the INSERM teams are already developing new approaches for the treatment of cannabis addiction.

These results are to be published in Science on 3 January.
Over 20 million people around the world are addicted to cannabis, including a little more than a half million people in France. In the last few years, cannabis addiction has become one of the main reasons for seeking treatment in addiction clinics. Cannabis consumption is particularly high (30%) in individuals between 16 to 24 years old, a population that is especially susceptible to the harmful effects of the drug.
While cannabis consumers are seeking a state of relaxation, well-being and altered perception, there are many dangers associated to a regular consumption of cannabis. Two major behavioural problems are associated with regular cannabis use in humans: cognitive deficits and a general loss of motivation. Thus, in addition to being extremely dependent on the drug, regular users of cannabis show signs of memory loss and a lack of motivation that make quite hard their social insertion.
The main active ingredient in cannabis, THC, acts on the brain through CB1 cannabinoid receptors located in the neurons. THC binds to these receptors diverting them from their physiological roles, such as regulating food intake, metabolism, cognitive processes and pleasure. When THC overstimulates CB1 receptors, it triggers a reduction in memory abilities, motivation and gradually leads to dependence.



Pregnenolone sulfate, an active relative of the hormone identified in this study. **Wikimedia commons**

Increase of dopamine release

Developing an efficient treatment for cannabis addiction is becoming a priority of research in the fiend of drug addiction. In this context, the INSERM teams led by Pier Vincenzo Piazza and Giovanni Marsicano have investigated the potential role of pregnenolone a brain produced steroid hormone. Up to now, pregnenolone was considered the inactive precursor used to synthesize all the other steroid hormones (progesterone, estrogens, testosterone, etc.). The INSERM researchers have now discovered that pregnenolone has quite an important functional role: it provide a natural defence mechanism that can protect the brain from the harmful effects of cannabis.
Essentially, when high doses of THC (well above those inhaled by regular users) activate the CB1 cannabinoid receptor they also trigger the synthesis of pregnenolone. Pregnenole then binds to a specific site on the same CB1 receptors (see figure) and reducing the effects of THC. The administration of pregnenolone at doses that increase the brain's level of this hormone even more, antagonize the behavioral effects of cannabis.
At the neurobiological level, pregnenolone greatly reduces the release of dopamine triggered by THC. This is an important effect, since the addictive effects of drugs involve an excessive release of dopamine.
This negative feedback mediated by pregnenolone (THC is what triggers the production of pregnenolone, which then inhibits the effects of THC) reveal a previously unknown endogenous mechanism that protects the brain from an over-activation of CB1 receptor.

A protective mechanism that opens the doors to a new therapeutic approach.

The role of pregnenolone was discovered when, rats were given equivalent doses of cocaine, morphine, nicotine, alcohol and cannabis and the levels of several brain steroids (pregnenolone, testosterone, allopregnenolone, DHEA etc..) were measured. It was then found that only one drug, THC, increased brain steroids and more specifically selectively one steroid, pregnenolone, that went up3000% for a period of two hours.

The effect of administering THC on the pregnenolone synthesis (PREG) and other brain steroids

This increase in pregnenolone is a built-in mechanism that moderates the effects of THC. Thus, the effects of THC increase when pregnenolone synthesis is blocked. Conversely, when pregnenolone is administered to rats or mice at doses (2-6 mg/kg) that induce even greater concentrations of the hormone in the brain, the negative behavioural effects of THC are blocked. For example, the animals that were given pregnenolone recover their normal memory abilities, are less sedated and less incline to self-administer cannabinoids.
Experiments conducted in cell cultures that express the human CB1 receptor confirm that pregnenolone can also counteract the molecular action of THC in humans. Pier Vincenzo Piazza explains that pregnenolone itself cannot be used as a treatment "Pregnenolone cannot be used as a treatment because it is badly absorbed when administerd orally and once in the blood stream it is rapidly transformed in other steroids".
However, the researcher says that there is strong hope of seeing a new addiction therapy emerge from this discovery. "We have now developed derivatives of pregnenolone that are well absorbed and stable. They then present the characteristics of compounds that can be used as new class of therapeutic drugs. We should be able to begin clinical trials soon and verify whether we have indeed discovered the first pharmacological treatment for cannabis dependence."
This work was made possible with support from: MILDT, Conseil Régional d'Aquitaine, ERC and INSERM.

http://www.eurekalert.org/pub_releases/2014-01/ip-ra010214.php

Residual activity 'hot spots' in the brain key for vision recovery in stroke patients

According to study published in Restorative Neurology and Neuroscience

Amsterdam, NL - Scientists know that vision restoration training (VRT) can help patients who have lost part of their vision due to glaucoma, optic nerve damage, or stroke regain some of their lost visual functions, but they do not understand what factors determine how much visual recovery is achieved.

New evidence published in Restorative Neurology and Neuroscience suggests that vision restoration depends mostly on activity of residual vision that is still left after the injury and that both local neuronal activity and activity in the immediate surround influence the development of visual recovery "hot spots." This shows that recovery of vision is mediated by partially surviving neurons.

Researchers from the Institute of Medical Psychology and Department of Computer Sciences, Otto-von-Guericke-University of Magdeburg, and the Max Planck Institute for Dynamics and Self-Organisation, Göttingen, Germany, conducted a retrospective analysis of multiple visual field tests before and after at least six months of VRT in 32 stroke patients with hemianopia, which is a loss of vision in half of the visual field. The test, known as high-resolution perimetry (HRP), presents visual stimuli on a computer monitor to which the patient has to respond by pressing a key on the keyboard.

The result is a map that indicates areas that are intact (unaffected by the injury), areas that are completely blind, and "areas of residual vision," where vision is reduced but not absent. Here, the response time is slower or the correct response occurs only occasionally. Repetitive stimulation through daily one-hour vision training with VRT was directed at these "areas of residual function" to strengthen their performance.

"Hot spots" were defined as those locations that were initially impaired at baseline but then recovered after VRT training, while "cold spots" remained impaired where vision training did not help. Of almost 11,000 visual spots analyzed from the 23 patients, 688 were found to be hot spots while 3,426 were cold spots. The average absolute improvement due to VRT training was 6%.

The investigators used computer-based data mining technology to study which features of the baseline HRP charts obtained before vision training could predict vision recovery. They looked at different topographic features and found that visual field areas have a higher probability of becoming vision restoration "hot spots" if they had higher local residual vision at baseline, more residual activity in a spatially limited surrounding area (of 5 degrees of visual angle), and if they were located closer to the blind field (scotoma). Vision restoration was not influenced much by residual activity at further distances, say the authors.

"Our findings confirm the special role of residual structures in vision restoration, which is likely mediated by surviving cells in partially damaged brain tissue," says lead author Bernhard A. Sabel, PhD, of the Institute of Medical Psychology, Otto-von-Guericke-University of Magdeburg. Dr. Sabel suggests that the massive visual stimulation presented during VRT enhances visual recovery by forcing subjects to focus their attention on "compromised" sectors of the visual field which are partially damaged and repeating this daily helps recover vision loss. "This new understanding now allows us to offer vision training on the internet through online training," says Dr. Sabel.

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Jumping DNA in the brain may be a cause of schizophrenia

Stretches of DNA called retrotransposons, often dubbed "junk DNA", might play an important role in schizophrenia.

In a study published today in the journal Neuron, a Japanese team revealed that LINE-1 retrotransposons are abnormally abundant in the schizophrenia brain, modify the expression of genes related to schizophrenia during brain development, and may be one of the causes of schizophrenia.

Retrotransposons are short sequences of DNA that autonomously amplify and move around the genome. One class of retrotransposons named Long Interspersed Nuclear Elements (LINE) make up a large part of the eukaryotic genome and it is believed that they may contribute to a number of disorders and diseases such as cancer.

LINE-1 have been shown to be more abundant in brain cells than in other cells in the body in adults, providing evidence for enhanced activity of LINE-1 in the human brain. However, the role played by LINE-1 in mental disorders, and in particular schizophrenia, has remained unclear.

The team led by Dr Kazuya Iwamoto from the University of Tokyo and Dr Tadafumi Kato from the RIKEN Brain Science Institute demonstrated that the number of LINE-1 copies is elevated in the post-mortem brains of patients with schizophrenia. They show using mouse and macaque models for schizophrenia and iPS cells that exposure to environmental risk factors during development, as well as the presence of genetic risk factors for

schizophrenia, can lead to increased levels of LINE-1 in neurons. The authors reveal employing whole genome analysis that in schizophrenia patients LINE-1 reinserts into genes involved in synaptic function or schizophrenia and may result in disruptions in their normal functions.
"Our findings strongly suggest that abnormal, enhanced retrotransposition of LINE-1 in neurons, triggered by environmental factors and/or combined with a genetic risk factor, plays a defining role in schizophrenia," conclude the authors.
"This study proposes a brand new mechanism of pathophysiology of schizophrenia. Previously, schizophrenia was regarded as a disease caused by gene-environment interactions, but our study shows that the environment can alter the genome and may contribute to the disease," explains Tadafumi Kato.
Miki Bundo1, Manabu Toyoshima2, Yohei Okada3, Wado Akamatsu3, Junko Ueda2, Taeko Nemoto-Miyauchi2, Fumiko Sunaga1, Michihiro Toritsuka4, Daisuke Ikawa4, Akiyoshi Kakita5, Motoichiro Kato3, Kiyoto Kasai1, Toshifumi Kishimoto4, Hiroyuki Nawa5, Hideyuki Okano3, Takeo Yoshikawa2, Tadafumi Kato2, Kazuya Iwamoto1* (* co-corresponding authors)*
"Increased L1 Retrotransposition in the Neuronal Genome in Schizophrenia" Neuron, 2013 DOI: 10.1016/j.neuron.2013.10.053
This study was carried out by The University of Tokyo and RIKEN Brain Science Institute in collaboration with Keio University, University of Niigata, and Nara Medical University. This study is funded in part by a grant from the Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan, JST PRESTO/ CREST, and Strategic Research Program for Brain Sciences by MEXT.

http://www.eurekalert.org/pub_releases/2014-01/cp-pui122713.php

Plant used in Chinese medicine fights chronic pain

A plant used for centuries as a pain reliever in Chinese medicine may be just what the doctor ordered, especially when it comes to chronic pain.

A key pain-relieving ingredient is a compound known as dehydrocorybulbine (DHCB) found in the roots of the flowering plant Corydalis, a member of the poppy family, according to researchers who report their findings in the Cell Press journal Current Biology on January 2.
"Our study reports the discovery of a new natural product that can relieve pain," says Olivier Civelli of the University of California, Irvine. "This analgesic acts in animal assays against the three types of pain that afflict humans, including acute, inflammatory, and neuropathic or chronic pain."
Civelli, along with Xinmiao Liang, made the discovery as part of the "herbalome" project, an effort to catalogue all of the chemical components of traditional Chinese medicine. The Corydalis plants that were the focus of the new study grow mainly in central eastern China, where underground tubers are harvested, ground, and boiled in hot vinegar. Those concoctions are often prescribed to treat pain, including headaches and back pain.
The researchers went looking for compounds in Corydalis that appeared likely to act in a manner similar to morphine. "We landed on DHCB but rapidly found that it acts not through the morphine receptor but through other receptors, in particular one that binds dopamine," Civelli explains. The discovery adds to earlier evidence showing that the dopamine D2 receptor plays a role in pain sensation.
While Corydalis extracts or isolated DHCB work against all types of pain, they hold special promise for those who suffer with persistent, low-level chronic pain. For one thing, DHCB doesn't appear to lose effectiveness with time in the way that traditional opiate drugs do.
"We have good pain medications for acute pain: codeine or morphine, for example," Civelli says. "We have pain medication for inflammatory pain, such as aspirin or acetaminophen. We do not have good medications for chronic pain. DHCB may not be able to relieve strong chronic pain, but may be used for low-level chronic pain." Although Corydalis preparations of various types can already be purchased online, Civelli and Liang say DHCB isn't ready for prime time just yet. Further testing for toxicity is needed before doctors should consider prescribing it to patients.
Current Biology, Zhang et al.: "A novel analgesic Isolated from a Traditional Chinese Medicine."

http://www.eurekalert.org/pub_releases/2014-01/uouh-ncm010214.php

New cell mechanism discovery key to stopping breast cancer metastasis

Researchers from Huntsman Cancer Institute (HCI) at the University of Utah discovered a cellular mechanism that drives the spread of breast cancer to other parts of the body (metastasis), as well as a therapy which blocks that mechanism.

SALT LAKE CITY - The research results were published online in the journal Cell Reports on January 2.
"Genetic mutations do not drive this mechanism," said Alana Welm, PhD, senior author of the study, associate professor in the Department of Oncological Sciences, and an investigator at Huntsman Cancer Institute. "Instead, it's improper regulation of when genes turn on and off."
The new discovery focuses on a protein called RON kinase (RON), which signals some areas of tumor cell DNA to become active. Normally, RON operates mostly during embryonic development and is not highly

expressed in healthy adults. But in about 50 percent of breast cancer cases, RON becomes re-expressed and reprograms genes responsible for metastasis, making them active.
"If there's an entire program in the tumor cell that's important for metastasis, blocking one small part of that program, for example, the action of a single gene, will probably not be an effective strategy," said Welm. "But if you could find a way to turn off the entire program, you're more likely to have the desired effect. We found that inhibiting RON turns off the entire metastasis program in these tumor cells.
"No one has ever described a specific pathway driving this kind of reprogramming in metastasis, much less a way to therapeutically block it,' Welm added. "Also, RON has not previously been known to be involved in reprogramming gene expression." Future work will include investigating the potential of detecting the RON-dependent program in tumor cells as a way to identify patients that are more likely to develop metastases and as a predictor of therapeutic response to drugs that inhibit RON.
The article's co-authors include Stéphanie Cunha, Yi-Chun Lin, Elizabeth Goossen, and Christa DeVette from HCI, and Mark Albertella, Mark Mulvihill, and Stuart Thomson of OSI/Astellas. The work was funded by the DOD Breast Cancer Research Program Era of Hope Scholar Award, a Susan G. Komen for the Cure Career Catalyst Award, and Huntsman Cancer Foundation. Research reported in this publication utilized HCI's Microarray and Genomic Analysis Shared Resource and was supported by the National Cancer Institute of the National Institutes of Health under Award Number P30CA042014.

http://www.eurekalert.org/pub_releases/2014-01/iu-sep010214.php

Study explaining parasite gene expression could help fight toxoplasmosis and malaria

A newly identified protein and other proteins it interacts with could become effective targets for new drugs to control the parasite that cause toxoplasmosis

INDIANAPOLIS -- A newly identified protein and other proteins it interacts with could become effective targets for new drugs to control the parasite that cause toxoplasmosis, researchers led by investigators at Indiana University School of Medicine have reported. The discovery could also open new research pathways for treatments for malaria.
The researchers determined that the protein, an enzyme called GCN5b, is necessary for the Toxoplasma parasite to replicate, so interfering with its activities could control the parasite. GCN5b is part of the molecular machinery that turns genes on and off in the parasite, working with other proteins that, the researchers discovered, are more plant-like than their counterparts in humans.
"GCN5b is a very different protein than its human counterpart, and proteins it interacts with are not found in humans," said William J. Sullivan Jr., Ph.D., associate professor of pharmacology and toxicology.
"That's what makes this exciting -- rather than just having one enzyme that we could go after, there could be a whole collection of associated enzyme components that could be potentially targeted for drug therapies to control this parasite," he said.
In discovering that some of the proteins interacting with GCN5b are plant-like transcription factors -- proteins that bind to DNA -- the researchers filled in what had been a missing link explaining how the parasites control the process of turning genes on and off, known as gene expression. The plant-like transcription factors recruit the GCN5b enzyme complex to activate a wide variety of genes for expression.
When the research team disabled the GCN5b complex, parasite replication swiftly came to a halt. Dr. Sullivan and his colleagues reported their findings in the Jan. 2, 2014, online edition of the journal PLOS Pathogens.
An estimated 60 million people in the United States are infected with the toxoplasmosis parasite, but in most cases the infection produces flu-like symptoms or no symptoms at all. However, for people with immune system problems – such as those undergoing chemotherapy or people with AIDS – the disease can cause serious effects including lung problems, blurred vision and seizures. Also, infants born to mothers who are infected for the first time during or shortly before pregnancy are at risk for severe complications, miscarriages or stillbirths.
One of the most common routes to human infection is via cats, in particular their feces or litter. Eating undercooked meat from infected livestock can also result in human infection. Although there are anti-parasitic drugs available to treat acute episodes of toxoplasmosis, it's currently impossible to completely eliminate the parasite because it can switch from an active to a latent cyst form in the body. Since GCN5b is active during both acute and latent stages, the enzyme and its associating components are very promising candidates for drug targeting, Dr. Sullivan said. Because the transcription factors are plant-like proteins not found in humans, drugs targeting them would be much less likely to affect human proteins and cause adverse effects.
Researchers also use Toxoplasma as a model organism for the malaria parasite Plasmodium, meaning much of what is learned about Toxoplasma could lead to new treatments for a disease that struck an estimated 207 million people worldwide in 2012 and caused an estimated 627,000 deaths, most of them children. Dr. Sullivan noted that the malaria parasite also possesses a GCN5 enzyme, as well as the plant-like proteins.

Other investigators contributing to the research were Jiachen Wang, Stacy E. Dixon, Victoria Jeffers and Ting-Kai Liu of the Indiana University School of Medicine; Li-Min Ting, Matthew M. Croken, Myrasol Calloway and Kami Kim of the Albert Einstein College of Medicine, Bronx, NY, and Dominique Cannella and Mohamed Ali Hakimi of Universite Joseph Fourier, Grenoble, France.
The research was supported by grants from the National Institutes of Health: AI077502, AI087625, T32 GM007491 and AI092801. Additional support came from the following NIH-funded shared instrumentation grants: 1S10RR019352 and 1S10RR021056.

http://www.sciencedaily.com/releases/2014/01/140102133027.htm

Scientists Uncover Most Detailed Picture Yet of Muscular Dystrophy Defect Then Design Targeted New Drug Candidates

Scripps Florida scientists revealed a detailed image of the genetic defect that causes myotonic dystrophy type 2, then used that information to design a drug candidate to counteract the disease.

Scientists from The Scripps Research Institute have revealed an atomic-level view of a genetic defect that causes a form of muscular dystrophy, myotonic dystrophy type 2, and have used this information to design drug candidates with potential to counter those defects -- and reverse the disease.

"This the first time the structure of the RNA defect that causes this disease has been determined," said TSRI Associate Professor Matthew Disney, who led the study. "Based on these results, we designed compounds that, even in small amounts, significantly improve disease-associated defects in treated cells."

Myotonic dystrophy type 2 is a relatively rare form of muscular dystrophy that is somewhat milder than myotonic dystrophy type 1, the most common adult-onset form of the disease.

Both types of myotonic dystrophy are inherited disorders that involve progressive muscle wasting and weakness, and both are caused by a type of genetic defect known as a "RNA repeat expansion," a series of nucleotides repeated more times than normal in an individual's genetic code. The repeat binds to the protein MBNL1, rendering it inactive and resulting in RNA splicing abnormalities -- which lead to the disease.

Many other researchers had tried to find the atomic-level structure of the myotonic dystrophy 2 repeat, but had run into technical difficulties. In a technique called X-ray crystallography, which is used to find detailed structural information, scientists manipulate a molecule so that a crystal forms. This crystal is then placed in a beam of X-rays, which diffract when they strike the atoms in the crystal. Based on the pattern of diffraction, scientists can then reconstruct the shape of the original molecule.

Prior to the new research, which was published in an advance, online issue of the journal ACS Chemical Biology, scientists had not been able to crystallize the problematic RNA. The Scripps Florida team spent several years on the problem and succeeded in engineering the RNA to have crystal contacts in different positions. This allowed the RNA to be crystallized -- and its structure to be revealed.

Using information about the RNA's structure and movement, the scientists were able to design molecules to improve RNA function.

The new findings were confirmed using sophisticated computational models that show precisely how the small molecules interact with and alter the RNA structure over time. Those predictive models matched what the scientists found in the study -- that these new compounds bind to the repeat structure in a predictable and easily reproducible way, attacking the cause of the disease.

"We used a bottom-up approach, by first understanding how the small components of the RNA structure interact with small molecules," said Jessica Childs-Disney of TSRI, who was first author of the paper with Ilyas Yildirim of Northwestern University. "The fact that our compounds improve the defects shows that our unconventional approach works."

Jessica L. Childs-Disney, Ilyas Yildirim, HaJeung Park, Jeremy R. Lohman, Lirui Guan, Tuan Tran, Partha Sarkar, George C. Schatz, Matthew D. Disney. Structure of the Myotonic Dystrophy Type 2 RNA and Designed Small Molecules That Reduce Toxicity. ACS Chemical Biology, 2013; : 131216144058009 DOI: 10.1021/cb4007387

http://bit.ly/19OnoDf

A Missing Genetic Link in Human Evolution

Humans have multiple copies of a gene known as SRGAP2, which is thought to be involved in brain development. Chimps and orangutans have only one copy.

By: Emily Singer

About 8 million to 12 million years ago, the ancestor of great apes, including humans, underwent a dramatic genetic change. Small pieces of DNA replicated and spread across their resident chromosomes like dandelions across a lawn. But as these “dandelion seeds” dispersed, they carried some grass and daisy seeds — additional segments of DNA — along for the ride. This unusual pattern, repeated in different parts of the genome, is found only in great apes — bonobos, chimpanzees, gorillas and humans.

"I think it's a missing piece of human evolution," said Evan Eichler, a geneticist at the University of Washington, in Seattle. "My feeling is that these duplication blocks have been the substrate for the birth of new genes."

Over the past few years, scientists have begun to uncover the function of a handful of genes that reside in these regions; they seem to play an important role in the brain, linked to the growth of new cells, as well as brain size and development. In September, Eichler's team published a new technique for analyzing how these genes vary from person to person, which could shed more light on their function.

Much about the duplication process — and its implications — remains a mystery. Eichler and others don't know what spurred the initial rounds of duplications or how these regions, dubbed "core duplicons," reproduced and moved around the genome.

Despite the duplication-linked genes' potential importance in human evolution, most have not been extensively analyzed. The repetitive structure of the duplicated regions makes them particularly difficult to study using standard genetic approaches — the most efficient methods for sequencing DNA start by chopping up the genome, reading the sequence of the small chunks and then assembling those sections like one would a puzzle. Trying to assemble repetitive sections is like trying to put together a puzzle made of pieces with almost the same pattern.

"Because these regions are so complex, they are often ignored by conventional genome studies, and some regions still haven't been fully sequenced," said James Sikela, a geneticist at the University of Colorado School of Medicine in Aurora. "So not only are they important, they are unfortunately unexamined."

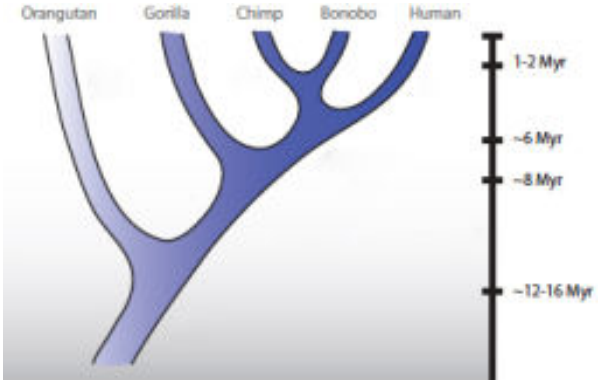
A Genetic Burst

In 2007, Eichler and his collaborators took on what seemed like a herculean task — looking comprehensively at the repetitive stretches of the human genome. Previous studies had characterized individual regions, but Eichler's team employed new computational techniques and comparative genomics — comparing DNA sequences from different species — to examine the entire genome. Mathematical analysis published in Nature Genetics that year revealed a set of "core duplicons" — stretches of DNA that appear over and over on a specific chromosome.

The core duplicon anchors an architecturally complex stretch of DNA, acting as the focal point for a larger block of duplications. Although scientists aren't sure how, the core seems to sweep up neighboring segments of DNA, duplicating the entire stretch and inserting the new copy into a new location on the chromosome. "Then it picks up again and duplicates some of the sequence around it and moves to another new location," Eichler said. "It seems to be an extremely unstable genetic element that provides a template for evolutionary change."

It is this process that appears to create new genes: When new duplications are inserted into the genome, they bring together two previously foreign pieces of DNA, which can lead to new functional components, such as proteins. This chaotic mix-and-match approach is different from the traditional model for the creation of a gene, in which an existing gene is duplicated and the copy is free to develop new functions.

"This mechanism appears to be seminal in our evolution," said Philip Hastings, a geneticist at Baylor College of Medicine, in Houston. "It's possible that we are the way we are largely because of this mechanism that generates dramatic episodes of chromosomal structural change."



The split between our great ape ancestors and other primates about 12 million years ago coincided with an outbreak of genetic duplication. **T. Marques-Bonet and E.E. Eichler, CSH Symp Quant Biol 2009**

The split between our great ape ancestors and other primates about 12 million years ago coincided with an outbreak of genetic duplication.

The pattern that the duplicons create seems to be unique to great apes, suggesting the mechanism itself is also unique to these species. In other animals, duplicated regions are lined up next to one another rather than dispersed along the chromosome.

The duplicated regions in great apes tend to be very active, meaning that their genes are turned on more often than genes in other areas and that they are producing more RNAs and proteins. That suggests these regions are functionally important.

Eichler and others have so far characterized the structure of only about half of the roughly dozen duplicon regions, each of which is unique to their resident chromosome. Most of the analysis to date has focused on the region's evolutionary history, including where the genes came from, how quickly they are evolving and how

they are related to one another. Eichler said his team has had a more difficult time understanding what they do, although he and others have managed to study the function of a handful of the duplication-linked genes.
What the scientists do know is that the genes appear to be important in evolution. According to Eichler, about a third of the gene families linked to core duplicons show signs of positive selection — meaning that they boost survival of their bearers and are passed on to the next generation, contributing to evolution — compared to about 5 percent of genes overall. Indeed, a gene on one of the cores, first described more than 10 years ago, appears to be the fastest-evolving human gene. However, Eichler cautioned, it's tricky to measure positive selection in these human or ape-specific genes because scientists have little to compare them to. To measure selection, scientists typically compare a gene in different species to examine how much it has changed.
Much like the rings of a tree trunk, the outer regions of core duplicons are the newest, arising from the latest round of replications. These regions also tend to be the most variable from person to person. They may therefore contribute to disease — extra or deleted copies of important genes or DNA segments are likely to affect how well cells or organs function. Eichler's team aims to use the new approaches described in their September paper in Nature Methods to track variation in duplicated regions, which could give insight into what these genes do. The researchers will look for variations in 30 human-specific genes within these zones in children with developmental disorders such as intellectual disability and epilepsy. If changes in a certain gene or region are reliably linked to specific traits, like a change in brain size, it gives hints to the gene's function.
Duplication-linked genes studied to date "seem to be important for cell proliferation, either speeding it up or slowing it down," Eichler said. "They are expressed in many tissues but highly in the brain, often in neurons, and often in areas of rapid cell division." In fact, some of the genes have been linked to cancer when they become overactive.

Bigger Brains

About 3.4 million years ago, a core duplicon on what is now called chromosome 1 in human descendants made one of its characteristic jumps, taking with it a copy of a gene known as SRGAP2. A million or so years later, it jumped again, creating a granddaughter of the original. No other mammals whose genomes have been examined to date have multiple copies of the gene, and the jumps coincide with a pivotal point in human evolution: As Australopithecus evolved into Homo habilis 2 to 3 million years ago, hominid brains were on their way to doubling in size.
The granddaughter gene, known as SRGAP2C, may be particularly important for the human brain. In 2012, Eichler's team and a group from the Scripps Research Institute near San Diego showed that SRGAP2C can influence how neurons migrate in a developing brain. By expressing the human version of the gene in mice, the Scripps team showed that SRGAP2C slows the maturation of certain brain cells and triggers the development of a denser array of neuronal structures called spines, which help form connections between brain cells. "I'm not saying it's responsible for the expansion of the human brain, but it might play a role in getting neural precursors [cells that give birth to neurons] to the right place," Eichler said.

Deciphering Duplications

Figuring out the function of human-specific genes will help uncover how they have contributed to our evolution. But this research presents a challenge. One of the standard approaches to deciphering what a gene does is to remove it in model organisms — mice, flies or worms — and see what goes wrong. But that's impossible if the animals don't have the gene in the first place. Genetically engineering a human version into mice, as researchers did for their experiment with the duplicated gene SRGAP2C, provides one alternative. But given that these genes are probably involved in brain development, it might be impossible to study their full repertoire in mice, which lack the wrinkled cortex characteristic of the human brain or the rich range of human behavior.

Evan Eichler, a geneticist at the University of Washington, in Seattle, and collaborators say one way around this issue is to study the genes in humans, looking for natural variation in the population and determining whether these differences are linked to specific disorders or cognitive abilities. In an unpublished study of SRGAP2C in nearly 3,000 people with intellectual disability, the researchers found five people who had lost it completely. Two of them have a smaller version of part of the brain called the orbitofrontal cortex, which is involved in functions such as decision-making. The numbers in the study aren't yet statistically significant, "but it's encouraging that we now have the ability to systematically probe these regions," Eichler said.
The SRGAP2 findings show how a human-specific genetic change led to changes in neurons. "That's what has been missing from the field," said Genevieve Konopka, a neuroscientist at the University of Texas Southwestern Medical Center, in Dallas. "People have identified unique changes in the human lineage, but they haven't really followed up on them in any functional manner."
Konopka said studies such as the SRGAP2 paper, which delve into the function of a gene, can help to clarify the role that human-specific genetic changes play in our development as a species. "Anytime you can show

something is unique in the human genome and how it modifies the biology, that is a unique and important thing to do," she said.

Double-Edged DNA

Core duplicons represent something of an evolutionary gamble. The same genetic instability that enables the creation of new genes may also destroy or delete existing ones or create too many copies, perhaps explaining some of our susceptibility to disease. Parts of the duplicated blocks have been tied to a number of brain disorders, including intellectual disability, schizophrenia and epilepsy.

When researchers searched for genetic regions that had been duplicated more often in humans than other great apes, a short stretch of DNA called DUF1220 caught their attention. DUF1220 has duplicated in humans more rapidly than any other protein-coding region of the genome and has been linked to brain size, suggesting it contributed to the evolution of the human brain, and disease, suggesting that either too little or too much of this gene segment can be harmful.

DUF1220 is not a gene itself, but rather a genetic component found in a family of genes — individual genes in the family carry 5 to 50 copies. Overall, humans have more than 250 copies of DUF1220, other great apes 90 to 125, monkeys about 30, and non-primates fewer than 10. In 2012, Sikela and collaborators used special tools to count the number of copies in healthy people and discovered that the more copies someone has, the larger their gray matter, the portion of the brain made up of nerve cells.

Although DUF repeats appear to provide an evolutionary advantage in terms of brain size, they may have harmful effects as well. DUF duplications are concentrated in an unstable region of chromosome 1 known as 1q21. Deletion or duplication of this region has been linked to a number of disorders, including autism, schizophrenia, heart disease and microcephaly or macrocephaly, when someone's brain is abnormally small or large, respectively. Sikela's team found that of all the sequences in the 1q21 region, the number of DUF1220 repeats is the most tightly linked to brain size in people with microcephaly. "The big increase in copy number in the human lineage has come at severe cost," Sikela said.

According to Sikela, the additional copies render the region unstable, making it more likely that genes in the area can be further deleted or duplicated. "It's the price we have to pay for the benefit of DUF, a trade-off given to us by evolution," he said.

Uncharted Territory

While evidence that core duplicons are a driving force behind human evolution is growing, many questions remain. For example, it's unclear what triggered the creation of these cores or how they spread. One popular theory points to a class of viruses known as retroviruses, which can insert DNA into their host's genome that is then passed from generation to generation. Perhaps a retrovirus was responsible for the initial core duplicons. A significant portion of our genome is known to arise from viruses that have left the imprint of their DNA but are no longer active in our cells. "My favorite hypothesis is that at a key point in great ape evolution, there was a burst in retroviral activity," said Edward Hollox, a geneticist at the University of Leicester, in Great Britain.

Human Variation

Human-specific genes are both the newest additions to the duplicon blocks and the most variable. For example, humans carry different numbers of copies of a gene known as TBC1D3. Europeans tend to have few copies, and Africans from certain areas have many, with a tenfold difference among human populations. By altering gene activity in human cell lines, Philip Stahl, a cell biologist at the Washington University School of Medicine, and his collaborators have shown that TBC1D3 is involved in cell growth and proliferation. "Now we know the rough outlines of what [TBC1D3] is doing, but we don't know why it's so variable," Stahl said. "Does it relate to nutrition? Reproduction? Brain development? If we can figure out what it's doing, it would be a very interesting evolutionary story."

Intriguingly, the core duplicons once so active in our genomes seem to have slowed or stopped hopping. Despite evidence for several spurts in the great ape evolutionary history, scientists have yet to find duplications that occurred in the past few million years. Eichler's team has searched for such cases, finding some younger duplications that the scientists think are specific to humans and distinct from Neanderthals. "But they are the exception rather than the rule," he said.

It's not yet clear how big a role core duplicons played in the formation of our species. "It's very difficult to provide an overarching theory of great ape evolution," Hollox said. "Undoubtedly, the core duplicon hypothesis is part of it. To what extent it contributes, the jury is still out."

Research suggests other factors such as gene regulation — when and where specific genes are turned on — play a part as well. But changes in gene regulation are probably not sufficient to explain all the differences between primates and humans. "I know there are going to be multiple paths to brain evolution," Konopka said, adding that core duplicons are "probably one of the main players."

http://www.medscape.com/viewarticle/818612?src=rss

Herpes Zoster Linked Again to Increased Stroke, MI

More evidence links herpes zoster (HZ) with vascular disease events

Pauline Anderson

A new study shows HZ to be an independent risk factor for transient ischemic attack (TIA) and myocardial infarction (MI) in all adults up to 24 years after an acute episode, and for stroke as well, although only among people whose HZ occurred when they were under 40 years of age.

"The messages from this study are that people who are found to have risk factors for vascular disease should be vaccinated to prevent herpes zoster, which in itself is a severe disease, and that people who have herpes zoster may be at increased risk for stroke," said lead study author Judith Breuer, MD, professor, virology, University College, London, United Kingdom (UK).

It's not clear yet whether the vaccine will prevent stroke, "although we think that it might," said Dr. Breuer.

The study is published online January 2 in Neurology. The research was supported by the National Institute for Health Research, University College London Hospitals Biomedical Research Centre, and Sanofi Pasteur MSD, the European maker of the herpes zoster vaccine.

No Stroke Signal

Researchers used The Health Improvement Network (THIN) primary care database, which includes information on more than 3 million patients and is representative of the UK population. The analysis included 106,601 cases of HZ as well as 213,202 controls (2 for every case) who did not have a record of HZ and were matched for age, sex, and general practice.

To reduce miscoding, the study excluded recurrent HZ, which can be confused with herpes simplex.

After adjustment for sex, age, obesity, smoking status, history of elevated cholesterol, hypertension, diabetes, ischemic heart disease, atrial fibrillation, intermittent arterial claudication, carotid stenosis, and valvular heart disease, the study showed a 15% increased risk for TIA and a 10% increased risk for MI associated with HZ.

TIA itself was a risk factor for stroke, increasing the incidence 7-fold compared with age-matched controls (14.32% vs 2.07%).

However, the analysis showed no significant difference in stroke risk for cases compared with controls.

"We found an association for MI and for TIA, which is a form of stroke, but we didn't find a signal for stroke; it was slightly more common in people who had herpes zoster, but not significantly so," said Dr. Breuer.

Table 1. Risk for Vascular Events With Herpes Zoster, Adjusted for Vascular Risk Factors

Endpoint	Adjusted Hazard Ratio (95% Confidence Interval)	*P* Value
TIA	*1.15 (1.09 - 1.21)*	*<.05*
MI	*1.10 (1.05 - 1.16)*	*<.05*
Stroke	*1.02 (0.98 - 1.07)*	*NS*

NS = not significant.

This lack of statistical association may have been due to the fact that the study looked at events occurring more than a year after the acute HZ episode. Dr. Breuer pointed to another study from Denmark published this past summer on July 17 that looked at the "immediate aftermath" and did find that herpes zoster was a short-term risk factor for stroke, although it looked at stroke and TIA together.

However, stroke, as well as TIA and MI, was significantly increased in those whose HZ occurred when they were younger adults, between ages 18 and 40 years.

Table 2. Risk for Vascular Events With Herpes Zoster Occurring at Ages 18 to 40 Years Predisposing Conditions

Endpoint	*Adjusted Hazard Ratio (95% Confidence Interval)*	*P Value*
TIA	*2.42 (1.34 - 4.36)*	*<.05*
MI	*1.49 (1.04 - 2.15)*	*<.05*
Stroke	*1.74 (1.13 - 2.66)*	*<.05*

Irrespective of age, conditions that predispose to vascular disease, including smoking and obesity, were significantly more common in patients with HZ, although some of this could be due to better recording of risk factors in patients who present with HZ, said the authors.

General practitioners aren't required to specify the location of the HZ for the THIN database. According to the authors, this could explain the 10-fold lower-than-expected percentage of HZ ophthalmicus cases in this study (1.6%) compared with previous UK studies.

Another potential study limitation was that GP recordings of transient neurologic symptoms mimicking TIA may have led to overestimates of the incidence of TIA after HZ occurrence. However, records of TIA in the THIN database mostly reflected typical disease, said the authors.

The prevalence of stroke in this study (2.5%) is higher than in other recent studies in the UK population. The incidence of stroke has decreased by more than 30% in the past 10 years in the UK, partly because of screening initiatives for vascular risk factors in persons older than 45 years. The incidence of stroke has remained unchanged, though, among those aged 45 years or younger, in whom such policies have not been implemented.

The authors offer several potential explanations of how HZ may increase the risk for cerebrovascular disease. It's possible, they write, that the circulating virus is able to infect arterial tissue, particularly when damaged by preexisting risk factors, which could contribute to prolonged inflammation with increased vascular insult.
"We think that the virus reactivates repeatedly and occasionally causes zoster," said Dr. Breuer. "Our hypothesis is that some people are more likely to have reactivation than others, that there's potentially a genetic predisposition or an underlying disease like diabetes, or immunosuppression that may cause reactivation."
Dr. Breuer called the virus–vascular disease link a "vicious cycle." "Having risk factors for vascular disease predisposes you to herpes zoster, and herpes zoster, in turn, adds to your risk of actually having a stroke or a vascular event," she said.
A vaccine that is licensed in the UK for people over age 70 years (and over age 60 in the United States) prevents about 50% of herpes zoster, which in itself "is a bad disease," said Dr. Breuer. "It may be worth considering vaccinating people who are found to have risk factors for stroke or vascular disease — high cholesterol, high blood pressure, diabetes, et cetera — to prevent herpes zoster."
This applies to some younger adults because they, too, can have risk factors for vascular events, she said. Patients presenting with HZ, especially younger patients, should be screened for vascular risk factors, she added.

Be "Mindful"

Reached for a comment, Glenn Graham, MD, PhD, deputy national director for neurology, Department of Veterans Affairs, said the study's most significant finding was the association between herpes zoster and stroke, as well as MI and TIA, in people who had HZ under age 40 years, although this could just be because strokes are so uncommon in this age group.
Dr. Graham found it curious that all but 1 vascular risk factor was significantly more common in patients who had herpes zoster. "I know the authors tried to correct for this, but I find it a little puzzling that every single one of them — hypertension, diabetes, heart disease, cholesterol, smoking, obesity, et cetera — was more common in cases than in controls, and statistically significantly so, with the exception of carotid stenosis."
It's important to be "mindful" that the study is case-controlled, noted Dr. Graham. "It shows a correlation, but doesn't show why this is true, and it can't necessarily definitely prove cause and effect. Of course, you can't go and give people shingles prospectively and see if they go on and have stroke."
Dr. Graham speculated that the cause of the association between herpes zoster and vascular events goes beyond inflammation. "I'm not a virologist, but my guess is that it's more than just a general inflammatory reaction because then you'd see it equivalently in people of different ages. It points to me that it has something to do with the involvement in the vessel itself."
That the zoster vaccine might reduce the risk for vascular events "seems to be a logical and actionable conclusion" of the study, said Dr. Graham. Herpes zoster itself is unpleasant and painful, and it affects quality of life. Reducing vascular risk in terms of TIA and MI "might be an additional reason to be immunized," he said. However, he added that it will take further research to prove that the vaccine actually does decrease vascular events. "I don't know that we can just assume that, but it's something to think about."
The research was supported by the National Institute for Health Research, University College London Hospitals Biomedical Research Centre, and Sanofi Pasteur MSD, the European maker of the shingles vaccine. Dr. Breuer has received funding from SPMSD for the VZV Identification Programme, which undertakes genotyping of varicella-zoster virus (VZV) from vaccine adverse events. She also heads the VZV reference laboratory, which has genotyped VZV for Glaxo/SmithKline.
Neurology. Published online January 2, 2014. ***Abstract***

http://www.sciencedaily.com/releases/2014/01/140102112334.htm?

Scientists Explain Age-Related Obesity: Brown Fat Fails

As we age the thermogenic activity of brown fat is reduced

As most people resolve themselves to lose weight this New Year, here's why it seems to get easier and easier to pack on unwanted pounds: New research published in the January 2014 issue of The FASEB Journal, shows that as we age, the thermogenic activity of brown fat is reduced. Brown fat is a "good" fat located in the backs of our necks that helps burn "bad" white fat around our bellies. Additionally, the researchers also discovered a possible metabolic on/off switch that could reactivate brown fat.
"Future studies on how PAF/PAFR signaling controls UCP1 levels through beta3-AR production in the BAT of animals and humans may reveal new therapeutic targets to treat metabolic disorders associated with obesity," said Junko Sugatani, Ph.D., a researcher involved in the work from the Department of Pharmaco-Biochemistry at the School of Pharmaceutical Sciences at the University of Shizuoka in Shizuoka, Japan.
To make this discovery, scientists analyzed two groups of mice. The first group had the platelet-activating factor receptors (PAFR) gene knocked out. The second group was normal. PAFR-deficient mice developed a

more severe obese state characterized by higher body and epididymal fat mass with age than that of wild-type littermates. Findings from the PAFR-KO genetic model reveal that PAFR-deficiency causes brown adipose tissue (BAT) dysfunction, which converges to induce the development of obesity, due to impaired thermogenic activity of BAT. This study could elucidate the molecular mechanism underlying the PAF/PAF receptor-mediated anti-obesity, leading to the development of new targets for the treatment of obesity and related disorders, such as diabetes, high blood pressure, heart disease, cancer, infertility and ulcers.
"A common complaint is that older people have to work twice as hard with their diets and exercise to get half of the results of younger people," said Gerald Weissmann, M.D., Editor-in-Chief of The FASEB Journal. "Now we have a much better idea why this is the case: Our brown fat stops working as we age. Unfortunately, until a way to turn it back on is developed, we'll have to be prepared to eat more salads and lean proteins, while logging more miles on the treadmill than our younger counterparts."
J. Sugatani, S. Sadamitsu, M. Yamaguchi, Y. Yamazaki, R. Higa, Y. Hattori, T. Uchida, A. Ikari, W. Sugiyama, T. Watanabe, S. Ishii, M. Miwa, T. Shimizu. Antiobese function of platelet-activating factor: increased adiposity in platelet-activating factor receptor-deficient mice with age. The FASEB Journal, 2013; DOI: 10.1096/fj.13-233262

http://www.sciencedaily.com/releases/2014/01/140102123401.htm?

More Evidence Suggests Type 2 Diabetes Is Inflammatory Disease

As people's waistlines increase, so does the incidence of type 2 diabetes.

Now scientists have a better understanding of exactly what happens in the body that leads up to type 2 diabetes, and what likely causes some of the complications related to the disease. Specifically, scientists from Denmark have found that in mice, macrophages, a specific type of immune cell, invade the diabetic pancreatic tissue during the early stages of the disease. Then, these inflammatory cells produce a large amount of pro-inflammatory proteins, called cytokines, which directly contribute to the elimination of insulin-producing beta cells in the pancreas, resulting in diabetes. This discovery was published in the January 2014 issue of the Journal of Leukocyte Biology.
"The study may provide novel insights allowing development of tailor-made anti-inflammatory based therapies reducing the burden of type 2 patients," said Alexander Rosendahl, Ph.D., a researcher involved in the work from the Department of Diabetes Complication Biology at Novo Nordisk A/S, in Malov, Denmark. "These novel treatments may prove to complement existing therapies such as insulin and GLP-1 analogues."
To make their discovery scientists compared obese mice that spontaneously developed diabetes to healthy mice. The mice were followed from a young age when the obese mice only showed early diabetes, to an age where they displayed systemic complication in multiple organs. Presence of macrophages around the beta cells in the pancreas and in the spleen was evaluated by state-of-the-art flow cytometric technology allowing evaluation on a single cell level. At both the early and late stages, the diabetic mice showed significant modulations compared to healthy mice.
"The more researchers learn about obesity and type 2 diabetes, the more it appears that inflammation plays a critical role in the progression and severity of these conditions," said John Wherry, Ph.D., Deputy Editor of the Journal of Leukocyte Biology. "This study sheds light on how a key inflammatory cell is connected to disease and what might go wrong when someone has type 2 diabetes. The knowledge gained from such studies offers hope that new immune-based therapies could be developed to mitigate the severity of such dieseases."
H. Cucak, L. G. Grunnet, A. Rosendahl. Accumulation of M1-like macrophages in type 2 diabetic islets is followed by a systemic shift in macrophage polarization. Journal of Leukocyte Biology, 2013; DOI: 10.1189/jlb.0213075

http://www.bbc.co.uk/news/world-asia-25550419

Quest to grow human organs inside pigs in Japan

I am standing in a fully functioning operating theatre. A surgeon and team of specialists in green smocks are preparing to operate. But I'm not in a hospital. I am on a farm deep in the Japanese countryside.

By Rupert Wingfield-Hayes BBC News, Ibaraki prefecture, Japan

On the gurney about to undergo the knife is a six-month-old female pig. Standing over her, scalpel in hand, is Professor Nagashima. He carefully cuts open her abdomen and pulls out her uterus.
To me, it looks more like intestines - but he assures me this is what a pig's uterus looks like. Then with a syringe and a catheter, he begins to inject 40 embryos into the uterus.
The unconscious pig is about to become a surrogate mother - and the embryos she is now carrying are very special. They are chimeric, that is, they carry genetic material from two different species.
In a nearby shed Prof Nagashima takes me to see his most prized possessions. For this I have to change into full smock, hat, boots and mask. It is not to protect me, it is to protect the occupants - fully grown chimeric pigs.

'Switched off'

Halfway down the long white shed, I am introduced to pig number 29 - a large, hairy male with jutting tusks. Number 29 is a white pig, but he is covered in coarse, black hair. More importantly, inside, he has the pancreas of a black pig.

How is that possible? It starts off by making what Prof Nagashima calls "a-pancreatic" embryos. Inside the white pig embryo, the gene that carries the instructions for developing the animal's pancreas has been "switched off". The Japanese team then introduce stem cells from a black pig into the embryo. What they have discovered is that as the pig develops, it will be normal except for its pancreas, which will be genetically a black pig's.

But this is just the first step.

In a lab at Tokyo University Professor Hiro Nakauchi is taking the next one, and this is even more astonishing. Prof Nakauchi takes skin cells from an adult brown rat. He then uses gene manipulation to change these adult skin cells into what are called "iPS" cells. The amazing thing about induced pluripotent stem cells is that they have many of the same characteristics as embryonic stem cells. In other words, they can develop into any part of the animal's body. IPS cells were first created in 2006 by Japanese medical researcher Dr Shinya Yamanaka. In 2012, he won the Nobel Prize for his discovery. In his lab, Prof Nakauchi has succeeded in using these iPS cells to grow a brown rat pancreas inside a white mouse. So why is all of this so important?

The ultimate objective of this research is to get human organs to grow inside pigs. By itself, that would be a massive breakthrough for science. But what Prof Nakauchi is trying to achieve goes further. He is hoping to develop a technique to take skin cells from a human adult and change them in to iPS cells. Those iPS cells can then be injected into a pig embryo.

Island of Dr Moreau

The result, he hopes, will be a pig with a human pancreas or kidney or liver, or maybe even a human heart. Not only that, the organ would be genetically identical to the human from which the skin cells were taken.

This is one of the holy grails of medical research: the ability to reproduce a human organ that is genetically identical to the person who needs it. It could mean an end to donor waiting lists, and an end to problems of organ rejection.

But there are many potential obstacles ahead. The first is that pigs and humans are only distantly related. It is one thing to get a black pig pancreas to grow inside a white pig, quite another to get a human pancreas to do the same. Prof Nakauchi is confident it can be done. He thinks it will take at least five years, but admits it could take much longer.

The other problem is getting approval. In Japan, it is illegal to make human-animal hybrids. Prof Nakauchi is pushing for a change in the law. But if that does not happen, he may have to move his research to America.

There are many here in Japan who oppose the idea of human-animal hybrids. Animal rights activists object to the idea of pigs, sheep or goats being used as human organ factories. Many more feel uncomfortable about the idea of pig-human hybrids. It brings to mind HG Wells' sci-fi classic, The Island of Dr Moreau.

Prof Nakauchi said his research is completely different. The pigs would still be pigs; they would just be carrying some human tissue inside them. He said there has always been resistance to new scientific breakthroughs. He points to widespread objections to In Vitro Fertilisation (IVF) when it was invented in Britain the 1970s. Today, IVF is used across the world, and no one thinks it is strange or unethical.

Whatever the ethical debate, for the hundreds of thousands of people around the world waiting for a new kidney or liver, the prospect of being able to make one to order is an astonishing thought.

http://www.eurekalert.org/pub_releases/2014-01/uoef-foc010314.php

Fear of childbirth predicts postpartum depression

Expectant women with prenatally diagnosed fear of childbirth are at an increased risk of postpartum depression, according to a study of over 500,000 mothers in Finland.

Women with a history of depression are at the highest risk of postpartum depression. The fact that fear of childbirth puts women without a history of depression at an approximately three times higher risk of postpartum depression is a new observation which may help health care professionals in recognising postpartum depression. The results were published recently in BMJ Open.

In Finland, postpartum depression was diagnosed in 0.3% of all mothers delivering a singleton birth in 2002–2010. The risk of postpartum depression is highest after the first childbirth. Postpartum depression was diagnosed in 5.3% of women with a history of depression, while approximately one-third of women experiencing postpartum depression had no history of depression. In these women, physician-diagnosed fear of childbirth during pregnancy was discovered to nearly triple the risk of postpartum depression. Other risk factors included Caesarean section, pre-term birth and major congenital anomaly.

Giving birth is a powerful experience both physically and mentally, and a variety of emotions are present. As much as 50–80% of women suffer from baby blues after birth, and some women develop postpartum depression the severity of which may range from minor symptoms to psychotic depression. The consequences of postpartum depression may be severe. For example, postpartum depression may affect the mother's abilities and skills to engage in delicate interaction with the child, and thus impair the development of an attachment relationship – possibly affecting the child's later development and well-being.
Women with a history of depression are known to be at a higher risk of postpartum depression, but it has been difficult to predict the risk of women not belonging to this risk group. According to the researchers, the observed link between fear of childbirth and postpartum depression may help health care professionals in recognising postpartum depression. The study provides strong evidence, as it relies on diagnosis-based data on postpartum depression.

The study was carried out in cooperation between the University of Eastern Finland, Kuopio University Hospital, the Finnish National Institute for Health and Welfare, Copenhagen University Hospital, the Nordic School of Public Health in Gothenburg, Sweden, and Emory University in the USA. The study used data from the Finnish medical birth register, the Finnish congenital malformations register and the Finnish hospital discharge register, which are maintained by the Finnish National Institute for Health and Welfare. The study examined all singleton births in Finland in 2002–2010, a total of 511,422 births.

Fear of childbirth predicts postpartum depression: a population-based analysis of 511 422 singleton births in Finland. Sari Räisänen, Soili M Lehto, Henriette Svarre Nielsen, Mika Gissler, Michael R Kramer, Seppo Heinonen. BMJ Open 2013;3:e004047 doi:10.1136/bmjopen-2013-004047

http://phys.org/news/2014-01-tomb-ancient-egyptian-beer-brewer.html

Tomb of ancient Egyptian beer brewer unearthed

Egypt's minister of antiquities says Japanese archeologists have unearthed the tomb of an ancient beer brewer in the city of Luxor that is more than 3,000 years old.

AP - Mohammed Ibrahim says Friday the tomb dates back to the Ramesside period and belongs to the chief "maker of beer for gods of the dead" who was also the head of a warehouse. He added that the walls of the tomb's chambers contain "fabulous designs and colors, reflecting details of daily life ... along with their religious rituals."
The head of the Japanese team, Jiro Kondo, says the tomb was discovered during work near another tomb belonging to a statesmen under Amenhotep III, grandfather of the famed boy-pharaoh Tutankhamun.

This image released by the Supreme Council of Antiquities shows colored inscriptions on a newly discovered tomb in Luxor, Egypt, Friday, Jan. 3, 2014. Egypt's minister of antiquities said Japanese archeologists have unearthed the tomb of an ancient beer brewer in the city of Luxor that is more than 3,000 years old. **AP Photo/Supreme Council of Antiquities**

http://bit.ly/1ewjeD2

Giraffe Was on Menu in Pompeii Restaurants

Giraffe was on the menu in Pompeii's standard restaurants, says a new research into a non-elite section of the ancient Roman city buried by Mount Vesuvius' eruption in 79 A.D.

Jan 3, 2014 01:03 PM ET // by Rossella Lorenzi

The study, which will be presented on Jan. 4 at the Archaeological Institute of America and American Philological Association Joint Annual Meeting in Chicago, draws on a multi-year excavation in a forgotten area inside one of the busiest gates of Pompeii, the Porta Stabia.
Steven Ellis, a University of Cincinnati associate professor of classics, said his team has spent more than a decade researching the life of the middle and lower classes in Pompeii, including the foods they ate.
The excavated area covered 10 separate building plots, comprising homes and a total of 20 shop fronts, most of which served food and drink. The researchers dug out drains as well as 10 latrines and cesspits, and analyzed residues such as excrement and food waste from kitchens.

It emerged that the poor ate rather well in Pompeii, living on a diet of inexpensive and widely available grains, fruits, nuts, olives, lentils, local fish and chicken eggs. But they also ate more expensive meat, shellfish, sea urchin and salted fish from Spain — not to mention delicacies such as giraffe meat.
"The traditional vision of some mass of hapless lemmings — scrounging for whatever they can pinch from the side of a street, or huddled around a bowl of gruel — needs to be replaced by a higher fare and standard of living, at least for the urbanites in Pompeii," Ellis said in a statement.
Waste from neighboring drains turned up variety of foods which included exotic and imported spices, some from as far away as Indonesia, revealing a socioeconomic distinction between neighbors.
But it was the butchered leg joint of the giraffe that intrigued the archaeologists.
Representing the height of exotic food, it is also "the only giraffe bone ever recorded from an archaeological excavation in Roman Italy," Ellis said. "How part of the animal, butchered, came to be a kitchen scrap in a seemingly standard Pompeian restaurant not only speaks to long-distance trade in exotic and wild animals, but also something of the richness, variety and range of a non-elite diet," he added.

http://nyti.ms/1eedm0U

You Can't Take It With You, but You Still Want More

All work and no play may just be a result of "mindless accumulation."

By MATT RICHTEL

So say scholars behind research, published in the journal Psychological Science in June, that shows a deeply rooted instinct to earn more than can possibly be consumed, even when this imbalance makes us unhappy.
Given how many people struggle to make ends meet, this may seem a frivolous problem. Nonetheless, the researchers note that productivity rates have risen, which theoretically lets many people be just as comfortable as previous generations while working less. Yet they choose not to.
To explore the powerful lure of material accumulation, the researchers constructed an experiment in two phases. In the first phase, subjects sat for five minutes in front of a computer wearing a headset, and had the choice of listening to pleasant music or to obnoxious-sounding white noise.
They were told they could earn pieces of Dove chocolate when they listened to the white noise a certain number of times. Some participants had to listen fewer times to get each piece of chocolate, making them "high earners"; some had to listen more times, making them "low earners."
All were told that there would be a second phase to the experiment, also lasting five minutes, in which they could eat the chocolate they earned. But they were told they would forfeit any chocolate they couldn't consume, and they were asked how much they expected to be able to eat.
On average, people in the high-earner group predicted that they could consume 3.75 chocolates.
But when it came time to "earn" chocolates, they accumulated well beyond their estimate. On average, they listened to enough white noise to earn 10.74 chocolates. Then they actually ate less than half of that amount. In other words, they subjected themselves to harsh noise to earn more than they could consume, or predicted they could consume.
"We introduce the concept of 'mindless accumulation,' " said one of the paper's authors, Christopher Hsee, a professor of behavioral science and marketing at the University of Chicago Booth School of Business. "It's a waste of effort," he added, "But once people are in action, they can't stop."
The impulse seemed less pronounced, even mixed, with the low earners. They earned less chocolate than they predicted they could eat. But the high earners and the low earners listened to about the same amount of obnoxious noise in the five-minute period, which Dr. Hsee said strongly suggested that both groups were driven by the same thing: not by how much they need, but by how much work they could withstand.
How applicable is this to the real world, where people earn money, not chocolate, and can't predict how long life will last, or whether they will need resources to prepare for a calamity? Hard to say, but the study does show that even when people know clear boundaries — that they absolutely can't take the candy with them when they go — they still earn more than they can possibly use.
Michael Norton, an associate professor at the Harvard Business School who is familiar with the field, said the study's implications were "enormous" in part because they can enlighten people to an unconscious motivation that leads to shortsighted, even unhappy choices.
Still, he said, choosing happiness or leisure over earning is challenging, in part because accumulation of money — or candy — is easier to measure than, say, happiness. "You can count Hershey's Kisses," Dr. Norton said. Being an involved parent or partner is not so quantifiable. "Most of the things that truly make us happy in life are harder to count," he said.

http://bit.ly/KvgNIe

Supervolcanoes Erupt by Their Own Rules

Mega-eruptions and smaller volcanoes are triggered by different mechanisms

By Alexandra Witze and Nature magazine | Sunday, January 5, 2014

Huge volcanic blasts occur less frequently than scientists would expect, and now volcanologists think they can explain why: super-eruptions and smaller eruptions are triggered by fundamentally different processes.

Small volcanoes, such as Italy's Stromboli, erupt when molten rock rises from deep within Earth and then stalls in an underground chamber until enough pressure builds to blast it out to the surface. But the magma chambers of giant volcanoes—such as the one that erupted 2 million years ago beneath what is now Yellowstone National Park in the western U.S.—are too large for pressure from magma squirts to cause an eruption.

Instead, the molten rock accumulates until its sheer buoyancy creates a different kind of stress, one that cracks open the top of the chamber and starts an eruption, researchers report1.

"Essentially we identify two different trigger mechanisms for eruptions—one for small ones up to about 500 cubic kilometers of magma, and one where we can generate super-eruptions," says Luca Caricchi, a volcanologist at the University of Geneva in Switzerland.

Caricchi and his colleagues describe the scenario today in Nature Geoscience (Scientific American is part of Nature Publishing Group). Big eruptions are less common in the geological record than scientists would expect if they were to simply extrapolate from the number of small eruptions that go off over time. That difference could be due to a sampling bias2 or to a fundamental difference between big and small eruptions.

Caricchi and his team used modeling and simulations to study the many factors that go into an eruption, from the heat of rising magma to the forces required to crack the top of a chamber. For small volcanoes, the scientists confirmed that the pressure of magma rising from below was enough to trigger an eruption. "It's like blowing inside a little balloon—if you blow fast enough you can make it explode," says Caricchi.

But adding magma to a much larger chamber would be like blowing fruitlessly into a hot-air passenger balloon. Instead, a supervolcano accumulates a huge amount of magma, which is less dense than the surrounding rock and hence more buoyant. At some threshold, Caricchi says, there is enough magma in the chamber for its buoyancy to crack the rock above it and trigger an eruption.

The idea is bolstered by a laboratory study, also published today in Nature Geoscience4. A team led by geoscientists Wim Malfait and Carmen Sanchez-Valle, of ETH Zurich in Switzerland, measured the density of molten rock chemically similar to that found at many volcanoes. The scientists used the European Synchrotron Radiation Facility in Grenoble, France, to re-create the high pressures and temperatures found inside Earth. From the density measurements they could determine the magma's buoyancy. "The bigger a magma chamber gets, the more buoyancy will start to play in," says Malfait.

Caricchi and his team have also worked out how big a magma chamber could theoretically get. The maximum size for an unerupted chamber of magma depends on a balance between its thickness and its horizontal extent: a chamber that is too thick will erupt, and a chamber that is too wide will start to cool and crystallize at its edges. The biggest chamber possible would be about 90 kilometers across and contain about 35,000 cubic kilometers of magma, Caricchi says. That's seven times the amount of magma spewed out during the largest eruption known—from the La Garita caldera 28 million years ago in what is now Colorado.

http://www.bbc.co.uk/news/health-25592214

Asthma: Altering diet may ease symptoms

Fruits, vegetables and whole-grains might be an unlikely treatment for asthma according to animal studies.

Tests on mice, published in the journal Nature Medicine, showed that a high-fibre diet could reduce inflammation in the lungs. The extra fibre changed the nutrients being absorbed from the gut, which in turn altered the immune system. The researchers argue the shift to processed foods may explain why more people are developing asthma.

The airways are more sensitive to irritation and more likely to become inflamed in people with asthma. It leads to a narrowing of the airways that make it harder to breathe. However, a possible solution may lie in another organ, the gut, and the bacteria which live there. The cells of the human body are vastly outnumbered by the trillions of microbes that live in and on it. There is growing evidence that these bacteria have a significant impact on health.

Gut bug fuel

A team at the University of Lausanne in Switzerland showed that the high and low fibre diets altered the types of bacteria living in the guts of the mice. Bacteria which can munch on soluble fibre, the type found in fruit and vegetables, flourished on the high-fibre diet and they in turn produced more short-chain fatty acids - a type of

fat, which is absorbed into the blood. The scientists said these fatty acids acted as signals to the immune system and resulted in the lungs being more resistant to irritation.
The opposite happened in low-fibre diets and the mice became more vulnerable to asthma. Their report argued that a dietary shift away from fibre in favour of processed foods may be involved in rising levels of asthma.
It said: "In recent decades, there has been a well-documented increase in the incidence of allergic asthma in developed countries and coincident with this increase have been changes in diet, including reduced consumption of fibre."

Human treatment?

One of the researchers Dr Benjamin Marsland said some of the differences caused by high-fibre diets have already been observed in people by comparing diets in Europe and Burkina Faso. He told the BBC: "There's a very high probability it works in humans, the basic principle of fibre being converted to short-chain fatty acids is known. "But we don't know what amount of fibre would be needed and the concentrations of short-chain fatty acids required might be different. "It is early days, but the implications could be far reaching."
The team in Lausanne are also investigating the role of diet in long-term lung inflammation such as COPD, which is set to become the world's third biggest killer. An alternative to tweaking diets is giving the purified fatty acids themselves as a dietary supplement. This worked in mice, but Dr Marsland warns there "certainly needs to be more work" before this is suggested in people.

http://www.computerworld.com/s/article/9244884/The_first_3D_printed_organ_a_liver_is_expected_in_2014

The first 3D printed organ -- a liver -- is expected in 2014

Printed tissue could vastly improve drug testing

Lucas Mearian

Computerworld -Approximately 18 people die every day waiting for an organ transplant. But that may change someday sooner than you think -- thanks to 3D printing.
Advances in the 3D printing of human tissue have moved fast enough that San Diego-based bio-printing company Organovo now expects to unveil the world's first printed organ -- a human liver -- next year.
Like other forms of 3D printing, bio-printing lays down layer after layer of material -- in this case, live cells -- to form a solid physical entity -- in this case, human tissue. The major stumbling block in creating tissue continues to be manufacturing the vascular system needed to provide it with life-sustaining oxygen and nutrients. Living cells may literally die before the tissue gets off the printer table.
Organovo, however, said it has overcome that vascular issue to a degree. "We have achieved thicknesses of greater than 500 microns, and have maintained liver tissue in a fully functional state with native phenotypic behavior for at least 40 days," said Mike Renard, Organovo's executive vice president of commercial operations.
A micron is one-millionth of a meter. To better understand the scale Renard is describing, think of it this way: A sheet of printer paper is 100 microns thick. So the tissue Organovo has printed is the thickness of five sheets of paper stacked on top of each other.
Printing hepatocytes -- the cells that make up most liver tissue -- isn't enough, however. There are multiple types of cells with different functions in tissue that must be combined to create a living human organ.
Organovo's researchers were able to bring together fibroblasts and endothelial cells, which perform the function of developing tiny vascular networks, allowing the company to achieve thick tissue with good cell viability, Renard said.
The liver tissue model that Organovo plans to release next year is for research use only and will be used in the laboratory for medical studies and drug research. That's important in its own right: Developing a new drug costs, on average, $1.2 billion and takes 12 years.
Organovo has as yet not released any information on possible future implantable organs. Any such initiative would have to undergo rigorous government review before being approved for clinical purposes.
Still, the creation of a viable liver is a watershed moment for the bio-printing industry and medicine because it proves 3D printed tissue can be kept alive long enough to test the effects of drugs on it or implant it in a human body where it can further develop. "It is too early to speculate on the breadth of applications that tissue engineering will ultimately deliver or on the efficacy that will be achieved," Renard said.
That question, Renard said, can only be answered through continued successful tissue development and the completion of clinical trials, followed by a review by the Food and Drug Administration (FDA) -- a process that can take three to 10 years.
To spur on the development of bio-printed organs, the Methuselah Foundation, a Springfield, Va.-based not-for-profit that supports regenerative medicine research, this month announced a $1 million prize for the first organization to print a fully functioning liver.

Currently, there are about 120,000 people on the organ waiting list in the U.S., and even those who receive a donated organ face the prospect of ongoing medical challenges because of organ rejection issues. However, if a patient's own stem cells could be used to regenerate a living organ, rejection would become moot.
Research into whole organ regeneration currently receives less than $500 million in funding a year in the U.S., compared to $5 billion for cancer research and $2.8 billion for HIV and AIDS, the Methuselah Foundation said in its contest announcement. "Regenerative medicine is the future of healthcare, but right now the field is falling through the cracks," said Methuselah CEO David Gobel.

Organs on a chip

While it may be a decade or more before human trials for organ transplants are approved by the FDA, the creation of organ tissue still holds the prospect of revolutionizing medicine.
Printing out sustainable organ tissue could allow pharmaceutical companies to develop and test drugs on human and not animal organs. Using human tissue yields more accurate results.
Researchers are now experimenting with laying down a thin layer of human tissue from any number of organs for pharmaceutical development. The process is known as creating an "organ on a chip" or a "human on a chip."
Scientists have for years been able manually grow thin skin tissue for temporary skin grafts that act as a type of bandage while the body heals itself. However, 3D printing has advanced that process.
Instead of the arduous task of manually laying down cells, 3D printing automates the process in an exact and repeatable way using a syringe on the end of a robotic mechanism guided by computer-aided design (CAD) software.
"Using 3D printing has given us the reproducibility and the automation needed to scale up," said Jordan Miller, assistant professor of bioengineering at Rice University. Miller recently helped open a microfabrication lab at Rice University after spending years in a similar lab at the University of Pennsylvania's department of bioengineering.
The key to creating viable, living tissue is first understanding how it works. As much as scientists know about the human body, the way tissue is formed at the cellular and sub-cellular level is still in large part a mystery.
There are about 40 different cell types that make up a human liver, including Kupffer cells for removing debris from the blood, stellate cells for regenerating tissue that has died or been injured, and sinusoidal endothelial cells, which make up the interior surface of blood vessels and lymphatic vessels.
"It's a complicated challenge," Miller said. "We don't know all the structures in the body. We're still learning. So we don't know to what extent we need to reconstitute all those features. We have some evidence that we may not need to re-create all those functions."
Miller and others believe that if they reconstitute a portion of tissue, even if it's not complete, there's a good chance it will continue to grow into a fully functioning organ once implanted in the body.
"We've had some success in thin tissues, skin, corneas and bladder," Miller said. "It gets more complicated when you're talking about biochemical functions in the liver or kidney. Those are fragile cells that don't do well in labs. Some of the most interesting cells we want to print are hardest to keep alive."
Instead of printing cells 10 layers deep, as might be needed for a skin graft, researchers are attempting to print cells 5,000 or 10,000 layers deep, Miller said.

Just add sugar and water, and voila -- blood vessels

In order to print thick tissues, scientists must also be able to create the vascular system needed for sustainability.
One approach with 3D printing has been to print out a temporary "scaffolding" made of sugar glass (a sugar-and-water combination) that can act as a mold to support cells that eventually form blood vessels. It's similar to the way a bronze statue is created: First the mold is formed, then filled with metal. In this case, living cells are used instead of metal.
Miller and others have had some success re-creating those vascular structures through the use of sugar glass -- the same substance that's used to make easily breakable bottles and windows for stunts in movies.
"You start with a template, cast it and then melt [the sugar glass] out, leaving the vascular structure behind," Miller said. "Sugar is great because it's very rigid." Using sugar glass as the scaffolding, Miller and his team of researchers have had some success in re-creating liver tissue. To date, the researchers have been able to create a piece of tissue the size of a thumbnail and keep it alive for two weeks.

Replacing ears and breasts

Earlier this year, researchers at Princeton University created a functional ear using a modified $1,000 ink-jet printer. They said the ear they created has the potential to hear radio frequencies far beyond the range of normal human capability because the tissue was combined with electronics as it grew in a petri dish.
The researchers laid down 3D printed cells and structural nanoparticles to build the ear. A cell culture was used to combine a small coil antenna with cartilage, creating what the scientists called a "bionic ear."

Scott Collins, CTO and vice president of research and development at bio-printing company TeVido BioDevices, said his firm is in the early-stages of using 3D bio-printing of live cells to build custom implants and grafts for breast cancer survivors.

This year alone, about 300,000 women in the U.S. will be diagnosed with breast cancer and up to 60% of them will choose a lumpectomy. According to TeVido BioDevices, at least 25% of women who undergo lumpectomies are dissatisfied with their physical appearance after the operation.

TeVido is developing an implant from fat and skin cells as well as working to print nipples and the surrounding areola using the patient's own cells. That way, the tissue won't be rejected and will have natural shape and pigmentation. "Today, we have ways of implanting the breast mound, but as far as rebuilding nipple and areola, it doesn't work well," Collins said. "The pigment is just tattooed on and fades over time."

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