

<http://www.bbc.co.uk/news/health-25775823>

## **Baby born to woman who suffered 20 miscarriages**

*A woman who suffered 20 miscarriages over 10 years, has had a baby boy after being given a drug normally used to treat malaria and rheumatoid arthritis.*

Kelly Moseley, from Birmingham, endured 11 miscarriages each at about eight weeks before she contacted a miscarriage expert she had seen on television. Hassan Shehata discovered that Kelly's pregnancies were being attacked by "natural killer cells" present in her body and decided to treat her with hydroxychloroquine. Initially, Kelly continued to miscarry - including losing two babies at five months - before one year of taking the drug, she found out she was pregnant and Tyler was born in April 2013. He is now nine months old. Kelly had been trying for a baby since 2002 when she married her husband Alan. Even though all her family and friends begged her to stop trying after so many heart-breaking miscarriages, she refused to give up. When she saw Mr Shehata interviewed about his work helping women who had experienced recurrent miscarriages, she was encouraged and made contact with him. Eventually she was referred to the consultant obstetrician and gynaecologist's clinic at Epsom and St Helier University Hospitals NHS Trust in Surrey.

### **Killer cells**

Mr Shehata and his colleagues had spent many years researching why some women's bodies reject pregnancies and their work was focused on natural killer cells which are present in everyone's white blood cells. He said: "We found that some women's natural killer cells are so aggressive they attack the pregnancy, thinking the foetus is a foreign body - and that's what was happening to Kelly. "Natural killer cells can be lowered by giving some women steroids - but for Kelly this didn't work so we tried an anti-malaria treatment which also lowers the immune system."

Mr Shehata said Kelly was the first patient to receive this treatment, in tablet form, of the immune modulator drug hydroxychloroquine. Finally, she became pregnant with Tyler and although the pregnancy was complicated by pre-eclampsia, he was safely delivered at 28-29 weeks weighing just under 3lbs.

### **No 'holy grail'**

"I still can't believe Tyler is here," Kelly says. "I just refused to give up hope and I hope our story encourages other women out there too. "I will never forget the babies I've lost but having Tyler makes it all worthwhile." Mr Shehata told BBC Radio 5 Live that he has since treated 10 to 15 women with the drug and found it had a 70% success rate. "It's important to say that it's not the holy grail, it's not for treating everyone.

"But hydroxychloroquine has been shown to be very safe in pregnancy."

Tyler spent a lot of time in a special baby care unit in Birmingham before he was allowed to come home, but he is now preparing to celebrate his first birthday in April surrounded by the whole family.

A spokesperson from the Royal College of Obstetricians and Gynaecologists said it was "interested" to hear that this drug could help women who suffer recurrent miscarriages, who tend to have problems with their immune system, but that it wasn't "standard practice".

<http://www.bbc.co.uk/news/health-25777428>

## **Health problems 'should be dealt with early', NHS says**

*People with worries about their health, especially those over 60, should seek help quickly, according to NHS England.*

A new eight-week campaign - called The Earlier, The Better - is aimed at reducing "unnecessary" hospital stays. Last year a review warned of a rise in avoidable emergency hospital admissions and NHS England said too many people simply "soldiered on". The online, radio and poster campaign, launched on Monday, will urge people to get help without going to hospital. It is being targeted at older people in particular because they often present themselves later, when conditions are more serious and are harder to treat.

Chronic conditions such as respiratory disorders can also be made worse by immobility, the cold and viral illnesses. To try to combat the issue, the campaign encourages over-60s and their carers to use self-care information to deal with minor health problems, such as a bad cough or sore throat.

Greater use of the local pharmacy, and calling the NHS 111 advice line, is also being encouraged.

"We see in our hospitals so many people who have not had or sought the help they need early enough," said Prof Keith Willett, NHS England's director for acute care. "We have to do better at helping people stay well, not just picking up the pieces when they fall seriously ill." He added: "Too many people make the mistake of soldiering on, losing the opportunity to nip things in the bud. "Unfortunately this can lead to an unnecessary stay in hospital, particularly for the more frail elderly, and those with long-term conditions."

Clare Howard, the organisation's deputy chief pharmaceutical officer, said: "Pharmacists and their teams are well trained and well placed to be able to offer advice to people seeking help. "They can provide medicines'

advice and support for minor ailments, advise you about how to manage a long-term condition and tell you if something needs more urgent medical attention from your GP, or even your local hospital."

<http://www.bbc.co.uk/news/health-25777978>

### **Are you a lark or an owl?**

*Whether you prefer being up at dawn or burning the midnight oil depends on your genes, experts have found.*

By Deborah Cohen BBC Radio Science

Some of us leap out of bed each morning, raring to start the day. Others need at least one alarm clock - preferably one with a snooze button - to ensure they get to work on time. And some of us happily stay up chatting until the wee small hours, while others prefer to be tucked up listening to 'Book at Bedtime' with the lights turned out.

We really are divided into larks and owls. And this is set by our genes, says neurogeneticist Dr Louis Ptacek of University of California. He says: "Whether we like it or not our parents are telling us when to go to bed - based on the genes that they gave us."

Scientists have come to realise the importance of understanding a person's chronotype, the time of the day when they function the best. Knowing how much of a lark or an owl we are should help us live more healthily in the modern 24/7 world.

Rick Neubig, a professor of pharmacology in Michigan, is an extreme lark. "People I communicated with in Europe will always notice that they get emails from me very early in the morning. "The other thing I like a lot which fits in with the early mornings is that I'm a fairly serious bird watcher. It's much easier for me than other people to get up and see the birds at dawn."

And it runs in his family. "My mother would always drag us out of bed at 4 in the morning to go on vacation, and my daughter works out early in the morning."

#### **'Strong genetic trait'**

Dr Louis Ptacek is studying the families of larks like Rick's that have Familial Advanced Sleep Phase syndrome. He got into this area of research when his colleague Dr Chris Jones met a 69 year old who was worried about waking up very early and whose concern had been ignored by other medics.

Drs Ptacek and Jones looked at her family. "We recognised this was a strong genetic trait. We found the mutated gene resided near the end of chromosome 2", says Louis Ptacek.

They knew that if similar genes were mutated in fruit flies and mice the circadian clocks speed up. The mutated gene made a different protein that affects the rhythm of the clock. They also study families of extreme owls, with Familial Delayed Sleep Phase syndrome. And they think this was due to a different mutation in the same genes.

Mutations in other genes have been found in other families with advanced or delayed sleep patterns.

We all have internal circadian clocks - the master clock is made up of thousands of nerve cells in the suprachiasmatic nucleus, a wing - shaped structure located in the hypothalamus, at the base of the brain.

The hypothalamus controls all kinds of bodily functions, from releasing hormones to regulating temperature and water intake. This internal clock is reset every day by light. You might expect that since the earth's day lasts 24 hours, everyone's clocks would run to a similar schedule. But they don't. That's why there are larks and owls.

"If you have a fast clock you like to do things early, and if you have a slow clock you like to do things late," says Prof Derk-Jan Dijk, Head of the University of Surrey's Sleep Research Centre.

#### **'A sleep map of the world'**

Our clocks are not fixed throughout life. Anyone who has small children will know they're prone to waking early, as do the elderly. But whatever the speed of your clock we have to fit in with the way that society is set up with its 9-5 working times.

This can be particularly hard for teenagers, who generally find it hard to get up in the morning.

Prof Till Roenneberg of Ludwig-Maximilians University has looked at the sleeping patterns of this age group with the help of his Munich Chronotype Questionnaire. "We can show that the famous lateness of teenagers is a real thing. They get later through childhood and puberty and reach a point of lateness at 19 and a half for women and 21 for men. It was so clear it was astonishing. "Our database has over 200,000 participants. We are hoping for a sleep map of the world."

Mary Carskadon, a professor of psychiatry at Brown University in the US, is campaigning for schools to start later. "School grades don't get always higher but for me one of the most important aspects of sleep loss is the issue of depression and sadness and lack of motivation of kids. "The moods improve when schools start later." But not many schools around the world have chosen a later start time. After all, most people do fit in with the working day, although they may be suffering from exhaustion.

### Social jet lag

Prof Roenneberg has a catchy way of describing and measuring the sleep deprivation many suffer during the working or studying week, when we rely on alarm clocks to get us out of bed. He calls it social jet lag. He finds that the middle of people's sleep on work days is usually earlier than that on free days. The difference is their social jet lag. "On average people accumulate one to two hours of social jet lag, though some can get up to five hours, particularly in the young, who still have to get to work at the same time as older people," says Prof Roenneberg. Having social jetlag is like flying from New York to London every weekend. And it's harder to get over social jet lag than time zone jet lag.

But Prof Roenneberg says there are things we can do to overcome social jetlag. "We should be changing work times and making them more individual to fit in with our chronotypes. If that's not possible we should be more strategic about light exposure. "You should try to go to work not in a covered vehicle but on a bike. The minute the sun sets we should use things that have no blue light, like computer screens and other electronic devices."

<http://www.sciencedaily.com/releases/2014/01/140120085058.htm>

### Melatonin May Lower Prostate Cancer Risk

*Higher levels of melatonin, a hormone involved in the sleep-wake cycle, may suggest decreased risk for developing advanced prostate cancer*

Higher levels of melatonin, a hormone involved in the sleep-wake cycle, may suggest decreased risk for developing advanced prostate cancer, according to results presented at the AACR-Prostate Cancer Foundation Conference on Advances in Prostate Cancer Research, held Jan. 18-21.

Melatonin is a hormone that is produced exclusively at night in the dark and is an important output of the circadian rhythm, or the body's inherent 24-hour clock. Many biological processes are regulated by the circadian rhythm, including the sleep-wake cycle. Melatonin may play a role in regulating a range of other hormones that influence certain cancers, including breast and prostate cancers.

"Sleep loss and other factors can influence the amount of melatonin secretion or block it altogether, and health problems associated with low melatonin, disrupted sleep, and/or disruption of the circadian rhythm are broad, including a potential risk factor for cancer," said Sarah C. Markt, M.P.H., doctoral candidate in the Department of Epidemiology at Harvard School of Public Health in Boston. "We found that men who had higher levels of melatonin had a 75 percent reduced risk for developing advanced prostate cancer compared with men who had lower levels of melatonin.

"Our results require replication, but support the public health implication of the importance of maintaining a stable light-dark and sleep-wake cycle," added Markt. "Because melatonin levels are potentially modifiable, further studies of melatonin and prostate cancer risk and progression are warranted."

To investigate the association between urine levels of the main breakdown product of melatonin, 6-sulfatoxymelatonin, and risk of prostate cancer, Markt and colleagues conducted a case-cohort study of 928 Icelandic men from the AGES-Reykjavik cohort between 2002 and 2009. They collected first morning void urine samples at recruitment, and asked the participants to answer a questionnaire about sleep patterns.

The researchers found that one in seven men reported problems falling asleep, one in five men reported problems staying asleep, and almost one in three reported taking sleeping medications.

The median value of 6-sulfatoxymelatonin in the study participants was 17.14 nanograms per milliliter of urine. Men who reported taking medications for sleep, problems falling asleep, and problems staying asleep had significantly lower 6-sulfatoxymelatonin levels compared with men without sleep problems, according to Markt. Of the study participants, 111 men were diagnosed with prostate cancer, including 24 with advanced disease. The researchers found that men whose 6-sulfatoxymelatonin levels were higher than the median value had a 75 percent decreased risk for advanced prostate cancer. A 31 percent decreased risk for prostate cancer overall was observed as well, but this finding was not statistically significant.

"Further prospective studies to investigate the interplay between sleep duration, sleep disturbance, and melatonin levels on risk for prostate cancer are needed," said Markt.

<http://www.sciencedaily.com/releases/2014/01/140120090415.htm>

### Forget About Forgetting: Elderly Know More, Use It Better

*Three generations, each with different cognitive strengths. The brains of older people work slower because they have more information to process.*

What happens to our cognitive abilities as we age? If you think our brains go into a steady decline, research reported this week in the Journal Topics in Cognitive Science may make you think again. The work, headed by Dr. Michael Ramscar of Tübingen University, takes a critical look at the measures usually thought to show that our cognitive abilities decline across adulthood. Instead of finding evidence of decline, the team discovered that

most standard cognitive measures, which date back to the early twentieth century, are flawed. "The human brain works slower in old age," says Ramscar, "but only because we have stored more information over time." Computers were trained, like humans, to read a certain amount each day, and to learn new things. When the researchers let a computer "read" only so much, its performance on cognitive tests resembled that of a young adult. But if the same computer was exposed to the experiences we might encounter over a lifetime -- with reading simulated over decades -- its performance now looked like that of an older adult. Often it was slower, but not because its processing capacity had declined. Rather, increased "experience" had caused the computer's database to grow, giving it more data to process -- which takes time.

Technology now allows researchers to make quantitative estimates of the number of words an adult can be expected to learn across a lifetime, enabling the Tübingen team to separate the challenge that increasing knowledge poses to memory from the actual performance of memory itself. "Imagine someone who knows two people's birthdays and can recall them almost perfectly. Would you really want to say that person has a better memory than a person who knows the birthdays of 2000 people, but can 'only' match the right person to the right birthday nine times out of ten?" asks Ramscar.

The answer appears to be "no." When Ramscar's team trained their computer models on huge linguistic datasets, they found that standardized vocabulary tests, which are used to take account of the growth of knowledge in studies of aging, massively underestimate the size of adult vocabularies. It takes computers longer to search databases of words as their sizes grow, which is hardly surprising but may have important implications for our understanding of age-related slowdowns. The researchers found that to get their computers to replicate human performance in word recognition tests across adulthood, they had to keep their capacities the same. "Forget about forgetting," explained Tübingen researcher Peter Hendrix, "if I wanted to get the computer to look like an older adult, I had to keep all the words it learned in memory and let them compete for attention."

The research shows that studies of the problems older people have with recalling names suffer from a similar blind spot: there is a far greater variety of given names today than there were two generations ago. This cultural shift toward greater name diversity means the number of different names anyone learns over their lifetime has increased dramatically. The work shows how this makes locating a name in memory far harder than it used to be. Even for computers.

Ramscar and Michael Ramscar, Peter Hendrix, Cyrus Shaoul, Petar Milin, Harald Baayen. *The Myth of Cognitive Decline: Non-Linear Dynamics of Lifelong Learning. Topics in Cognitive Science, 2014; DOI: 10.1111/tops.12078*

<http://bit.ly/1eKf37X>

## **Water found in stardust suggests life is universal**

*The charged solar winds may have given stardust one of the ingredients of life*

20:00 20 January 2014 by Catherine Brahic

A sprinkling of stardust is as magical as it sounds. The dust grains that float through our solar system contain tiny pockets of water, which form when they are zapped by a blast of charged wind from the sun.

The chemical reaction causing this to happen had previously been mimicked in laboratories, but this is the first time water has been found trapped inside real stardust.

Combined with previous findings of organic compounds in interplanetary dust, the results suggest that these grains contain the basic ingredients needed for life. As similar dust grains are thought to be found in solar systems all over the universe, this bodes well for the existence of life across the cosmos.

"The implications are potentially huge," says Hope Ishii of the University of Hawaii in Honolulu, one of the researchers behind the study. "It is a particularly thrilling possibility that this influx of dust on the surfaces of solar system bodies has acted as a continuous rainfall of little reaction vessels containing both the water and organics needed for the eventual origin of life."

### **Dust rain**

Solar systems are full of dust – a result of many processes, including the break-up of comets. John Bradley of the Lawrence Livermore National Laboratory in California and his colleagues inspected the outer layer of interplanetary dust particles extracted from Earth's stratosphere.

Ultra-high-resolution microscopy allowed them to probe the 5- to 25-micrometre specks of dust to reveal small pockets of trapped water just beneath the surface.

Laboratory experiments offer clues to how the water forms. The dust is mostly made of silicates, which contains oxygen. As it travels through space, it encounters the solar wind.

This stream of charged particles including high-energy hydrogen ions is ejected from the sun's atmosphere. When the two collide, hydrogen and oxygen combine to make water.

As interplanetary dust is thought to have rained down on early Earth, it is likely that the stuff brought water to our planet, although it is difficult to conceive how it could account for the millions of cubic kilometres of water that cover Earth today. "In no way do we suggest that this was sufficient to form oceans," says Ishii.

### **Universal water**

A more likely origin for the huge volume of water on our planet is wet asteroids that pummelled early Earth. Comets are also a candidate: the European Space Agency's Rosetta spacecraft, due to send a lander to a comet later this year, is tasked with probing their role.

However, the Bradley team's results are relevant to the quest for life on other planets. The water-producing reaction is likely to be universal, and to happen in any corner of the universe with a star, or even a supernova, says Ishii. What's more, interplanetary dust in our solar system – and in others – contains organic carbon. If stardust contains carbon and water, it means the essentials of life could be present in solar systems anywhere in the universe and raining down on their planets.

"These are the types of processes that we expect to occur in other planetary systems," says Fred Ciesla of the University of Chicago in Illinois, who was not involved in the work. "Water and organics are not uncommon."

Journal reference: PNAS, DOI: 10.1073/pnas.1320115111

<http://www.bbc.co.uk/news/health-25807139>

### **Sudden death relatives should be screened, say heart experts**

*Relatives of people who die from sudden death syndrome should be screened for hidden heart problems, say experts.*

Many of the 12 unexplained deaths a day among young people in the UK are found subsequently to be the result of inherited heart conditions. The British Heart Foundation (BHF) says a simple blood test can establish whether blood relatives carry the same genetic risk. It is urging more people to have the tests. Guidelines are being issued to all coroners in England and Wales, asking them to promote screening, as they are often the first point of contact after post-death investigations. Inherited heart conditions, such as Long QT Syndrome, can be picked up by a simple trace, known as an ECG, that looks at the electrical activity within the heart.

#### **Screening widely available**

But currently not everyone who is at risk gets tested. Doctors may also want to do a type of scan called an echocardiogram to examine the heart's appearance. The BHF says hundreds of lives could be saved by better uptake of the screening, which is on offer to any relatives who have lost a loved one because of an inherited heart condition. Testing will mean some can be reassured that they do not carry the same risk, and those found to have inherited culprit genes can take action to lower their own heart risk - for example, by changing their lifestyle.

Prof Peter Weissberg, medical director at the BHF, said: "The death of a loved one can, sadly, be the first time people find out about an inherited heart condition in their family. "Yet even after a 'suspicious' death, family members are not always screened themselves. Their life could be in danger and their family could be devastated all over again - something a simple blood test could set right."

[http://www.eurekalert.org/pub\\_releases/2014-01/asfm-ppv011714.php](http://www.eurekalert.org/pub_releases/2014-01/asfm-ppv011714.php)

### **Pathogenic plant virus jumps to honeybees**

*A viral pathogen that typically infects plants has been found in honeybees and could help explain their decline.*

Researchers working in the U.S. and Beijing, China report their findings in mBio, the online open-access journal of the American Society for Microbiology.

The routine screening of bees for frequent and rare viruses "resulted in the serendipitous detection of Tobacco Ringspot Virus, or TRSV, and prompted an investigation into whether this plant-infecting virus could also cause systemic infection in the bees," says Yan Ping Chen from the U.S. Department of Agriculture's Agricultural Research Service (ARS) laboratory in Beltsville, Maryland, an author on the study.

"The results of our study provide the first evidence that honeybees exposed to virus-contaminated pollen can also be infected and that the infection becomes widespread in their bodies," says lead author Ji Lian Li, at the Chinese Academy of Agricultural Science in Beijing.

"We already know that honeybees, *Apis mellifera*, can transmit TRSV when they move from flower to flower, likely spreading the virus from one plant to another," Chen adds.

Notably, about 5% of known plant viruses are pollen-transmitted and thus potential sources of host-jumping viruses. RNA viruses tend to be particularly dangerous because they lack the 3'-5' proofreading function which edits out errors in replicated genomes. As a result, viruses such as TRSV generate a flood of variant copies with differing infective properties.

One consequence of such high replication rates are populations of RNA viruses thought to exist as "quasispecies," clouds of genetically related variants that appear to work together to determine the pathology of their hosts. These sources of genetic diversity, coupled with large population sizes, further facilitate the adaptation of RNA viruses to new selective conditions such as those imposed by novel hosts. "Thus, RNA viruses are a likely source of emerging and reemerging infectious diseases," explain these researchers.

Toxic viral cocktails appear to have a strong link with honey bee Colony Collapse Disorder (CCD), a mysterious malady that abruptly wiped out entire hives across the United States and was first reported in 2006. Israel Acute Paralysis Virus (IAPV), Acute Bee Paralysis Virus (ABPV), Chronic Paralysis Virus (CPV), Kashmir Bee Virus (KBV), Deformed Wing Bee Virus (DWV), Black Queen Cell Virus (BQCV) and Sacbrood Virus (SBV) are other known causes of honeybee viral disease.

When these researchers investigated bee colonies classified as "strong" or "weak," TRSV and other viruses were more common in the weak colonies than they were in the strong ones. Bee populations with high levels of multiple viral infections began failing in late fall and perished before February, these researchers report. In contrast, those in colonies with fewer viral assaults survived the entire cold winter months.

TRSV was also detected inside the bodies of Varroa mites, a "vampire" parasite that transmits viruses between bees while feeding on their blood. However, unlike honeybees, the mite-associated TRSV was restricted to their gastric cecum indicating that the mites likely facilitate the horizontal spread of TRSV within the hive without becoming diseased themselves. The fact that infected queens lay infected eggs convinced these scientists that TRSV could also be transmitted vertically from the queen mother to her offspring.

"The increasing prevalence of TRSV in conjunction with other bee viruses is associated with a gradual decline of host populations and supports the view that viral infections have a significant negative impact on colony survival," these researchers conclude. Thus, they call for increased surveillance of potential host-jumping events as an integrated part of insect pollinator management programs.

[http://www.eurekalert.org/pub\\_releases/2014-01/ibri-rda012014.php](http://www.eurekalert.org/pub_releases/2014-01/ibri-rda012014.php)

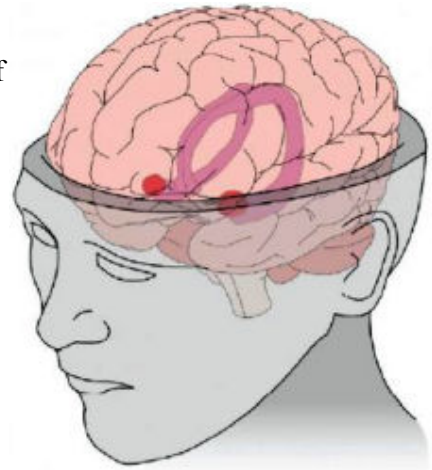
**Researchers discover an epigenetic lesion in the hippocampus of Alzheimer's**  
*Alzheimer's disease can reach epidemic range in the coming decades, by the increasing average age of society.*

There are two key issues for Alzheimer's disease: there is currently no effective treatment and it has been described very few associated genetic changes (mutations) which reduces the number of targets for future therapies.

**Alzheimer's disease**

Pathologically, Alzheimer's disease is characterized by the accumulation of protein deposits in the brain of patients. These deposits are formed by plates of a protein called amyloid-beta and rolled tangles of tau protein. The root cause of these lesions in most cases is unknown, but specific alterations in regulating genes expression might be involved.

Today, the prestigious international journal in neurology Hippocampus publishes an article led by Manel Esteller, Director of Epigenetics and Cancer Biology, Institute of Biomedical Research of Bellvitge (IDIBEL), ICREA researcher and Professor of Genetics at the University of Barcelona, with the collaboration of the Institute of Neuropathology IDIBELL led by Isidre Ferrer, demonstrating for the first time the existence of an epigenetic lesion in the hippocampus of the brain of patients with Alzheimer.



*In pink is the location and structure of the brain hippocampus, the region where the epigenetic lesion was found in Alzheimer's patients. IDIBELL*

**Switches in the hippocampus**

"We first started studying 30,000 molecular switches that turn on and off genes in the hippocampal region in the brains of Alzheimer patients in different stages of disease and compared with that of healthy patients of the same age. We note that dusp22 gene switch off (methylated) as the disease advances" explained Manel Esteller, director of the study.

"But more importantly" continues "was the discovery that this gene regulates tau protein. Perhaps therefore the accumulation of tau protein produced in the brain of patients with Alzheimer results from dusp22 epigenetic inactivation".

According Esteller "the finding is relevant not only to determine the causes of the disease, but also to test potential treatments in the future to act on these epigenetic molecular switches".

[http://www.eurekalert.org/pub\\_releases/2014-01/uhn-rbs012014.php](http://www.eurekalert.org/pub_releases/2014-01/uhn-rbs012014.php)

## **Radiation before surgery more than doubles mesothelioma survival: UHN study**

***Results of clinical research that treated mesothelioma with radiation before surgery show the three-year survival rate more than doubled for study participants afflicted with this deadly disease, compared to treating with surgery first.***

TORONTO, Canada – The findings, published online today ahead of print in the Journal of Thoracic Oncology (DOI 10.1097/JTO.000000000000078), chart a viable route to treat patients more effectively and also improve their quality of life and potential survival, says principal investigator and lead author Dr. John Cho, radiation oncologist at Princess Margaret Cancer Centre, University Health Network (UHN). Dr. Cho is also an Assistant Professor, Department of Radiation Oncology at the University of Toronto.

"The patients in our study experienced shorter treatment, fewer complications and speedier recovery," says Dr. Cho. "The three-year survival rate more than doubled to 72% from 32%." Mesothelioma is an aggressive malignancy that starts in the lining of the lung and progressively restricts and invades the whole organ.

The study assessed a new approach dubbed SMART – Surgery for Mesothelioma After Radiation Therapy – and was completed over four years with 25 patients who had radiation therapy at Princess Margaret Cancer Centre and surgery at Toronto General Hospital, both part of UHN.

Participants were treated with an accelerated, five-day course of intensity-modulated radiation therapy (IMRT), a specialized technique that conforms the radiation dose around the tumours in 3D while sparing the heart, spine and other healthy tissues. The patients underwent surgery to remove the affected lung the following week.

"It was imperative to do the surgery quickly because the lung is particularly sensitive to radiation toxicity," says thoracic surgeon Dr. Marc de Perrot, also an author of the study. He says the SMART approach significantly reduced the treatment cycle for patients to one month from five months. It also reduced the risk of recurrence because the radiation wiped out the cancer's ability to seed itself elsewhere in the chest or abdomen during surgery. Dr. de Perrot is an Associate Professor of Surgery at the University of Toronto and also leads the Toronto Mesothelioma Research Program.

"These research results offer real hope to mesothelioma patients who have too often been told in the past that they may have only six months to live," says Dr. de Perrot. Exposure to asbestos is the main cause of mesothelioma in the 500 new cases reported in Canada each year, a number that has essentially doubled in the past decade, he says.

"Individuals with known exposure to asbestos, who experience shortness of breath, weight loss and fatigue for more than three weeks, need to see a doctor. A basic chest X-Ray will show a pleural effusion (which appears as half the lung in white shadow), and that is the trigger to seek specialist care quickly. We need to shorten the diagnostic and treatment cycle in mesothelioma because we now have an approach that makes it possible to control the disease and improve quality of life for several years."

Since the study, Drs. Cho and de Perrot have used the SMART approach to successfully treat 20 more patients. The research was funded at UHN by The Princess Margaret Cancer Foundation and The Toronto General and Western Hospital Foundation.

<http://www.nytimes.com/2014/01/21/science/reviving-a-life-saver.html?partner=rss&emc=rss>

## **Reviving a Life Saver, the Tourniquet**

***As far back as Alexander the Great's campaigns, tourniquets were wartime staples, used to stanch the bleeding of wounded soldiers.***

By MICHAEL S. SCHMIDTJAN. 19, 2014

But they became a last resort for both military and civilian emergency personnel after World War II, when medical experts blamed the prolonged cutoff of blood for frequent amputations.

Transportation was so poor in those days that it took the wounded hours, if not days, to receive adequate medical attention - far too long for a tourniquet to remain in place. "The treatment was initially worse than the disease," said Dr. Lenworth M. Jacobs, the head of the Hartford Consensus, a group of experts in emergency medicine who have studied how to respond more effectively to mass casualties.

But now law enforcement agencies across the country, responding to an increase in mass shootings over the last decade and to new guidelines from the federal government, have placed a new emphasis on training and equipping officers to treat serious wounds by reviving the use of tourniquets. The Virginia State Police, along with departments in Dallas, Philadelphia and other major cities, have distributed tourniquets and special bandages to officers in recent months, in a break from traditional police procedure.

The tourniquet's resurgence results in part from lessons learned in Afghanistan and Iraq. Only 2 percent of soldiers with severe bleeding in those countries died compared with 7 percent in Vietnam in part because tourniquets were in widespread use and the injured were quickly transported to doctors.

In the past year, civilian trauma doctors, realizing that emergency personnel in much of the country can transport the wounded to a trauma center in less than 30 minutes, have followed the lead of the military. The success of the rapid medical response to the Boston Marathon bombings, where bystanders used their clothes as tourniquets, has bolstered their efforts.

"As we began to take a hard look at how to respond to these types of incidents, what became clear was that the sooner you can stop victims from bleeding, the higher likelihood you will have for reducing fatalities," said John Cohen, a senior counterterrorism official at the Department of Homeland Security and a member of a committee appointed by President Obama to study gun violence after the mass shooting in Newtown, Conn. "And the things that make the biggest difference in stopping bleeding are tourniquets and other bandages." As part of a broader effort to encourage the public to help treat victims, the committee has been developing plans to put tourniquets in public places, like malls and schools, and to train teachers and others how to use them. In September, committee members also released new recommendations for emergency responders after studying the Boston bombings and other attacks. Among their ideas: Paramedics wearing body armor should be prepared to enter into "warm zones" where there may still be gunmen or unexploded bombs.

"Along with encouraging police, who are often the first emergency personnel to arrive at the scene, we have been trying to figure out how to get the public trained and educated in how they can help, because they are almost always the closest to the victims," Mr. Cohen said.

In June, the Hartford Consensus reported that "hemorrhage control" was one of the most important factors in saving lives after mass casualties occur. Four months later, the Major Cities Chiefs Association, a group of police commissioners from the 63 largest urban cities in the nation, unanimously endorsed guidelines to equip police officers with tourniquets.

Modern tourniquets resemble a belt with a large clamp and a metallic rod, known as a windlass, used to tighten them around a wounded limb. Officers carry them on their belts or keep them in first-aid kits in their vehicles. For many, it all is something of a cultural change. "Until recently, there was an anecdotal bias against using them in the pre-hospital phase of treatment, but it wasn't based on any real studies," said Dr. William Fabbri, the head of the F.B.I.'s emergency medical support program.

Charles H. Ramsey, the police commissioner in Philadelphia, said that when he started in law enforcement, "we had directives that said not to move a victim when you found them at a scene, and wait for rescue personnel." "It always took time for them to get there, and a person lost a tremendous amount of blood," Commissioner Ramsey continued.

Speed is still an issue in treating someone whose bleeding has been stanching, and Commissioner Ramsey said his officers were now instructed to take victims who were treated with tourniquets directly to the hospital if emergency responders have not arrived at the scene.

These tactics have raised concerns among some police officials, who question whether their officers will be diverted from catching criminals if they are also responsible for treating victims. "Chasing and catching bad guys is part of what we do," Commissioner Ramsey said, "but there is nothing more important than saving a life." Although the expanded use of tourniquets has encouraged some medical experts, they believe more needs to be done.

Dr. Jacobs said that "when they began putting \$15,000 defibrillators in public places 15 to 20 years ago, there was no concept" that terrorist attacks or mass shootings might one day be more common.

"There's no reason a \$15 tourniquet can't be right beside the defibrillator," he said.

<http://www.sciencedaily.com/releases/2014/01/140120173456.htm>

### **Middle-School Girls Continue to Play Soccer With Concussion Symptoms**

*Concussions are common among middle-school girls who play soccer, and most continue to play with symptoms, according to a study by John W. O' Kane, M.D., of the University of Washington Sports Medicine Clinic, Seattle, and colleagues.*

Sports-related concussions account for 1.6 to 3.8 million injuries in the United States annually, including about 50,000 soccer-related concussions among high school players. Injury-tracking systems for younger players are lacking so they are largely unstudied, according to the study background.

Using an email survey and interviews, the authors evaluated the frequency and duration of concussions in young female soccer players, as well as whether the injuries resulted in stopping play and seeking medical



attention. Their study included 351 soccer players (ages 11 to 14 years) from soccer clubs in the Puget Sound region of Washington.

Among 351 players, there were 59 concussions with 43,742 athletic exposure hours. Concussion symptoms can include memory loss, dizziness, drowsiness, headache and nausea. Cumulative concussion incidence was 13 percent per season with an incidence of 1.2 per 1,000 athletic exposure hours. Symptoms lasted a median four days (average 9.4 days). Heading the ball accounted for 30.5 percent of concussions. Most players (58.6 percent) continued to play with symptoms, with almost half (44.1 percent) seeking medical attention, according to the results.

The authors note that the rate of 1.3 concussions per 1,000 athletic exposure hours was higher than what has been reported in other studies of girls soccer at the high school and college levels.

"Future studies are needed to develop education strategies to ensure players understand and report concussion symptoms and that parents and coaches ensure appropriate medical evaluation and clearance before returning to play," the authors conclude. "Future studies should also compare short- and long-term outcomes for those who seek medical care and return to play according to recommended guidelines vs. those who do not seek medical care and/or return to play prematurely."

*John W. O'Kane, Amy Spieker, Marni R. Levy, Moni Neradilek, Nayak L. Polissar, Melissa A. Schiff. Concussion Among Female Middle-School Soccer Players. JAMA Pediatrics, 2014; DOI: 10.1001/jamapediatrics.2013.4518*

[http://www.eurekalert.org/pub\\_releases/2014-01/w-awu012114.php](http://www.eurekalert.org/pub_releases/2014-01/w-awu012114.php)

### **Arctic warmth unprecedented in 44,000 years, reveals ancient moss**

*When the temperature rises on Baffin Island, in the Canadian high Arctic, ancient Polytrichum mosses, trapped beneath the ice for thousands of years, are exposed.*

Using radiocarbon dating, new research in Geophysical Research Letters has calculated the age of relic moss samples that have been exposed by modern Arctic warming. Since the moss samples would have been destroyed by erosion had they been previously exposed, the authors suggest that the temperatures in the Arctic are warmer than during any sustained period since the mosses were originally buried.

The authors collected 365 samples of recently exposed biological material from 110 different locations, cutting a 1000 kilometer long transect across Baffin Island. From their samples the authors obtained 145 viable measurements through radiocarbon dating. They found that most of their samples date from the past 5000 years, when a period of strong cooling overtook the Arctic. However, the authors also found older samples which were buried from 24,000 to 44,000 years ago.

The records suggest that in general, the eastern Canadian Arctic is warmer now than in any century in the past 5000 years, and in some places, modern temperatures are unprecedented in at least the past 44,000 years. The observations, the authors suggest, show that modern Arctic warming far exceeds the bounds of historical natural variability.

"The great time these plants have been entombed in ice, and their current exposure, is the first direct evidence that present summer warmth in the Eastern Canadian Arctic now exceeds the peak warmth there in the Early Holocene era", said Gifford Miller, from the University of Colorado. "Our findings add additional evidence to the growing consensus that anthropogenic emissions of greenhouse gases have now resulted in unprecedented recent summer warmth that is well outside the range of that attributable to natural climate variability."

<http://www.sciencedaily.com/releases/2014/01/140121104156.htm>

### **Anti-Swine Flu Vaccination Linked to Increased Risk of Narcolepsy in Young Adults**

*Pandemrix linked to an increased risk of narcolepsy in young adults*

Pandemrix is an influenza vaccination, created in 2009 to combat H1N1, known as Swine Flu. Now, a team of Swedish clinicians testing the vaccine for links to immune-related or neurological diseases have linked Pandemrix to an increased risk of narcolepsy in young adults.

Using a population-based prospective cohort study, the team analyzed data from regional vaccination registries and national health registries, covering seven healthcare regions and 61% of the Swedish population.

While the team did not identify any link to a large number of immune-related or neurological diseases, they did confirm an increased risk in diagnosis of narcolepsy in individuals younger than 20 years of age, and observed a trend towards an increased risk amongst young adults between 21 and 30.

"The follow-up of Pandemrix vaccinations in a large registry based study in Sweden confirms an increased risk of narcolepsy in children and adolescents, while also providing reassuring results for a large number of other neurological and immune related diseases," said Dr. I. Persson from the Karolinska Institutet, Stockholm.

*Persson, F. Granath, J. Askling, J. F. Ludvigsson, T. Olsson, N. Feltelius. Risks of neurological and immune-related diseases, including narcolepsy, after vaccination with Pandemrix: a population- and registry-based cohort study with over 2 years of follow-up. Journal of Internal Medicine, January 2014*

<http://www.sciencedaily.com/releases/2014/01/140121113320.htm>

## Baseball: Not Safe at Home

***Tag plays at home plate have the highest injury rate in professional baseball, occurring 4.3 times more often than other base-running plays, according to researchers at Wake Forest Baptist Medical Center.***

"The current Major League Baseball (MLB) rules have a loophole that allows catchers to stand in the baseline and block the plate if the ball is being thrown home, which allows for collisions," said Daryl Rosenbaum, M.D., sports medicine physician at Wake Forest Baptist and lead author of the study. "Over the years, whether intentional or not, this oversight has permitted a different standard of play at home plate than other bases." The research is published in the current online edition of the International Journal of Sports Medicine.

To reduce the number of home-plate collisions in an otherwise limited-contact sport, Rosenbaum suggests that the major leagues adopt the collegiate rule, which prohibits defensive players, including catchers, from blocking a base, including home plate. A similar proposal has been proposed by the MLB owners and is awaiting approval by the players and umpires. "Making this change would protect both catchers and baserunners," Rosenbaum said. "The runner wouldn't be able to run into the catcher to knock the ball loose and be called safe, and the catcher would have to stand behind or next to the baseline rather than in it to tag the runner out."

In the study, the researchers looked at three types of MLB plays from 2002 to 2011 -- non-force putouts by a catcher at home plate (Catcher Tag Out), groundball force outs at second base with less than two outs (Double Play Attempt) and outfield assisted non-force putouts of runners attempting to advance to second or third base (Outfield Assist 2nd/3rd), which served as the control play. This data was cross-referenced with 2002 to 2011 disabled lists to see if an involved player went on the disabled list the day of or day after the play. An online search for each match determined if the injury was attributable to that play.

The findings showed that the rate of injury for Catcher Tag Out was 4.3 times higher than the control play, Rosenbaum said. The Double Play Attempt was statistically even with the Outfield Assist control play.

Nearly three players per year were injured severely enough in tag plays at the plate to be put on the 15-day disabled list, according to the study findings. Using the average MLB player salary for 2011 of \$3.1 million, injuries from home plate collisions cost teams an average of approximately \$2.3 million annually.

"That's just the financial impact," Rosenbaum said. "More difficult to quantify but also worth considering are the players' health and the effect of their absences on their teams' performance."

"I don't think fans go to baseball games to see collisions and I don't think if you remove them it would change the inherent nature of the game," he added. "Why are collisions allowed in this one scenario when they're not really part of the game?"

*D. Rosenbaum, S. Davis. Injury Risk Due to Collisions in Major League Baseball. International Journal of Sports Medicine, 2014; DOI: 10.1055/s-0033-1363253*

<http://www.sciencedaily.com/releases/2014/01/140121130030.htm>

## Colonoscopy Withdrawal Times Linked to Polyp Detection Rates

***Dartmouth-Hitchcock Norris Cotton Cancer Center (NCCC) researchers found that longer withdrawal times during a colonoscopy correlates with a higher rate of polyp detection.***

The study was recently published online in the American Journal of Gastroenterology.

"There has been controversy over whether longer withdrawal times could lead to detection of increased numbers of polyps of various types," said Lynn F. Butterly, MD, director of Colorectal Cancer Screening at Dartmouth-Hitchcock Medical Center and NCCC, and associate professor of Medicine at the Geisel School of Medicine at Dartmouth. "Since the rate of discovery of polyps is a critical quality measure for colonoscopy, examining whether or not there is an association between withdrawal time and finding more polyps may contribute evidence leading to improved quality in screening through colonoscopy."

During a colonoscopy, a lighted tube (colonoscope) is passed through the colon to find and remove polyps. The colonoscope is passed to the area where the large and small intestine meet, and the scope is then slowly withdrawn back through the colon, carefully examining the lining. The time spent in withdrawing the scope and doing a detailed examination is called the withdrawal time.

Colorectal cancer (CRC) is the second most common cause of death from cancer in the US, but CRC is preventable through screening. Most CRC begins as a small growth on the lining of the colon, known as a polyp. Over a period of several years, some polyps may turn into cancer.

Using data from the New Hampshire Colonoscopy Registry (NHCR), the authors examined how endoscopists' withdrawal time in normal, well-prepped colonoscopies affected their polyp detection rates. They analyzed 7,996 colonoscopies performed in 7,972 patients between 2009 and 2011 by 42 endoscopists at 14 hospitals,

ambulatory surgery centers, and community practices. Polyp detection rates were calculated based on median withdrawal time in normal exams. "Our investigation demonstrates a statistically significant correlation between longer normal withdrawal time and higher (overall) polyp detection rates, adenoma detection rates, and serrated polyp detection rates, and provides strong evidence to support a 9-minute median normal withdrawal time as a quality standard," Butterly said.

*Lynn Butterly, Christina M Robinson, Joseph C Anderson, Julia E Weiss, Martha Goodrich, Tracy L Onega, Christopher I Amos, Michael L Beach. Serrated and Adenomatous Polyp Detection Increases With Longer Withdrawal Time: Results From the New Hampshire Colonoscopy Registry. The American Journal of Gastroenterology, 2014; DOI: 10.1038/ajg.2013.442*

[http://www.eurekalert.org/pub\\_releases/2014-01/cu-ho012114.php](http://www.eurekalert.org/pub_releases/2014-01/cu-ho012114.php)

### 'Love hormone' oxytocin carries unexpected side effect

#### *New Concordia University study shows an increase in emotional oversensitivity among off-label users*

Montreal - The love hormone, the monogamy hormone, the cuddle hormone, the trust-me drug: oxytocin has many nicknames. That's because this naturally occurring human hormone has recently been shown to help people with autism and schizophrenia overcome social deficits.

As a result, some psychologists are keen to prescribe oxytocin off-label, in order to treat mild social unease in those who don't suffer from a diagnosed disorder. Not such a good idea, say researchers from Concordia University's Centre for Research in Human Development.

Their recent study, published in the American Psychological Association's journal *Emotion*, study shows that, in healthy young adults, too much oxytocin can actually result in oversensitivity to emotions in others.

To perform the study, PhD candidates Christopher Cardoso and Anne-Marie Linnen, and psychology professor Mark Ellenbogen recruited 82 healthy young adults who presented no signs of schizophrenia, autism or related disorders. Half of the participants were given measured doses of oxytocin while the other half was given a placebo.

Participants then completed an emotion identification accuracy test that had them compare different facial expressions showing various emotional nuances. As expected, the participants who had been given oxytocin saw greater emotional intensity in the faces that they were rating than did those given a placebo.

"For some, typical situations like dinner parties or job interviews can be a source of major social anxiety," says Cardoso, who was the lead author on the study. "Many psychologists initially thought that oxytocin could be an easy fix in overcoming these worries. Our study proves that the hormone ramps up innate social reasoning skills, resulting in an emotional oversensitivity that can be detrimental in those who don't have any serious social deficiencies."

Cardoso explains: "if your potential boss grimaces because she's uncomfortable in her chair and you think she's reacting negatively to what you're saying, or if the guy you're talking to at a party smiles to be friendly and you think he's coming onto you, it can lead you to overreact and can be real a problem. That's why we're cautioning against giving oxytocin to people who don't really need it.

Ultimately, oxytocin has solid potential to help those with diagnosed mental disorders overcome social deficits, such as autism, but the potential social benefits of oxytocin in most people may be countered by unintended negative consequences, like being too sensitive to emotional cues in everyday life.

*Partners in research: This research was supported by grants to Mark A. Ellenbogen from the Canadian Institutes of Health Research and the Canada Research Chair program (supported by the Social Sciences and Humanities Research Council of Canada). Christopher Cardoso is supported by a scholarship from the Fonds de Recherche en Santé du Québec.*

Watch Concordia researcher Christopher Cardoso explain [the links between oxytocin and oversensitivity](http://www.sciencedaily.com/releases/2014/01/140122134148.htm)

<http://www.sciencedaily.com/releases/2014/01/140122134148.htm>

### Humanity's Most Recent Common Male Ancestor Emerged Earlier Than Thought: 209,000 Years Ago, Study Finds

*New research finds that humanity's most recent common male ancestor emerged some 209,000 years ago -- earlier than many scientists previously thought.*

Our most recent common male ancestor emerged some 209,000 years ago -- earlier than many scientists previously thought, according to new research from the University of Sheffield.

The pioneering study, conducted by Dr Eran Elhaik from the University of Sheffield and Dr Dan Graur from the University of Houston, also debunked the discovery of the Y chromosome that supposedly predated humanity.

In the new research, published in the *European Journal of Human Genetics*, Dr Elhaik and Dr Graur used conventional biological models to date our most recent common male ancestor 'Adam' in his rightful place in

evolutionary history. The ground breaking results showed that this is 9,000 years earlier than scientists originally believed.

Their findings put 'Adam' within the time frame of his other half 'Eve', the genetic maternal ancestor of humankind. This contradicts a recent study which had claimed the human Y chromosome originated in a different species through interbreeding which dates 'Adam' to be twice as old.

Debunking unscientific theories is not new to Dr Elhaik. Earlier this year he debunked Hammer's previous work on the unity of the Jewish genome and together with Dr Graur they refuted the proclamations made by the ENCODE project on junk DNA.

"We can say with some certainty that modern humans emerged in Africa a little over 200,000 years ago," said Dr Elhaik.

"It is obvious that modern humans did not interbreed with hominins living over 500,000 years ago. It is also clear that there was no single 'Adam' and 'Eve' but rather groups of 'Adams and 'Eves' living side by side and wandering together in our world."

Dr Elhaik added: "We have shown that the University of Arizona study lacks any scientific merit. "In fact, their hypothesis creates a sort of 'space-time paradox' whereby the most ancient individual belonging to Homo sapiens species has not yet been born. If we take the numerical results from previous studies seriously we can conclude that the past may be altered by the mother of 'Adam' deciding not to conceive him in the future, thus, bringing a retroactive end to our species.

"Think of the movie Back to the Future, when Marty was worried that his parents would not meet and as a result he wouldn't be born -- it's the same idea. "The question to what extent did our human forbearers interbreed with their closest relatives is one of the hottest questions in anthropology that remains open."

*Eran Elhaik, Tatiana V Tatarinova, Anatole A Klyosov, Dan Graur. The 'extremely ancient' chromosome that isn't: a forensic bioinformatic investigation of Albert Perry's X-degenerate portion of the Y chromosome. European Journal of Human Genetics, 2014; DOI: 10.1038/ejhg.2013.303*

[http://www.eurekalert.org/pub\\_releases/2014-01/yu-mdc012214.php](http://www.eurekalert.org/pub_releases/2014-01/yu-mdc012214.php)

### **Malaria drug combo could help prevent pregnancy complications in lupus patients**

#### ***Anti-malaria drug combination possibly useful in preventing pregnancy complications in women with lupus***

An anti-malaria drug combination might be useful in helping to prevent pregnancy complications in women with lupus and the related disorder antiphospholipid syndrome, Yale School of Medicine researchers have found in a new study published in the American Journal of Reproductive Immunology.

Circulating antibodies called antiphospholipid antibodies are normally produced by the body to recognize and attack bacteria and other microbe.

In those with lupus and/or antiphospholipid syndrome, however, these antibodies recognize and attack the body's own proteins, putting women at high risk for recurrent pregnancy loss and late gestational complications, such as preeclampsia.

Patients with lupus or antiphospholipid syndrome are often treated with the anti-malarial drug hydroxychloroquine. While the drug can be safely continued during pregnancy, it was unknown whether it might be beneficial in preventing pregnancy complications in women with lupus and/or antiphospholipid syndrome.

In this new study, senior author Vikki M. Abrahams, associate professor in the Department of Obstetrics, Gynecology & Reproductive Sciences at Yale, and first author and Yale medical student Caroline Albert explored whether the drug could treat obstetrical antiphospholipid syndrome.

Abrahams and Albert used a lab-based system to measure the detrimental effects of antiphospholipid antibodies on human placental trophoblast cell function.

"We found that hydroxychloroquine partially reversed some, but not all, of the detrimental effects of antiphospholipid antibodies on human placental cell function," said Abrahams.

"So perhaps some form of combination therapy that includes hydroxychloroquine may be beneficial to pregnant patients with lupus and/or antiphospholipid syndrome."

*Other authors on the study include William J. Schlesinger, Chez A. Viall, Melissa J. Mulla, Jan J. Brosens, and Lawrence W. Chamley.*

*The study was funded by grants from the Lupus Foundation of America and the March of Dimes. Caroline Albert was supported by the 2012 Lupus Foundation of America Gina M. Finzi Memorial Student Summer Fellowship.*

*Citation: American Journal of Reproductive Immunology (Jan. 2014)*

## Famine, Not Calcium Absorption, May Have Driven Evolution of Milk Tolerance in Europeans

*Ancient DNA from early Iberian farmers shows that the wideheld evolutionary hypothesis of calcium absorption was not the only reason Europeans evolved milk tolerance.*

Most of us grew up drinking milk. We were told it was the ultimate health drink. It is packed full of nutrients like calcium and other minerals, vitamins, including vitamin D, protein, fat and sugar in the form of lactose. In the West, people take milk drinking for granted because most people of European descent are able to produce the enzyme lactase in adulthood and so digest the milk sugar lactose. However, this is not the norm in much of the world, and was not the norm for our Stone Age ancestors. In fact, genetic data has shown that the ability of adults to produce the enzyme lactase has only evolved within the last ten thousand years under strong natural selection. Without this enzyme, consuming milk can lead to some unpleasant side effects like bloating, cramps, flatulence and diarrhea -- a condition known as lactose intolerance.

Why this trait -- known as lactase persistence -- has evolved so quickly has been something of a mystery. Archaeologists and anthropologists have shown that lactase persistence evolved in pastoralist populations, and it is easy to see why; there's not a lot of point being able to digest lactose if you're not consuming milk. But why was it such an advantage for our ancestors? This week in the journal *Molecular Biology and Evolution*, Oddný Sverrisdóttir of the Evolutionary Biology Centre at Uppsala University, and colleagues, have taken us a little closer to answering this question.

For a long time scientists and clinicians thought the main advantage in Europe was to enable early farmers to avoid the consequences of calcium deficiency; milk is an amazing source of calcium and there is a bit of vitamin D in there too (vitamin D is necessary for calcium absorption). What's more those early European farmers, especially in the low sunlight regions of the North, would have had trouble making sufficient vitamin D in the skin throughout most of the year, and it's widely thought there was not a lot of vitamin D in their mainly cereal-based diet. "For them, milk could have been the new superfood," says Sverrisdóttir.

But what about our cousins in sunny Spain? They have plenty enough sunlight for most of the year to make vitamin D, and yet still many are lactase persistent. Sverrisdóttir and colleagues obtained DNA from the bones of early Spanish farmers and they couldn't find the mutation that causes lactase persistence in Europeans (LCT - 13910\*T).

Getting DNA out of ancient bones can be difficult because DNA breaks down over time and old samples are very easily contaminated with the DNA from living people (archaeologists, lab researchers etc.). However, the samples used in this study have been proven to be of very good quality.

"We have worked with this material for several studies now and the DNA preservation in these samples is excellent" says Anders Götherström of Stockholm University, a co-author on the study.

To see how much natural selection was needed to drive lactase persistence up to today's frequencies in that Iberia, Sverrisdóttir contacted her colleague Professor Mark Thomas in London. Using computer simulations they found that the answer was, "a lot"!

"But here's the thing," says Sverrisdóttir, "if natural selection is driving lactase persistence evolution in a place where people have no problems making vitamin D in their skin, then clearly the vitamin D and calcium explanation (known as the calcium assimilation hypothesis) isn't cutting it. So while the calcium assimilation hypothesis may have some relevance in Northern Europe it's clearly not the whole story."

"The evolution of lactase persistence is one of the best known and most dramatic examples of recent human evolution. One of the ironies of working in this area is that we know it happened but we still don't fully know why" says Sverrisdóttir. Lactase persistence is found at highest frequencies in southern Sweden and in Ireland. Given that calcium absorption is not the only reason why this trait evolved so rapidly, Sverrisdóttir and colleagues have proposed another cause:

Although most early European farmers would not have been lactase persistent, they would still have been able to consume fermented milk products such as yoghurt and cheese, because fermentation converts much of the lactose into fats. But in famine conditions, such as when crops fail, they are likely to have eaten all the fermented milk foods, leaving only the more high-lactose products. This would have caused the usual lactose intolerance symptoms such as diarrhea. Diarrhea in healthy people is not usually life-threatening, but in severely malnourished individuals it certainly can be. So famine could have led to episodes of very strong natural selection favoring lactase persistence.

*O. Sverrisdóttir, A. Timpson, J. Toombs, C. Lecoeur, P. Froguel, J. M. Carretero, J. L. Arsuaga Ferreras, A. Götherström, M. G. Thomas. Direct estimates of natural selection in Iberia indicate calcium absorption was not the only driver of lactase persistence in Europe. Molecular Biology and Evolution, 2014; DOI: 10.1093/molbev/msu049*

<http://www.medscape.com/viewarticle/819307?src=rss>

## Little Girl Is Brain Dead: Don't Give Family False Hope

### *When Death Has Happened*

Arthur L. Caplan, PhD

[Video](#)

Hi. I'm Art Caplan at the Division of Medical Ethics at the New York University (NYU) Langone Medical Center. What should you say to a family when someone dies? Many physicians want to approach the family with compassion and consideration for their loss and their grieving, but I believe that you have to be blunt and direct about the fact that death has happened. The Jahi McMath case, a 13-year-old girl who died after an elective tonsillectomy at Oakland Children's Hospital, certainly makes it clear that that is an important stance to take.

Jahi McMath went in for a tonsillectomy to help with her sleep apnea. She was obese and having problems with sleep, and as often happens, the physicians there recommended that she have her tonsils out, have some tissue removed to open up the airway. Something went terribly wrong. She bled a lot. She had a heart attack. Her brain hemorrhaged. The doctors examined her and determined according to brain-death protocols that she was brain dead. They came out and told the family that she was brain dead and the decision now had to be made about removing life support. The family was angry, shocked, and despondent, and this was a strongly religious family. They heard "brain death, kind of dead, sort of dead, but maybe not really dead" and then they heard the term "life support" and said that they didn't want doctors to take life support away from their little girl. That case turned into a fiasco. They hired a lawyer. They fought with Oakland Children's Hospital about removing the ventilator from Jahi. Ultimately they got courts involved that required that the ventilator be continued, and the girl's body was removed from Oakland Children's Hospital and sent to an unknown facility where, apparently, ventilation would continue despite the fact that a death certificate had been written for Jahi weeks before and an independent expert had been called in by the courts to verify brain death.

### **Brain Death Is Death**

It's very important to be clear about a couple of things. If you are going to tell someone that a person has died, you have to say death, not brain death. You have to say they have died.

If they ask, "How do you know?" you can say, "We have done a brain death protocol on the patient," or tell them that the person died due to cardiac and respiratory arrest. Being very clear that death has come is important even when trying to be considerate of a family's feelings. Families are going to have heard on the news about all kinds of people in comas or permanent vegetative states coming back, waking up, or somehow being interactive. They will confuse that with brain death, so it's very important to be clear that brain death is death. It has no relationship to other states of brain injury.

Sometimes a metaphor is useful. I sometimes say to families, "Coma is like having a TV set with a picture on it, but it was flipping or you couldn't see it very clearly because there are lines through it, but maybe it can be fixed and the TV set can come back. Permanent vegetative state is all snow on the screen; it's not going to get repaired. There is still some activity but nothing is going to bring the TV back to life. Brain death is the TV set unplugged, with no electrical activity." Whether you like that metaphor or something else, being very clear with families about what the difference is is critical, because they may be inclined to confuse brain death with other states.

### **No "Life Support" for "Brain Death"**

"Life support" is a term I would use very judiciously around families. They hear life and they want to pursue life. You have to say that "artificial support" is going to be discontinued. I would not use the term "life support" around families when it's time to stop.

The McMath case reminds us of one other very important consideration with brain death. Brain death is death, and if you look at the way the media covered that case, there was a headline that appeared that said, "Little girl pronounced brain dead; the issue now is when should she die?" The public doesn't necessarily understand the difference between brain death, coma, and other forms of brain injury, so in talking not only to families but in talking to the media, in talking to the community, in talking at your church or your synagogue, temple, or mosque about what brain death is, it's very important to educate people that there are 2 ways that doctors determine that someone has died.

One is brain death, a total irreversible loss of all brain function. The other is when cardiac and respiratory function are permanently lost. The public needs education, and families need direct blunt conversation, even with caring and compassion coming along with that. Brain death is a flat line. We have to make sure that bereaved families and the public understand that.

I'm Art Caplan at the Division of Medical Ethics at the NYU Langone Medical Center. Thanks for watching.

<http://phys.org/news/2014-01-scotland-glacier.html>

## Scotland's last glacier discovered

*A glacier was still in place in Scotland within the last 400 years - some 11,000 years less than previously thought - a scientist at the University of Dundee has discovered.*

Phys.org - It had long been understood that Britain's last glaciers melted around 11,500 years ago. However, geographer Dr Martin Kirkbride, based in the School of Environment at the University of Dundee, has now established that a glacier was in place in the Cairngorms possibly as recently as the 18th century.

Using a technique called cosmogenic  $^{10}\text{Be}$  dating, Dr Kirkbride has shown that a small glacier in a Cairngorm corrie piled up granite boulders to form moraine ridges within the last few centuries, during the period of cool climate known as the Little Ice Age.



*Picture shows the corrie in the Cairngorms examined by Dr Kirkbride*

'Our laboratory dating indicates that the moraines were formed within the last couple of thousand years, which shows that a Scottish glacier existed more recently than we had previously thought,' said Dr Kirkbride.

'The climate of the last few millenia was at its most severe between 1650 and 1790. There are some anecdotal reports from that time of snow covering some of the mountain tops year-round. What we have now is the scientific evidence that there was indeed a glacier.' Scientists had speculated that glaciers may have re-formed in the Highlands around the time of this Little Ice Age but hard evidence has proved to be elusive.

Dr Kirkbride teamed up with Dr Jez Everest at the British Geological Survey in Edinburgh, and the Cosmogenic Isotope Analysis Facility at the Scottish Universities Environmental Reactor Centre in East Kilbride, to carry out the research.

Dr Everest said, 'This is exciting news, as for the first time we have shown that climatic conditions in Scotland allowed glaciation within the last half millennium, at a time when other glaciated areas, such as Scandinavia, Iceland and the Alps saw their glaciers grow to some of their largest sizes since the end of the last Ice Age. This has great importance when we start to reconstruct climate change in Scotland and the wider region over the last few centuries.' The dating technique estimates the time since quartz crystals in granite boulders were exposed at the Earth's surface, based on measuring the concentration of beryllium-10 isotopes which form when the rock surface is bombarded by cosmic rays from deep space.

Dr Kirkbride's discovery is backed up by a parallel study by Dr Stephan Harrison (University of Exeter) and Dr Anne Rowan (University of Aberystwyth). They have developed a numerical climate model to simulate Little Ice Age climate in the Cairngorms, allowing them to calculate how much cooler and snowier the winter weather must have been to cause glaciers to form. The models show that small glaciers would have been created in the corries by a cooling of air temperatures by 1.5degreesC and precipitation increasing by ten per cent.

Dr Harrison said, 'Our findings show that the Cairngorm mountains were probably home to a number of small glaciers during the last few hundred years - around 11,000 years later than previous evidence has suggested. It may be that such glaciers also existed in the Scottish Highlands and elsewhere during other cold periods after the main ice sheets had disappeared. 'Present climate warming means there is little chance of a return of glacier ice to the Highlands for the foreseeable future.'

Both studies are published in the latest issue of the journal *The Holocene*.

<http://www.wired.com/wiredscience/2014/01/ceres-water-jets/>

## Water Plumes Discovered on the Solar System's Largest Asteroid

*The largest object in the asteroid belt, Ceres, is shooting out wisps of water at a prodigious rate.*

By Adam Mann

This unexpected finding allows Ceres to join other small bodies in the solar system, including Saturn's moon Enceladus and Jupiter's moon Europa, as an icy world with gushing jets.

Because of its mass, Ceres is classified as a dwarf planet, so it's more like frozen Pluto and less like the lumpy potato-shaped objects that we typically think of as hanging out in the asteroid belt. Scientists have long suspected that the object contains an abundance of frozen water, roughly the same amount as all the fresh water on Earth. Recent observations with the European Space Agency's Herschel space observatory showed for the first time unmistakable signatures of water vapor shooting out from Ceres.

Water jets have been spotted on asteroids and comets before, perhaps most famously on comet Hartley 2, which was photographed by NASA's Deep Impact spacecraft as it flew by in 2010. Icy objects are known to heat up as they approach the sun, producing the watery outflow. Plumes on moons such as Enceladus and Europa are thought to form as tidal forces from the mass of Saturn and Jupiter squeeze and release the tiny worlds. But

Ceres is not barreling toward our central star nor does it orbit close to a massive planet, which presents scientists with something of a conundrum: What is powering these jets?

It's possible that sun is responsible for some of the activity. Like any object in orbit around the sun, Ceres swings closer and farther at different times. Herschel saw no plumes when Ceres was farthest from the sun. Scientists also suspect that decaying radioisotopes could be heating the asteroid's subsurface, creating cryovolcanoes, which act like normal volcanoes except that they spew ice and water vapor instead of molten rock.

The discovery of Ceres' plumes comes at a fortuitous time. NASA currently has a probe, the Dawn spacecraft, speeding toward the object. Dawn will arrive and enter orbit around Ceres in 2015, giving researchers a front-row view of the activity. Dawn previously visited Vesta, the second largest object in the asteroid belt. These two worlds could not be more contrary to one another, with Vesta being a rocky world that has clear indications of heating and volcanic eruptions. Because both objects orbit out approximately 2.5 times the distance between the Earth and the sun, figuring out why one world is icy and the other rocky will be a major topic of Dawn's research.

The current best guess for the two asteroids' opposite appearance is that Ceres formed much farther out from the sun, where the colder environment allowed it to hold on to its ice. According to the Nice model of the solar system's origin (named for the town in France, not the enjoyable formation scenario) the gas giants such as Jupiter and Saturn formed far from their current positions. As these enormous objects migrated around in the early solar system, they scattered everything else like billiard balls and caused objects such as Ceres and Vesta - which formed far from one another - to come much closer together.

<http://www.wired.com/wiredscience/2014/01/mrsa-col-cafo/>

### **Almost Three Times the Risk of Carrying MRSA from Living Near a Mega-Farm**

*In the long fight over antibiotic use in agriculture, one of the most contentious points is whether the resistant bacteria that inevitably arise can move off the farm to affect humans.*

By [Marvyn McKenna](#)

Most of the illnesses that have been associated with farm antibiotic use - [resistant foodborne illness](#), for example - occur so far from farms that opponents of antibiotic control find them easy to dismiss. So whenever a research team can link resistant bacteria found in humans with farms that are close to those humans, it is an important contribution to the debate.

A team from the University of Iowa, Iowa City Veterans Affairs, and Kent State University have done just that. In next month's *Infection Control and Hospital Epidemiology*, they survey 1,036 VA patients who lived in rural Iowa and were admitted to the Iowa City facility in 2010 and 2011. Overall, among those patients, 6.8 percent were carrying MRSA, drug-resistant staph, in their nostrils. But the patients' likelihood of carrying MRSA was 2.76 times higher if they lived within one mile of a farm housing 2,500 or more pigs.

They say:

The increasing populations of swine raised in densely populated CAFOs and exposed to antibiotics presents opportunities for drug-resistant pathogens to be transmitted among human populations. Our study indicates that residential proximity to large numbers of swine in CAFOs in Iowa is associated with increased risk of MRSA colonization. Some important things to unpack here:

- ***MRSA (formally, methicillin-resistant Staphylococcus aureus) often "colonizes" people - takes up residence on the skin or in the nostrils - before it causes an infection. Studies have shown repeatedly that being colonized with MRSA increases the risk of contracting a difficult-to-treat infection.***
- ***Because of that risk, and because MRSA spreads easily in hospitals, the VA since 2006 has required facilities to screen all incoming patients to see whether they are carrying MRSA and thus are posing a risk to other patients.***
- ***MRSA is frequently found in the vicinity of pigs: not just MRSA ST398, the specific resistant variety that was first identified in pig farmers in the Netherlands in 2004, but the garden-variety community forms as well.***
- ***And Iowa has a lot of pigs: 19 million, according to the US Department of Agriculture, housed in about 7,000 "CAFOs" (for confined or concentrated animal-feeding operations), which the US Environmental Protection Agency defines as a facility of at least 1,000 pigs, though most are many thousands larger.***

(If you'd like to know more about MRSA, including the "livestock-associated "pig MRSA" variety, I [wrote a book](#). OK, back to this paper.)

The authors, led by Margaret Carrel, PhD, initially identified 2,996 patient admissions in that 2-year period, and then winnowed out any patients who lived in cities as well as any whose addresses could not be confirmed and plotted using geo-coding. That left them with 1,746 samples taken from 1,036 patients, of which 119 - 6.8 percent - were positive for MRSA. That was a red flag to begin with, because MRSA colonization in the general population is less than 2 percent.



Using data from the Iowa Department of Natural Resources for the locations of very large pig-raising facilities, they then sorted the patients by the distance of their homes from pig CAFOs. Initially, patients who lived 1 mile or less from a CAFO were 1.8 times more likely to be colonized. When the team cleaned up the data - accounting for patients who came into the hospital more than once in that 2-year period, and also adjusting for the known likelihood that elderly patients, who are likely to be in a VA facility, have higher colonization rates - they came up with a relative risk of 2.76.

This is not the first time that MRSA has been found in people who work on farms or live in the vicinity of them. Last year, a study found "pig MRSA" in [workers from North Carolina hog farms](#), and another identified it in [workers in Iowa and Illinois](#). Meanwhile, a [third study published just in November](#) found MRSA among people who lived in the vicinity of fields where swine manure was being applied. And last year, a [group in Germany identified](#) MRSA in people who lived near hog farms but did not have contact with animals.

None of these studies have been able to trace with precision how workers and neighbors are acquiring MRSA. The authors of the newest study say:

Although the exact mechanism by which residential proximity to large swine CAFOs increased risk of MRSA is unknown, it appears that there is potential for drug-resistant strains of *S. aureus* in animals to transmit to people living at close distances. For example, a 55-pound or greater hog can produce upward of 40 2 (see [Update](#)) gallons of manure a day. Typically, in Iowa, manure is spread on surrounding fields, and MRSA can be aerosolized from this manure to human food or water sources.

And they add:

Residential proximity to CAFOs could be risky in ways other than simply direct exposure to preexisting livestock-associated *S. aureus* strains, including via exposure to antibiotic residues via air or water, application of manure containing residues near their homes.

As last year ended, a number of food-policy writers noted that 2013 marked the first time that discussion of agricultural use of antibiotics - and the unintended consequences of that use - really emerged into mainstream discourse. Papers like this can move that process along. Throughout the decades-long discussion of farm antibiotics, the challenge has been linking the externalized costs of those antibiotics back to their use on the farm. The more those off-farm effects are elucidated, the more complete and transparent the discussion of on-farm use ought to become.

*(Update: Eli Perencevich, the paper's senior author, got in touch to say that an error was edited into the paper when it was cut for length. The correct amount of manure would be 1-2 gallons a day, as noted in this [paper from the Clemson University Extension](#) by Chastain et al.)*

*Cite: Carrel M, Schweizer ML, Sarazin MV, Smith TC, Perencevich EN. [Residential Proximity to Large Numbers of Swine in Feeding Operations Is Associated with Increased Risk of Methicillin-Resistant Staphylococcus aureus Colonization at Time of Hospital Admission in Rural Iowa Veterans](#). *Infect Control Hosp Epidemiol* 2014;35(2).*

<http://www.bbc.co.uk/news/health-25849628>

## Central heating may make you fat, say researchers

***Having the central heating on may be contributing to our ballooning waistlines, Dutch researchers suggest.***

By James Gallagher Health and science reporter, BBC News

They say higher temperatures in homes, offices and hospitals provide more comfort, but mean bodies no longer need to burn extra calories to keep warm.

A Maastricht University Medical Centre group says 19C (66F) is sufficient to provide the right balance.

However, some argue that turning down the thermostat would merely prompt people to eat more.

The weight loss idea, proposed in Trends in Endocrinology and Metabolism, comes down to energy balance.

People will gain weight if they consume more calories in food than they burn off in day-to-day life.

### **Cooler and thinner?**

The report said people spent 90% of their time indoors and yet "we cool and heat our dwellings for maximal comfort while minimising our body energy expenditure necessary to control body temperatures". The energy balance is shifted towards weight gain and can require a drop in temperature to help burn off some calories.

Dr Wouter van Marken Lichtenbelt told the BBC: "19C is enough - and not for the whole day.

"Energy increases were in the order of 6% in mild cold, and in the long term that could really make a difference.

"It could be a substantial influence and help in combination with food changes and exercise."

He said people could "try turning the thermostat down" at home or "go outside".

About two in every three adults in the UK are classed as overweight or obese, and it is a growing problem globally. Cases have quadrupled to about one billion in the developing world since 1980.

### **Cold comfort**

However, temperature control may not be the perfect solution and is the source of some debate.

Dr Michael Daly, who investigated the issue at the University of Stirling, told BBC News: "If you didn't compensate you would lose weight, but that's not really how it happens. You will want a chocolate bar." "Also, studies suggest that in cold indoor temperatures you are more likely to get a stroke, and there is a [overall] winter mortality effect."

His research on 100,000 homes in England suggested people in houses heated above 23C tended to be slightly thinner, because at this point the body needed to lose heat - and sweating used up energy.

He said higher temperatures also lowered appetite and the amount of food being consumed.

Tam Fry, from the UK's National Obesity Forum, argued: "A cold environment switches on brown fat deposits, which are said to generate 300 times more heat than any organ in the body.

"They are its natural thermal resource. The heat kept us warm as babies and is still capable of keeping us warm now. "Losing weight at the same time is a bonus. Turn your stat down now and see for yourself."

<http://phys.org/news/2014-01-japan-cosmic-rays-nuclear-fuel.html>

### **Japan researchers use cosmic rays to see nuclear fuel**

*Japanese researchers said Thursday they had succeeded in using cosmic rays to find nuclear fuel inside a reactor, a technology that might be helpful in the complicated decommissioning at Fukushima.*

By observing the way the particles behaved near reactors, container vessels and spent fuel pools, they were able to obtain a clear visual picture of the fuel, they said. "We are conducting this study carefully as this enables you to find where nuclear fuel is anywhere in the world," said Fumihiko Takasaki, a researcher at the High Energy Accelerator Research Organisation, or KEK, one of the laboratories involved in the research.

The technology could help Tokyo Electric Power Co. in the clean-up at its Fukushima Daiichi power plant, he told AFP by telephone. A massive earthquake and subsequent tsunami knocked out cooling systems at the power station, sparking reactor meltdowns that contaminated land, air and the sea.

Engineers working on the decades-long decommissioning are faced with a series of difficulties, not least of which is that they do not know exactly where the molten fuel is inside the battered reactors.

Present technology is not robust enough to allow them to get a look inside the units, where some fear that fuel has melted through containment vessels and possibly into the ground underneath.

KEK, working jointly with University of Tokyo, University of Tsukuba and Tokyo Metropolitan University, observed particles called muons in experiments.

Muons are constantly falling on the earth and move without hindrance through water, human bodies and many other objects. But substances with high density such as nuclear fuel reduce their penetration.

A team of researchers monitored muons at three locations outside an off-line nuclear plant in Ibaraki prefecture, east of Tokyo, from February 2012 to December 2013.

They tracked where muon penetration was blocked to produce the image of nuclear fuel at the plant. Takasaki said the team would propose use of the system to Tokyo Electric Power, adding observations at some five locations for less than two months would enable them to produce visual images of nuclear fuel at Fukushima.

<http://bit.ly/1jvb2Zl>

### **Ice-age animals live on in Eurasian mountain range**

*IT'S the land that time forgot. Not only have conditions in the Altai-Sayan region in central Asia barely changed since the last ice age, but the mix of mammals that lives there is also almost the same.*

23 January 2014 by Colin Barras

Věra Pavelková Řičánková and colleagues at the University of South Bohemia in České Budějovice, Czech Republic, compiled lists of mammals living at 14 sites across Eurasia. They compared them with mammals that lived at seven Eurasian sites during the last glacial period 35,000 to 12,000 years ago.

The team discovered that the combination of mammals found together in the Altai and Sayan mountains of western Mongolia and southern Russia – such as horses, reindeer, saiga antelopes and wolverines – is similar to the ancient glacial communities. There are a few obvious differences, however, such as the lack of mammoths. These animals do not normally live together anymore, says Pavelková Řičánková. She says the Altai-Sayan is one of the last places on Earth to retain an ice age fauna (PLoS One, doi.org/q2n).

"You've basically got a really good modern analogue for the Pleistocene communities," says John Stewart of the University of Bournemouth, UK.

The Altai-Sayan has not been fully explored, so could hold more surprises. In 2010, snails thought to have died out when the ice melted were found alive there (Journal of Biogeography, doi.org/d4vn4n).

The cold, arid climate is key to the animal community, says Pavel Tarasov of the Free University of Berlin, Germany. The last ice age had a similarly dry climate, so Eurasia was surprisingly free from snow. Grasses flourished, helping feed the many herbivores.

However, there is a better model for conditions in northern Eurasia, says Tarasov. Wrangel, a small island in the Arctic Ocean, retains the plant community of that time. And the last mammoths lived on Wrangel, vanishing just 4000 years ago.

The Altai-Sayan may also have been vital for humanity's success. The mountains are home to Denisova cave, famous for the 2010 discovery of 50,000-year-old fossils of a new kind of human, the Denisovans. Since then, Neanderthal bones, and tools crafted by Homo sapiens have also been found in the cave. This makes it the only place where we know all three hominins lived.

That may be no coincidence, says Pavelková Řičánková. Conditions in the Altai-Sayan are fairly stable, so ancient humans may have taken refuge there and lived off the diverse game species.

"It looks increasingly like the east [of Eurasia] may have been a refugium," agrees Stewart.

When the ice age ended, the Altai people left the mountains and spread far and wide. Recent genetic evidence suggests that the first Americans can trace their ancestry to the Altai-Sayan (American Journal of Human Genetics, doi.org/fxq8gx).

[http://www.eurekalert.org/pub\\_releases/2014-01/wcmc-ap012214.php](http://www.eurekalert.org/pub_releases/2014-01/wcmc-ap012214.php)

### **A pill 'melts away' common form of leukemia**

#### ***Results on test of Idelalisib suggest CLL may be treated without toxic chemotherapy***

NEW YORK - Use of a twice-daily pill could turn a deadly blood cancer into a highly treatable disease, according to scientists at Weill Cornell Medical College who led a multinational research team. Their findings on the therapy for chronic lymphocytic leukemia (CLL), reported in the Jan. 22 issue of the New England Journal of Medicine, suggest that patients may be able to avoid having to take debilitating chemotherapy.

CLL is the most common form of leukemia, a cancer of the white blood cells. Some 16,000 Americans are diagnosed with CLL annually, and about 5,000 die of it each year.

"The treatment today for CLL can be worse than the disease, leading to a great deal of side effects and death.

This study, and others we have conducted on idelalisib, demonstrates that we may no longer need to use chemotherapy in CLL," says the lead investigator, Dr. Richard R. Furman, the Richard A. Stratton Associate Professor in Hematology and Oncology at Weill Cornell Medical College and a hematologist/oncologist at NewYork-Presbyterian/Weill Cornell Medical Center. "Even if this cancer remains incurable, it now can be treated as if it was a chronic disease with a pill, in the same way that high blood pressure is treated."

CLL is a cancer of B cells, which normally produce antibodies to fight infections. In CLL, B cells grow out of control, accumulating in all of a patient's organs. Patients are typically treated with a combination of chemotherapeutic drugs, to which they commonly respond. Unfortunately, patients ultimately relapse and require repeated cycles of chemotherapy. With each relapse, the remissions become shorter until the patient either no longer responds, or is forced to stop taking the drugs because of their side effects, which are a result of the medications' inability to differentiate between healthy cells and cancer cells.

In this randomized, double-blinded study, researchers from 19 medical centers in five countries tested a combination of two targeted drugs – medications that attack cancer without damaging healthy cells. They compared rituximab and idelalisib against rituximab and a placebo pill in 220 CLL patients who could not receive chemotherapy.

They found that those who received the combination of idelalsib and rituximab went longer without their disease worsening than those who received only rituximab, which has been the standard of care. Six months into the study, cancers in 93 percent of participants in the combination therapy group had not worsened, compared to 46 percent of those in the rituximab plus placebo group.

What's more, just 13 percent of patients treated with rituximab alone responded to the therapy, compared to 81 percent of the participants in the idelalisib treatment group. A higher percentage of patients who received both drugs – some 92 percent – were still alive a year after the study began, compared to 80 percent of those who only received rituximab. About the same percentage of patients in each group suffered side effects from the treatments.

The contrast was so significant that an independent data-monitoring committee halted the study early, in October 2013, so that all of the study participants could receive idelalisib.

"We saw incredible responses in patients who used idelalisib. Their cancer quickly melted away," says Dr. Furman, who is also director of Weill Cornell's CLL Research Center and an associate professor of medicine.

"These types of responses were even seen in patients who didn't respond to chemotherapy."

Chemotherapy-resistant patients are typically the most difficult patients to treat. "It is remarkable how quickly idelalisib worked in this heavily treated group of patients, many of whom were resistant to chemotherapy. We saw responses within a week," Dr. Furman says.

Previous studies led by Weill Cornell Medical College have shown equally significant results in newly diagnosed CLL patients and in those who could tolerate chemotherapy.

"Having a treatment like idelalisib, which is highly effective and well tolerated, and thus can generate responses in patients that are unable to tolerate treatment and unlikely to respond, indicates the potential for idelalisib in all patients," Dr. Furman says.

Idelalisib is the second targeted drug that Dr. Furman has tested that shows strong activity against CLL. He also studied ibrutinib in a phase 2 clinical trial reported last July in the *New England Journal of Medicine*. Both drugs, known as tyrosine kinase inhibitors, work on different targets within the same molecular pathway. Ibrutinib was approved for use in mantle cell lymphoma (another B cell lymphoma) in November by the U.S. Food and Drug Administration. Because it targets B cells, Dr. Furman is using the drug as a first-line treatment for all of his CLL patients -- even those who are newly diagnosed. "I am now able to avoid all use of chemotherapy in these patients, which has long been my goal," he says.

Dr. Furman believes idelalisib and ibrutinib will become the treatments of choice for all B cell lymphomas.

"These drugs will change the lives of many patients," he says. "Given the long-term toxicities of chemotherapy, leading to bone marrow failure, infections, and death, moving this therapy up front in the treatment algorithm and providing it to all patients is the next step."

*The study was funded by Gilead, for which Dr. Furman has served as an advisor.*

*Dr. Furman's co-authors include co-first authors Drs. Jeff P. Sharman, US Oncology Research, Springfield, OR, and Steven E. Coutre, University School of Medicine, Stanford, CA; Dr. Nicole Lamanna, Columbia University Medical Center; Dr. Bruce D. Cheson, Lombardi Comprehensive Cancer Center, Georgetown University Hospital, Washington, DC; Dr. John M. Pagel, Fred Hutchinson Cancer Research Center, University of Washington, Seattle, WA; Dr. Peter Hillmen, St. James's University Hospital, Leeds, United Kingdom; Dr. Jacqueline C. Barrientos, Department of Medicine, Hofstra North Shore-LIJ School of Medicine, New Hyde Park, NY; Dr. Andrew D. Zelenetz, Memorial Sloan-Kettering Cancer Center, New York, NY; Dr. Thomas J. Kipps, University of California San Diego, Moores Cancer Center, La Jolla, CA; Dr. Ian Flinn, Sarah Cannon Research Institute, Nashville, TN; Dr. Paolo Ghia, Università Vita-Salute San Raffaele, Istituto Scientifico San Raffaele, Milano, Italy; Dr. Herbert Eradat, David Geffen School of Medicine, University of California Los Angeles, Los Angeles, CA; Dr. Thomas Ervin, Florida Cancer Specialists, Englewood, FL; Bertrand Coiffier, Centre Hospitalier Lyon-Sud, Pierre-Benite, France; Dr. Andrew R. Pettitt, Royal Liverpool University Hospital, Liverpool, United Kingdom; Dr. Shuo Ma, Robert H. Lurie Comprehensive Cancer Center, Feinberg School of Medicine, Northwestern University, Chicago, IL; Dr. Stephan Stilgenbauer, University of Ulm, Ulm, Germany; Maria Aiello, Dave M. Johnson, Langdon L. Miller, and Drs. Daniel Li, Thomas M. Jahn and Roger D. Dansey, Gilead Sciences, Inc., Foster City, CA; Drs. Paula Cramer and Michael Hallek, University of Cologne, Cologne, Germany; Dr. Susan M. O'Brien, University of Texas MD Anderson Cancer Center, Houston, TX.*

<http://bit.ly/KNlnS1>

## **Alchemy May Not Have Been the Pseudoscience We All Thought It Was**

*Although scientists never could quite turn lead into gold, they did attempt some noteworthy experiments*

**By Richard Conniff**

Throughout much of the 20th century, the academic community had little patience with alchemists and their vain efforts to transmute base metals into gold. Any contemporary scholar who even dared to write about alchemy, historian Herbert Butterfield warned, would "become tinctured with the kind of lunacy they set out to describe."

But, in the 1980s, some revisionist scholars began arguing that alchemists actually made significant contributions to the development of science. Historians of science began deciphering alchemical texts - which wasn't easy. The alchemists, obsessed with secrecy, deliberately described their experiments in metaphorical terms laden with obscure references to mythology and history. For instance, text that describes a "cold dragon" who "creeps in and out of the caves" was code for saltpeter (potassium nitrate) - a crystalline substance found on cave walls that tastes cool on the tongue.

This painstaking process of decoding allowed researchers, for the first time, to attempt ambitious alchemical experiments. Lawrence Principe, a chemist and science historian at Johns Hopkins University, cobbled together obscure texts and scraps of 17th-century laboratory notebooks to reconstruct a recipe to grow a "Philosophers' Tree" from a seed of gold. Supposedly this tree was a precursor to the more celebrated and elusive Philosopher's Stone, which would be able to transmute metals into gold. The use of gold to make more gold would have seemed entirely logical to alchemists, Principe explains, like using germs of wheat to grow an entire field of wheat.

Principe mixed specially prepared mercury and gold into a buttery lump at the bottom of a flask. Then he buried the sealed flask in a heated sand bath in his laboratory.

One morning, Principe came into the lab to discover to his "utter disbelief" that the flask was filled with "a glittering and fully formed tree" of gold. The mixture of metals had grown upward into a structure resembling coral or the branching canopy of a tree minus the leaves.

What intrigues Principe and his fellow historians, though, is the growing evidence that the alchemists seem to have performed legitimate experiments, manipulated and analyzed the material world in interesting ways and reported genuine results. And many of the great names in the canon of modern science took note, says William Newman, a historian at Indiana University Bloomington.

Robert Boyle, one of the 17th-century founders of modern chemistry, "basically pillaged" the work of the German physician and alchemist Daniel Sennert, says Newman. When Boyle's French counterpart, Antoine-Laurent Lavoisier, substituted a modern list of elements (oxygen, hydrogen, carbon and others) for the ancient four elements (earth, air, fire and water), he built on an idea that was "actually widespread in earlier alchemical sources," Newman writes. The concept that matter was composed of several distinctive elements, in turn, inspired Sir Isaac Newton's work on optics - notably, his demonstration that the multiple colors produced by a prism could be reconstituted into white light.

Other scholars have at times responded to this idea with outrage. Principe was once confronted at an academic conference by a member of the audience who was "literally shaking with rage that I could defame Boyle in this way." But younger academics have taken up alchemy as a hot topic. The early revisionist research, says Principe, "cracked open the seal and said 'Hey, look everybody, this is not what you thought it was.'"

In a mark of that new acceptance, the Museum Kunst-palast in Düsseldorf, Germany, will present a show, beginning in April, that - along with alchemy-influenced artworks, from Jan Brueghel the Elder to Anselm Kiefer - will include an exhibit on Principe's "Philosophers' Tree" experiment.

Does this new view of alchemy make the great names in the early history of science seem more derivative and thus less great? "We were just talking in my class about the rhetoric of novelty," says Principe, "and how it benefits people to say that their discoveries are completely new." But that's not how scientific ideas develop. "They don't just sort of come to someone in a dream, out of nowhere. New scientific ideas tend to develop out of older ones by a slow process of evolution and refinement."

From that perspective, the scientific revolution may have been a little less revolutionary than we imagine. Better to think of it as a transmutation, like the alchemists' quest to change lead into gold.

<http://www.sciencedaily.com/releases/2014/01/140122112624.htm>

### **Men Forget Most**

*If your husband is absent-minded, forgets your wedding anniversary or the name of your new neighbor, don't worry.*

You are not the only one with a forgetful man in the house. Even researchers were surprised by how much men forget. "It was surprising to see that men forget more than women. This has not been documented before. It was also surprising to see that men are just as forgetful whether they are 30 or 60 years old. The results were unambiguous," says Professor Jostein Holmen, from the Norwegian University of Science and Technology (NTNU) in Trondheim. The results were published in BMC Psychology in late 2013.

#### **What did I do one year ago?**

Holmen and his co-workers asked nine questions about how well people think they remember as a part of a large longitudinal population health study conducted in mid-Norway called HUNT3.

HUNT3 is one of the largest health studies ever performed, with answers from over 48,000 people as part of the research material.

The participants were asked how often they had problems remembering things, whether they had problems with remembering names and dates, if they could remember what they did one year ago and if they were able to remember details from conversations. Men reported the most problems for eight out of nine questions.

"We have speculated a lot about why men report more frequent problems with remembering than women do, but have not been able to find an explanation. This is still an unsolved mystery," says Holmen.

#### **Higher education associated with better memory**

Women have the same problems with remembering as men do, but to a lesser extent. Names and dates are also hardest to remember for women. These problems accelerate with age, but to a much lesser extent than the researchers believed before. Women forget just as much whether they are 30 or 50 years old.

The study also shows that people who are more highly educated forget less than those with less education.

People who suffer from anxiety or depression forget more than other people do. This is true for people of both sexes.

#### **Importance for dementia**

Memory problems begin to accelerate overall in the 60-70 year-old group, the researchers found. Holmen wants to see whether people who self-reported problems with remembering at a younger age are also at a higher risk of developing dementia.

"That was the reason why we included these questions. It is important to emphasize that we still don't know what clinical importance these problems with remembering have. But we might know this in a few years. Problems with remembering at a younger age might not have any importance either. I know this from my own experience, but now I know that I am not alone," Holmen says.

Holmen, by the way, was born in 1947.

*Jostein Holmen, Ellen Langballe, Kristian Midthjell, Turid Holmen, Arvid Fikseanet, Ingvild Saltvedt, Kristian Tambs. Gender differences in subjective memory impairment in a general population: the HUNT study, Norway. BMC Psychology, 2013; 1 (1): 19 DOI: 10.1186/2050-7283-1-19*

<http://www.sciencedaily.com/releases/2014/01/140122133419.htm>

## Scientists Find Estrogen Promotes Blood-Forming Stem Cell Function

***Scientists have known for years that stem cells in male and female sexual organs are regulated differently by their respective hormones.***

In a surprising discovery, researchers at the Children's Medical Center Research Institute at UT Southwestern (CRI) and Baylor College of Medicine have found that stem cells in the blood-forming system -- which is similar in both sexes -- also are regulated differently by hormones, with estrogen proving to be an especially prolific promoter of stem cell self-renewal.

The research, published in *Nature*, raises several intriguing possibilities for further investigation that might lead to improved treatments for blood cancers and increased safety and effectiveness of chemotherapy.

Before the finding, blood-forming stem cells were thought to be regulated similarly in both males and females, according to the paper's senior author, Dr. Sean Morrison, Director of CRI, Professor of Pediatrics, and the Mary McDermott Cook Chair in Pediatric Genetics at UT Southwestern Medical Center.

However, while working in Dr. Morrison's laboratory as postdoctoral fellows, Dr. Daisuke Nakada, the first and co-corresponding author of the study, and Dr. Hideyuki Oguro discovered that blood-forming stem cells divide more frequently in females than in males due to higher estrogen levels. The research, conducted using mice, demonstrated that the activity of blood-forming stem cells was regulated by systemic hormonal signals in addition to being regulated by local changes within the blood-forming system.

"This discovery explains how red blood cell production is augmented during pregnancy," said Dr. Morrison. "In female mice, estrogen increases the proliferation of blood-forming stem cells in preparation for pregnancy. Elevated estrogen levels that are sustained during pregnancy induce stem cell mobilization and red cell production in the spleen, which serves as a reserve site for additional red blood cell production."

The study involved treating male and female mice over a period of several days with amounts of estrogen needed to achieve a level consistent with pregnancy. When an estrogen receptor that is present within blood-forming stem cells was deleted from those cells, they were no longer able to respond to estrogen, nor were they able to increase red blood cell production. The results demonstrate that estrogen acts directly on the stem cells to increase their proliferation and the number of red blood cells they generate.

"If estrogen has the same effect on stem cells in humans as in mice, then this effect raises a number of possibilities that could change the way we treat people with diseases of blood cell-formation," said Dr. Morrison. "Can we promote regeneration in the blood-forming system by administering estrogen? Can we reduce the toxicity of chemotherapy to the blood-forming system by taking into account estrogen levels in female patients? Does estrogen promote the growth of some blood cancers? There are numerous clinical opportunities to pursue."

*Daisuke Nakada, Hideyuki Oguro, Boaz P. Levi, Nicole Ryan, Ayumi Kitano, Yusuke Saitoh, Makiko Takeichi, George R. Wendt, Sean J. Morrison. Oestrogen increases haematopoietic stem-cell self-renewal in females and during pregnancy. Nature, 2014; 505 (7484): 555 DOI: 10.1038/nature12932*

<http://www.sciencedaily.com/releases/2014/01/140122133423.htm>

## Hearing Loss Linked to Accelerated Brain Tissue Loss

***Brain shrinkage seems to be fast-tracked in older adults with hearing loss***

Although the brain becomes smaller with age, the shrinkage seems to be fast-tracked in older adults with hearing loss, according to the results of a study by researchers from Johns Hopkins and the National Institute on Aging. The findings add to a growing list of health consequences associated with hearing loss, including increased risk of dementia, falls, hospitalizations, and diminished physical and mental health overall.

For the study, Frank Lin, M.D., Ph.D., and his colleagues used information from the ongoing Baltimore Longitudinal Study of Aging to compare brain changes over time between adults with normal hearing and adults with impaired hearing. The Baltimore Longitudinal Study of Aging was started in 1958 by the National Institute on Aging to track various health factors in thousands of men and women.

Previous research from other studies had linked hearing loss with marked differences in brain structure compared to those with normal hearing, both in humans and animals. In particular, structures that process information from sound tended to be smaller in size in people and animals with impaired hearing. Lin, an assistant professor at the Johns Hopkins University schools of medicine and public health, says it was unknown, however, whether these brain structural differences occurred before or after hearing loss.

As part of the Baltimore Longitudinal Study of Aging, 126 participants underwent yearly magnetic resonance imaging (MRI) to track brain changes for up to 10 years. Each also had complete physicals at the time of the first MRI in 1994, including hearing tests. At the starting point, 75 had normal hearing, and 51 had impaired hearing, with at least a 25-decibel loss.

After analyzing their MRIs over the following years, Lin and his colleagues, reporting in an upcoming issue of *Neuroimage*, say those participants whose hearing was already impaired at the start of the sub-study had accelerated rates of brain atrophy compared to those with normal hearing. Overall, the scientists report, those with impaired hearing lost more than an additional cubic centimeter of brain tissue each year compared with those with normal hearing. Those with impaired hearing also had significantly more shrinkage in particular regions, including the superior, middle and inferior temporal gyri, brain structures responsible for processing sound and speech.

That structures responsible for sound and speech are affected in those with hearing loss wasn't a surprise, says Lin -- shrinkage in those areas might simply be a consequence of an "impoverished" auditory cortex, which could become atrophied from lack of stimulation. However, he adds, these structures don't work in isolation, and their responsibilities don't end at sorting out sounds and language. The middle and inferior temporal gyri, for example, also play roles in memory and sensory integration and have been shown to be involved in the early stages of mild cognitive impairment and Alzheimer's disease.

"Our results suggest that hearing loss could be another 'hit' on the brain in many ways," Lin explains.

The study also gives some urgency to treating hearing loss rather than ignoring it. "If you want to address hearing loss well," Lin says, "you want to do it sooner rather than later. If hearing loss is potentially contributing to these differences we're seeing on MRI, you want to treat it before these brain structural changes take place."

Lin and his colleagues say they plan to eventually examine whether treating hearing loss early can reduce the risk of associated health problems.

<http://www.sciencedaily.com/releases/2014/01/140122202304.htm>

## **One Quarter of the World's Cartilaginous Fish, Namely Sharks and Rays, Face Imminent Extinction**

*New research finds that one quarter of the world's cartilaginous fish, namely sharks and rays, face extinction within the next few decades.*

One quarter of the world's cartilaginous fish, namely sharks and rays, face extinction within the next few decades, according to the first study to systematically and globally assess their fate.

The International Union for Conservation of Nature's (IUCN's) Shark Specialist Group (SSG), co-chaired by Nick Dulvy, a Simon Fraser University (SFU) Canada Research Chair in Marine Biodiversity and Conservation in British Columbia, conducted the study.

It was published in *Life* journal today.

Previous studies have documented local overfishing of some populations of sharks and rays. But this is the first one to survey their status through out coastal seas and oceans. It reveals that one-quarter (249) of 1,041 known shark, ray and chimaera species globally fall under three threatened categories on the IUCN Red List.

"We now know that many species of sharks and rays, not just the charismatic white sharks, face extinction across the ice-free seas of the world," says Dulvy. "There are no real sanctuaries for sharks where they are safe from overfishing."

Over two decades, the authors applied the IUCN's Red List categories and criteria to the 1,041 species at 17 workshops involving more than 300 experts. They incorporated all available information on distribution, catch, abundance, population trends, habitat use, life histories, threats and conservation measures.

Sharks and rays are at substantially higher risk of extinction than many other animals and have the lowest percentage of species considered safe. Using the IUCN Red List, the authors classified 107 species of rays (including skates) and 74 species of sharks as threatened. Just 23 percent of species were labeled as being Least Concern.

The authors identified two main hotspots for shark and ray depletion -- the Indo-Pacific (particularly the Gulf of Thailand), the Red Sea and the Mediterranean Sea.

"In the most peril are the largest species of rays and sharks, especially those living in relatively shallow water that is accessible to fisheries. The combined effects of overexploitation -- especially for the lucrative shark fin soup market -- and habitat degradation are most severe for the 90 species found in freshwater.

"A whole bunch of wildly charismatic species is at risk. Rays, including the majestic manta and devil rays, are generally worse off than sharks. Unless binding commitments to protect these fish are made now, there is a real risk that our grandchildren won't see sharks and rays in the wild."

Losing these fish will be like losing whole chapters of our evolutionary history says Dulvy. "They are the only living representatives of the first lineage to have jaws, brains, placentas and the modern immune system of vertebrates."

The potential loss of the largest species is frightening for many reasons, says Dulvy. "The biggest species tend to have the greatest predatory role. The loss of top or apex predators cascades throughout marine ecosystems." The IUCN SSG is calling on governments to safeguard sharks, rays and chimaeras through a variety of measures, including the following: prohibition on catching the most threatened species, science-based fisheries quotas, protection of key habitats and improved enforcement.

*N. K. Dulvy, S. L. Fowler, J. A. Musick, R. D. Cavanagh, P. M. Kyne, L. R. Harrison, J. K. Carlson, L. N. Davidson, S. V. Fordham, M. P. Francis, C. M. Pollock, C. A. Simpfendorfer, G. H. Burgess, K. E. Carpenter, L. J. Compagno, D. A. Ebert, C. Gibson, M. R. Heupel, S. R. Livingstone, J. C. Sanciangco, J. D. Stevens, S. Valenti, W. T. White. Extinction risk and conservation of the world's sharks and rays. eLife, 2014; 3 (0): e00590 DOI: 10.7554/eLife.00590*

[http://www.eurekalert.org/pub\\_releases/2014-01/cfb-drc012314.php](http://www.eurekalert.org/pub_releases/2014-01/cfb-drc012314.php)

### **Death row confessions and the last meal test of innocence**

#### ***Can last meals reveal more about individuals on death row than their taste preference?***

Some have argued there is significance embedded in death row last meal decisions. Famously, Ricky Ray Rector asked to save his untouched pecan pie for after his execution. This request sparked significant discussion about Rector's competency – on the basis of his food request. Similarly, in a documentary film about last suppers, artists Bigert and Bergstrom have claimed a connection between whether or not an individual chooses to have a last meal and his or her guilt. In each case, there is an assertion that last meals are relevant to the legitimacy of an execution. It is these signals that Cornell University researchers Kevin Kniffin and Brian Wansink examined in this self-funded study. In particular, they studied whether an individual who has accepted guilt—by apologizing or confessing—is more likely to indulge in a last meal. They also looked at how their meals differ from those who maintain that they are innocent.

The researchers hypothesized that those who perceived themselves as innocent would request fewer calories or decline to receive a last meal altogether. After analyzing the last meals of 247 people who were executed in the United States between 2002 and 2006, they found the hypothesis to be accurate. Those who denied guilt were 2.7 times more likely to decline a last meal than those who admitted guilt. Furthermore those who were admittedly guilty requested 34% more calories of food and were more likely to request brand name, comfort-food items.

Social circumstance often gives meals meaning, so it is logical that the last meals of those on death row may signify something beyond taste preference. While there are many factors that could contribute to last meal selection, this study is the first to provide evidence of a link between food selection and self-perceived guilt or innocence. These findings may be useful to the legal community in further assessing the innocence and perceived innocence of those who have received the death penalty in the past.

[http://www.eurekalert.org/pub\\_releases/2014-01/cumc-mdo012314.php](http://www.eurekalert.org/pub_releases/2014-01/cumc-mdo012314.php)

### **Moderate doses of radiation therapy to unaffected breast may prevent second breast cancers**

#### ***Moderate radiation doses can kill premalignant cells in the unaffected breast***

NEW YORK, NY - Survivors of breast cancer have a one in six chance of developing breast cancer in the other breast. But a study conducted in mice suggests that survivors can dramatically reduce that risk through treatment with moderate doses of radiation to the unaffected breast at the same time that they receive radiation therapy to their affected breast. The treatment, if it works as well in humans as in mice, could prevent tens of thousands of second breast cancers. The study, conducted by researchers at Columbia University Medical Center (CUMC), was published on December 20 in the online journal PLOS ONE.

"Over the past decades, we've had great success in treating breast cancer, and the 15-year survival rate is now 77 percent," said study leader David J. Brenner, PhD, director of CUMC's Center for Radiological Research and the Higgins Professor of Radiation Biophysics. "Unfortunately, breast cancer survivors have a several times higher risk of developing cancer in their other breast, compared with healthy women of the same age."



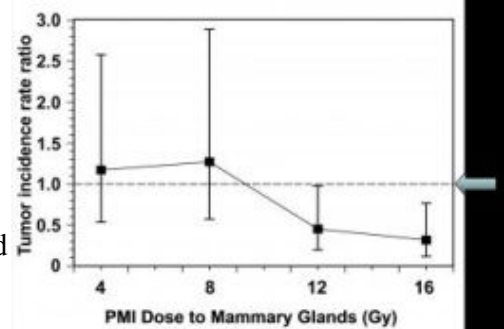
"While drugs such as tamoxifen and aromatase inhibitors can reduce the risk somewhat, at least for women with estrogen receptor-positive tumors, the long-term risks of a second breast cancer in the unaffected breast remain high. Because of these risks, approximately 10 to 20 percent of breast cancer survivors in the U.S. undergo prophylactic mastectomy of their other breast," said Dr. Brenner.

The idea for prophylactic mammary irradiation (PMI) of the unaffected breast stems from an earlier study of standard whole-breast irradiation after lumpectomy. In that study, Dr. Brenner found that radiation is highly effective at killing premalignant cells, not only in the quadrant of the breast where the primary tumor was located, but also in the other three quadrants, where premalignant cells are generally considered to be unrelated to the primary tumor. "So, we thought, why can't we treat the other breast with a moderate dose of radiation and kill any premalignant cells that could lead to second cancers?" said Dr. Brenner.

The critical question was whether treating the breast with a moderate dose of radiation would indeed lower the overall risk of a second cancer. "We know that there will be a balance between radiation killing premalignant cells and radiation producing premalignant cells, but it seemed that using the right radiation dose would put the balance strongly toward lowering the cancer risk," Dr. Brenner said.

The current study tested this hypothesis by performing PMI on transgenic mice that have a high risk of developing breast cancer, simulating the unaffected breast of a breast cancer survivor. Lead shields were positioned so that one side of each mouse was shielded from the radiation. As predicted, a moderate dose of radiation reduced the breast cancer risk in the treated side by a factor of about 3.

The researchers are now planning to test PMI in a clinical trial.



***Breast-cancer rates in breast cancer-prone mice whose mammary glands were treated with different doses of prophylactic mammary irradiation (PMI), compared with mice whose mammary glands were not treated. At moderate PMI doses of 12 or 16 Gy -- much lower than that used to treat the affected breast -- the breast cancer rate was reduced by about three-fold. Lab of David J. Brenner, Ph.D./Columbia University Medical Center.***

If PMI proves to be successful in patients, it could be used as an adjunct to tamoxifen or aromatase inhibitors for women with estrogen receptor-positive tumors and as a standalone therapy for those with estrogen-receptor negative tumors, who do not benefit from drug therapy. In either case, PMI could be performed concurrently with radiotherapy of the affected breast.

PMI could have a substantial clinical impact. At present, there are more than 2.6 million breast cancer survivors in the U.S., according to the American Cancer Society. "About 160,000 of these women are likely to develop cancer in their other breast," said Dr. Brenner. "If PMI does, in fact, reduce the incidence of cancer by three-fold, as suggested by our results, about 100,000 cases of breast cancer could be prevented."

"Whether PMI would work for women with BRACA1 or BRACA2 mutations, which greatly increase one's risk for breast and/or ovarian cancer, is another story," said Dr. Brenner. "We don't know that. Our next mouse study will look at the effects of PMI in BRACA1 mice."

The paper is titled, "Potential Reduction of Contralateral Second Breast-Cancer Risks by Prophylactic Mammary Irradiation: Validation in a Breast-Cancer-Prone Mouse Model." The other contributors are Igor Shuryak, Lubomir B. Smilenov, and Norman J. Kleiman, all at CUMC.

*The authors declare no financial or other conflicts of interests.*

*This study was supported by a Pilot Study Award Grant from the Irving Institute for Clinical and Translational Research, Columbia University, and by grant from NIH's National Institute of Allergy and Infectious Diseases (U19 AI67773).*

[http://www.eurekalert.org/pub\\_releases/2014-01/osu-mbe012314.php](http://www.eurekalert.org/pub_releases/2014-01/osu-mbe012314.php)

### **More benefits emerging for one type of omega-3 fatty acid: DHA**

***Study of omega-3 fatty acids concludes they may have an even wider range of biological impacts than previously considered***

CORVALLIS, Ore. – A study of the metabolic effects of omega-3 fatty acids, especially DHA, concludes that these compounds may have an even wider range of biological impacts than previously considered, and suggests they could be of significant value in the prevention of fatty liver disease.

The research, done by scientists at Oregon State University and several other institutions, was one of the first of its type to use "metabolomics," an analysis of metabolites that reflect the many biological effects of omega-3 fatty acids on the liver. It also explored the challenges this organ faces from the "Western diet" that increasingly is linked to liver inflammation, fibrosis, cirrhosis and sometimes liver failure.

The results were surprising, researchers say.

Supplements of DHA, used at levels that are sometimes prescribed to reduce blood triglycerides, appeared to have many unanticipated effects. There were observable changes in vitamin and carbohydrate metabolism, protein and amino acid function, as well as lipid metabolism.

Supplementation with DHA partially or totally prevented metabolic damage through those pathways often linked to the Western diet – excessive consumption of red meat, sugar, saturated fat and processed grains. The findings were published last month in PLOS One, an online professional journal.

"We were shocked to find so many biological pathways being affected by omega-3 fatty acids," said Donald Jump, a professor in the OSU College of Public Health and Human Sciences. "Most studies on these nutrients find effects on lipid metabolism and inflammation.

"Our metabolomics analysis indicates that the effects of omega-3 fatty acids extend beyond that, and include carbohydrate, amino acid and vitamin metabolism," he added.

Omega-3 fatty acids have been the subject of much recent research, often with conflicting results and claims. Possible reasons for contradictory findings, OSU researchers say, are the amount of supplements used and the relative abundance of two common omega-3s – DHA and EPA. Studies at OSU have concluded that DHA has far more ability than EPA to prevent the formation of harmful metabolites. In one study, it was found that DHA supplementation reduced the proteins involved in liver fibrosis by more than 65 percent.

These research efforts, done with laboratory animals, used a level of DHA supplementation that would equate to about 2-4 grams per day for an average person. In the diet, the most common source of DHA is fatty fish, such as salmon, mackerel or sardines.

The most recent research is beginning to break down the specific processes by which these metabolic changes take place. If anything, the results suggest that DHA may have even more health value than previously thought. "A lot of work has been done on fatty liver disease, and we are just beginning to explore the potential for DHA in preventing or slowing disease progression," said Jump, who is also a principal investigator in OSU's Linus Pauling Institute.

"Fish oils, a common supplement used to provide omega-3, are also not prescribed to regulate blood glucose levels in diabetic patients," he said. "But our studies suggest that DHA may reduce the formation of harmful glucose metabolites linked to diabetic complications."

Both diabetes and liver disease are increasing steadily in the United States. The American Liver Foundation has estimated that about 25 percent of the nation's population, and 75 percent of those who are obese, have nonalcoholic fatty liver disease. This can progress to nonalcoholic steatohepatitis, cirrhosis and cancer.

This study established that the main target of DHA in the liver is the control of inflammation, oxidative stress and fibrosis, which are the characteristics of more progressively serious liver problems. Omega-3 fatty acids appear to keep cells from responding to and being damaged by whatever is causing inflammation.

*Collaborators on this research were from OSU, the Baylor College of Medicine, Vanderbilt University Medical Center, and Metabolon, Inc. It was supported by the USDA and the National Institutes of Health.*

*Editor's Note: The study this story is based on is available online: <http://bit.ly/1dDuf7i>.*

[http://www.eurekalert.org/pub\\_releases/2014-01/afps-dsb012314.php](http://www.eurekalert.org/pub_releases/2014-01/afps-dsb012314.php)

### **Detecting sickness by smell**

***Humans are able to smell sickness in someone whose immune system is highly active within just a few hours of exposure to a toxin, according to new research published in Psychological Science, a journal of the Association for Psychological Science.***

According to researcher Mats Olsson of Karolinska Institutet in Sweden, there is anecdotal and scientific evidence suggesting that diseases have particular smells. People with diabetes, for example, are sometimes reported to have breath that smells like rotten apples or acetone.

Being able to detect these smells would represent a critical adaptation that would allow us to avoid potentially dangerous illnesses. Olsson wondered whether such an adaptation might exist already at an early stage of the disease. "There may be early, possibly generic, biomarkers for illness in the form of volatile substances coming from the body," explains Olsson.

To test this hypothesis, Olsson and his team had eight healthy people visit the laboratory to be injected with either lipopolysaccharide (LPS) — a toxin known to ramp up an immune response — or a saline solution. The volunteers wore tight t-shirts to absorb sweat over the course of 4 hours.

Importantly, participants injected with LPS did produce a noticeable immune response, as evidenced by elevated body temperatures and increased levels of a group of immune system molecules known as cytokines. A separate group of 40 participants were instructed to smell the sweat samples. Overall, they rated t-shirts from the LPS group as having a more intense and unpleasant smell than the other t-shirts; they also rated the LPS shirt as having an unhealthier smell.

The association between immune activation and smell was accounted for, at least in part, by the level of cytokines present in the LPS-exposed blood. That is, the greater a participant's immune response, the more unpleasant their sweat smelled.

Interestingly, in a chemical assay the researchers found no difference in the overall amount of odorous compounds between the LPS and control group. This suggests that there must have been a detectable difference in the composition of those compounds instead.

While the precise chemical compounds have yet to be identified, the fact we give off some kind of aversive signal shortly after the immune system has been activated is an important finding, the researchers argue. It grants us a better understanding of the social cues of sickness, and might also open up doors for understanding how infectious diseases can be contained.

*For more information about this study, please contact: Mats J. Olsson at [mats.j.olsson@ki.se](mailto:mats.j.olsson@ki.se).*

*Co-authors on this research include Johan Lundström, Amy Gordon, Bianka Karshikoff, Nishteman Hosseini, Kimmo Sorjonen, Caroline Olgart Höglund, Carmen Solares, Anne Soop, John Axelsson, and Mats Lekander of Karolinska Institutet; and Bruce Kimball of the Monell Chemical Sense Center in Philadelphia, Pennsylvania.*

*This study was supported by the Swedish Research Council; the Bank of Sweden Tercentenary Foundation; the Knut and Alice Wallenberg Foundation; the Osher Center for Integrative Medicine; the Swedish Heart-Lung Foundation; the Center for Allergy Research; the Petrus and Augusta Hedlund's Foundation; the Swedish Asthma and Allergy Foundation; the Stockholm Stress Center; and the Swedish Council for Working Life and Social Research.*

*The article abstract can be found online: <http://ps.sagepub.com/content/early/2014/01/21/0956797613515681.abstract>.*

*The APS journal Psychological Science is the highest ranked empirical journal in psychology. For a copy of the article "The Scent of Disease: Human Body Odor Contains an Early Chemosensory Cue of Sickness" and access to other Psychological Science research findings, please contact Anna Mikulak at 202-293-9300 or [amikulak@psychologicalscience.org](mailto:amikulak@psychologicalscience.org).*

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## **Almost 200 years later, are we living in the final days of the stethoscope?**

### ***World of medicine could be experiencing its final days of the stethoscope***

An editorial in this month's edition of *Global Heart* (the journal of the World Heart Federation) suggests the world of medicine could be experiencing its final days of the stethoscope, due to the rapid advent of point-of-care ultrasound devices that are becoming increasingly accurate, smaller to the point of being hand-held and less expensive as the years roll by. The editorial is by Professor Jagat Narula, Editor-in-Chief of *Global Heart* (Mount Sinai School of Medicine, New York, USA) and Associate Professor Bret Nelson, also of Mount Sinai School of Medicine, New York, USA.

Looking at the stethoscope (invented in 1816) and ultrasound (invented in the 1950s), with the the authors suggest that the stethoscope could soon be exiled to the archives of medical history. They say\*: "At the time of this writing several manufacturers offer hand-held ultrasound machines slightly larger than a deck of cards, with technology and screens modelled after modern smartphones." As the minimum size of an ultrasound continued to decrease, concerns about smaller machines having inferior image quality compared to devices many times larger and more expensive were over time outweighed by evidence that rapid diagnostic decisions could be made with portable machines. Today, more than 20 medical specialties include use of point-of-care ultrasound as a core skill, and that mounting evidence suggests that compared with the stethoscope ultrasound technology can reduce complications, assist in emergency procedures and improve diagnostic accuracy. The authors say: "Thus, many experts have argued that ultrasound has become the stethoscope of the 21st century. Why then, do we not see ultrasound machines in the coat pocket of every clinician? Several factors play a role. The ultrasound machines are expensive, and even clinicians enamored with the promise of point-of-care ultrasound must make a financial decision weighing the increased diagnostic accuracy against increased cost. In addition, point-of-care ultrasound is still a new field relative to traditional imaging. Many older clinicians completed training long before ultrasound use was part of standard practice for their specialty." Additionally, while the cheapest available stethoscopes are literally disposable (though many can cost hundreds of dollars), the cost of the cheapest ultrasound devices is still several thousand dollars, making roll-out, especially in developing nations, much more difficult. Yet the authors believe all the evidence shows that ultrasound can diagnose heart, lung, and other problems with much more accuracy than the 200-year-old stethoscope.

The authors conclude\*: "Certainly the stage is set for disruption; as LPs were replaced by cassettes, then CDs and .mp3s, so too might the stethoscope yield to ultrasound. Medical students will train with portable devices during their preclinical years, and witness living anatomy and physiology previously only available through simulation. Their mentors will increasingly use point-of-care ultrasound in clinical environments to diagnose illness and guide procedures. They will see more efficient use of comprehensive, consultative ultrasound as well- guided by focused sonography and not limited by physical examination alone. And as they take on

leadership roles themselves they may realise an even broader potential of a technology we are only beginning to fully utilize. At that point will the "modern" stethoscope earn a careful cleaning, tagging, and white-glove placement in the vault next to the artifacts of Laënnec, Golding Bird, George Cammann, and David Littmann? Or, as some audiophiles still maintain the phonograph provides the truest sound, will some clinicians yet cling to the analog acoustics of the stethoscope?"

<http://bit.ly/1dZCLiL>

## **Giant leaps of evolution make cancer cells deadly** *Understanding cancer's deadliest trait could stop it in its tracks*

23 January 2014 by Michael Slezak

Tumour cells take big genetic jumps called macromutations to become invasive "hopeful monsters". Treatment to block that evolution could be the next step

HOW does cancer do it? How does one little cell transform itself into an invader that rages out of control?

Surprisingly abruptly, according to new results that are pointing the way to Darwinian-inspired treatments.

When a cancer evolves the ability to metastasise, or invade multiple tissues in the body, it has to pull off several remarkable feats: wrench itself from the primary tumour; thrive independently; burst through the wall of a blood or lymphatic vessel; outwit the immune system; and, finally, anchor and grow in a new location. Once it figures out how to do all this and can spread around the body, a person is unlikely to survive more than a few months.

Now Charles Swanton from Cancer Research UK and his team at University College London think they understand what happens. Rather than gradually collecting many tiny mutations, cancer dramatically reorders its genome, evolving these abilities in large leaps or "macromutations". This allows it to conjure up the suite of traits it needs to turn into a killer. "Metastasis is an extremely complex process," Swanton says. "It's very unlikely that those multiple abilities can be driven by one gene."

Macromutation is an idea with a chequered past. In the 1940s, biologist Richard Goldschmidt argued that organisms splintered into new species when large mutations happen in a single generation, creating a well-adapted beast he called a "hopeful monster". His ideas were dismissed but the process has now been spotted in some plants and even animals, including flies and fish. Cancer, Swanton says, evolves in an analogous way, lurching from benign tumour to metastatic disease just like Goldschmidt's hopeful monsters.

For 10 years we have known there is a connection between cancers with unstable chromosomes – ones prone to large mutations like gaining, losing or reordering chromosomes – and aggressive behaviour such as metastasis. But it wasn't clear if the instability was a cause of the aggression or a consequence. Now, armed with evidence from work on colon cancer cells, Swanton says it's a cause.

His group showed that cultured cells that had doubled their number of chromosomes during faulty cell division were better able to tolerate large-scale mutations. They could totally rearrange their genome, and continue living. In other words, the cells could become hopeful monsters (see diagram).

But this only shows that cancer cells can survive macromutations. Those mutations had to be linked to the evolution of deadly traits. So Swanton looked at what had happened to people whose cancer cells have doubled their genome. In 150 people with early colon cancer, genome doubling was associated with a fivefold increased risk of their cancer returning within two years of treatment. Together, Swanton says the results suggest genome-doubling could be a "macro-evolutionary leap" in tumours, which allows them to become killers (Cancer Discovery, doi.org/q29).

There are at least two ways that genome doubling could give cancer the impetus it needs. Swanton thinks genome-doubled cells could have acquired an earlier mutation that allows them to survive huge genomic rearrangements. That opens up an obvious treatment strategy: find that mutation and block it or reverse it. Mutate and invade

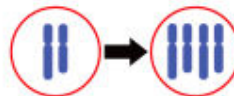
Another possibility is that genome doubling itself buffers a cell, making it tolerant of mutations, says Giulia Rancati at the Agency for Science, Technology and Research in Singapore. Genome-doubled cells essentially have a back-up of every chromosome. So if one is deleted, moved, repeated or otherwise messed up, a healthy version can step in to lessen the overall impact of the change. Rancati says the evidence for macromutation

### Cancer's giant evolutionary steps

New evidence suggests tumours evolve the ability to spread around the body in large leaps or "macromutations". Here are two ways this can happen

#### Genome doubling

Faulty cell division means every chromosome is duplicated, creating a cell with twice the normal number of chromosomes



#### Copy number variations

This occurs when sections of chromosomes are duplicated (see below), deleted or moved, resulting in big changes in the number of copies of a particular gene or a section of DNA



driving cancer evolution is overwhelming. "It suggests that cancer evolution does not happen by gradual accumulation of mutations but mutations that enable genome chaos," she says.

Last month, Fan Bai from Peking University in Beijing, China, and colleagues found intriguing hints that the key drivers of cancer's ability to spread might be some particular macromutations called copy number variations, where sections of chromosomes are deleted, moved or duplicated. In 11 people with lung cancer similar macromutations were repeated in each cancer cell, suggesting the mutations helped the cells survive or spread – possibly by driving metastasis (PNAS, doi.org/q3b). "Copy number variations could influence the functions of a large set of genes," says Bai. "Such changes could alter the gene expression of different pathways, conferring a selective advantage for metastasis."

Recognising that cancers evolve in giant leaps opens up new avenues for treatment. One might be to lower the rate that cells accumulate these macromutations. Evidence published last June by Carlo Maley from the University of California, San Francisco, suggested slowing the rate of copy number variations might be how aspirin helps prevent cancer.

This approach also suggests that chemotherapy may not help everyone. Although the drugs kill cancer cells, they also destabilise the genomes of surviving cells, making chromosomal rearrangements more likely. Swanton says the effect could be to create more hopeful monsters. "I worry that you could you potentially make outcomes worse in a small population of patients," he says.

It's a balancing act, says David Thomas from the Garvan Institute in Sydney, Australia. Large mutations are very likely to kill a cell. Cancer needs to find an optimum level of mutation – the sweet spot between hopeful and hopeless monster. "There's a zone in the middle where there's a balance between being adaptable and being so genomically unstable as to compromise the cancer's success," he says.

The key will be to customise chemotherapy to push chromosomal instability past that sweet spot. Swanton's group is in the early stages of studying 3500 women with breast cancer to properly figure out what connects the degree of chromosomal instability, chemotherapy, and how well patients do. His team is carefully rating the chromosomal instability of tumours in all the women and will watch their progress through treatment.

If Swanton can find some key genetic changes in cancer cells that allow genome doubling and other macromutations, those could be targets for therapy that stops cancer from becoming deadly. That is a long way off. Even before new treatments emerge, a better understanding of cancer evolution might improve existing treatments and explain why some people initially respond to chemotherapy, only to see their cancer come back even more aggressively.

<http://bit.ly/LZadJY>

### **Mars Rover Opportunity Finds Life-Friendly Niche**

*Gale Crater, the region being explored by NASA's Curiosity rover, isn't the only place on Mars where ancient microbes may have thrived.*

Jan 23, 2014 02:00 PM ET // by Irene Klotz

The Mars rover Curiosity just found out that Martian soil is 2 percent water! Anthony tells us what that means for the age-old question of whether life once existed on Mars and what it means for future human colonists on the red planet. New evidence from NASA's senior robotic Mars scout, Opportunity, shows life-friendly water once mixed with telltale, clay-bearing rocks that now lie on the broken rim of Endeavour Crater, an ancient 14-mile wide basin on the other side of the planet from Gale.

"If I were to go Mars early in time and wanted to do a well, I'd do it there," planetary scientist Ray Arvidson, with Washington University in St. Louis, told Discovery News. "It's like drinking water," he said, as opposed to the "acidic goo" Opportunity found at a previous site. "This would have been a niche for whatever life at the time existed," Arvidson said.

The finding dovetails with similar discoveries made by newcomer Curiosity, which, unlike Opportunity, is outfitted with a drill, onboard chemistry lab, and other instruments to hunt for potential life-friendly habitats. Opportunity's mission -- to find signs of past water -- was more basic.

"You've got the same kind of clay minerals on a completely different part of the planet, and in a much older -- relatively speaking, hundreds of millions of years older -- succession of rocks," geologist John Grotzinger, with the California Institute of Technology, told Discovery News.

Curiosity, which arrived in August 2012, already completed the primary goal of its mission. Analysis of samples drilled out from inside a slab of once water-covered bedrock shows that Mars did indeed have the right conditions and chemistry to support life.

Curiosity scientists now are focused on a more ambitious challenge to find places where organic carbon may be shielded from the radiation-rich and highly oxidizing environment of present-day Mars.

Likewise, the Opportunity science team is stepping up its game. Once Martian spring arrives at Endeavour Crater and there is more power for the rover's solar arrays, Opportunity will head toward what lead scientist Steve Squyres calls "the mother lode" of clays, based on chemical data collected by instruments on NASA's Mars Reconnaissance Orbiter and Europe's Mars Express satellite.

Scientists have learned to be patient -- it took Opportunity nearly three years to reach the rim of Endeavour Crater -- and count their blessings. Opportunity, along with a now-dormant sister rover, Spirit, were only designed to last 90 days. Saturday marks Opportunity's 10-year anniversary on Mars. "It's the hardest working rover in show business," Grotzinger said. The research is published in this week's Science.

[http://www.eurekalert.org/pub\\_releases/2014-01/meae-ai012314.php](http://www.eurekalert.org/pub_releases/2014-01/meae-ai012314.php)

### **Aspirin intake may stop growth of vestibular schwannomas/acoustic neuromas**

#### *Findings described in the February issue of the journal Otology and Neurotology*

BOSTON - Researchers from Massachusetts Eye and Ear, Harvard Medical School, Massachusetts Institute of Technology and Massachusetts General Hospital have demonstrated, for the first time, that aspirin intake correlates with halted growth of vestibular schwannomas (also known as acoustic neuromas), a sometimes lethal intracranial tumor that typically causes hearing loss and tinnitus.

Motivated by experiments in the Molecular Neurotology Laboratory at Mass. Eye and Ear involving human tumor specimens, the researchers performed a retrospective analysis of over 600 people diagnosed with vestibular schwannoma at Mass. Eye and Ear. Their research suggests the potential therapeutic role of aspirin in inhibiting tumor growth and motivates a clinical prospective study to assess efficacy of this well-tolerated anti-inflammatory medication in preventing growth of these intracranial tumors.

"Currently, there are no FDA-approved drug therapies to treat these tumors, which are the most common tumors of the cerebellopontine angle and the fourth most common intracranial tumors," explains Konstantina Stankovic, M.D., Ph.D., Mass. Eye and Ear clinician-researcher and assistant professor of otology and laryngology, Harvard Medical School, who led the study. "Current options for management of growing vestibular schwannomas include surgery (via craniotomy) or radiation therapy, both of which are associated with potentially serious complications."

The findings, which are described in the February issue of the journal Otology and Neurotology, were based on a retrospective series of 689 people, 347 of whom were followed with multiple magnetic resonance imaging MRI scans (50.3%). The main outcome measures were patient use of aspirin and rate of vestibular schwannoma growth measured by changes in the largest tumor dimension as noted on serial MRIs. A significant inverse association was found among aspirin users and vestibular schwannoma growth (odds ratio: 0.50, 95 percent confidence interval: 0.29-0.85), which was not confounded by age or gender.

"Our results suggest a potential therapeutic role of aspirin in inhibiting vestibular schwannoma growth," said Dr. Stankovic, who is an otologic surgeon and researcher at Mass. Eye and Ear, Assistant Professor of Otology and Laryngology, Harvard Medical School (HMS), and member of the faculty of Harvard's Program in Speech and Hearing Bioscience and Technology.

*This work was funded by National Institute on Deafness and Other Communication Disorders grants T32 DC00038, K08DC010419 and by the Bertarelli Foundation. A full list of authors is available in the paper.*

<http://scitechdaily.com/study-reveals-life-earths-early-oceans-increased-size/>

### **Study Reveals Why Life in Earth's Early Oceans Increased in Size**

#### *Biologists Reveal Why Early Life Began to Get Larger in Earth's Oceans*

A newly published study examined the earliest communities of large multicellular organisms in the fossil record, revealing why life in Earth's early oceans increased in size.

Why did life forms first begin to get larger and what advantage did this increase in size provide? UCLA biologists working with an international team of scientists examined the earliest communities of large multicellular organisms in the fossil record to help answer this question.

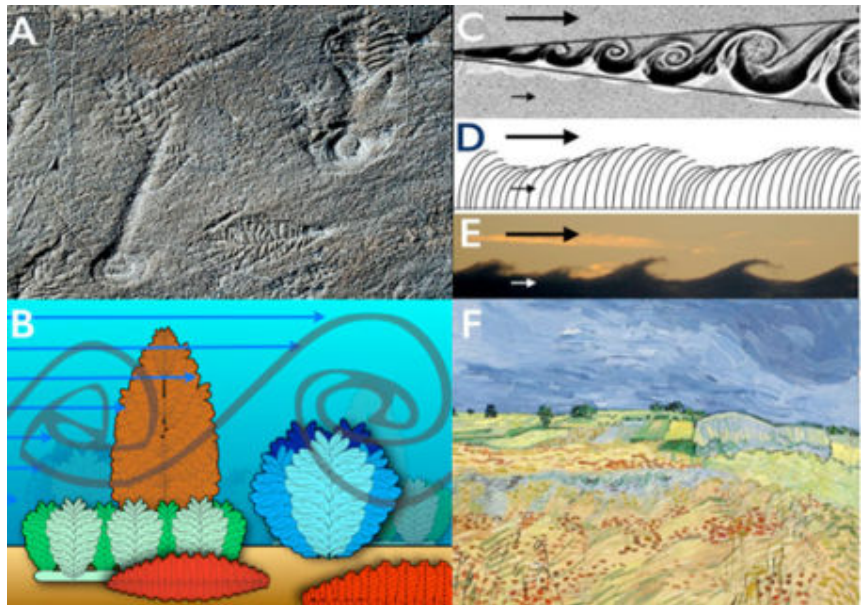
The life scientists used a novel application of modeling techniques at a variety of scales to understand the scientific processes operating in the deep sea 580 million years ago. The research reveals that an increase in size provided access to nutrient-carrying ocean flow, giving an advantage to multicellular eukaryotes that existed prior to the Cambrian explosion of animal life, said David Jacobs, a professor of ecology and evolutionary biology in the UCLA College of Letters and Science and senior author of the research.

In this study by Ghisalberti et al., an international team of scientists reconstructed one of the oldest fossil beds containing communities of large life forms. The organisms in these rocks (collectively known as rangeomorphs) lived on the sea floor and directly absorbed nutrition from the ocean water.

The study findings are published January 23 in the journal Current Biology.

A multidisciplinary research team reconstructed ocean flow in the fossil community using “canopy flow models,” a particular class of flow models consistent with the dense spacing of organisms on the ancient seabed. The research was inspired by the NASA Astrobiology Institute’s “Foundations of Complex Life” meeting in Newfoundland, Canada, where the oldest known fossil communities of large, multicellular organisms - collectively called rangeomorphs - are found on rock surfaces exposed along the coast. These feather- or brush-shaped creatures ranged in size from several millimeters to tens of centimeters in height.

The scientists addressed the absorption properties of the rangeomorphs’ surfaces based on the model’s results. These rangeomorphs could not photosynthesize because they lived in the extreme depths, where light did not penetrate, Jacobs said. Their complex surfaces suggest that they absorbed dissolved nutrients directly from the water — which raises the question of how rangeomorphs competed with bacteria, which also specialize in absorbing nutrients from seawater. Understanding what advantages rangeomorphs gained over bacteria by growing tall would provide scientists with insights into what drove the evolution of the first communities of large life forms in the fossil record, Jacobs said.



**Canopy flow and rangeomorph communities.** *A: Bedding plane, at Mistaken Point, Newfoundland, showing the preservation of rangeomorph taxa. B: Schematic of the reconstructed community showing the velocity gradient (blue arrows) and large Kelvin-Helmholtz vortices. C: Kelvin-Helmholtz vortices visualised at the boundary between parallel flows of different velocity. D: The waving of a vegetated canopy produced by Kelvin-Helmholtz vortices. E: Kelvin-Helmholtz Vortices produced in a cloud layer. Arrows in C-E indicate the relative velocity of flow. F: ‘The Fields’ by Vincent van Gogh was among a number of his paintings inspired by Kelvin-Helmholtz behavior of fields and clouds. Credit: Current Biology*

The scientists discovered that rangeomorphs had an advantage when they grew off the sea floor, as they were exposed to higher flow, generating much greater “nutrient uptake.”

The inducement to “grow upwards is a function of the canopy, which controls the velocity of ocean water as it moves through the rangeomorph community,” Jacobs said. “As individuals grow upwards, the properties of water flow change, which promotes further upward growth.”

Both the canopy-flow and surface-uptake models represent significant advances in scientists’ ability to understand the ecology of fossil and modern communities, Jacobs said. Such modeling may prove critical to understanding processes that affect ocean life today, such as coral bleaching, he said.

Co-authors of the research include David Gold, a UCLA graduate student in Jacobs’ laboratory; Roger Summons (MIT) and David Johnston (Harvard), who helped reconstruct the paleoceanography of this time; and Guy Narbonne (Queens University), Marc LaFlamme (University of Toronto) and Matthew Clapham (UC Santa Cruz), who contributed the paleontological data necessary to populate the model. Marco Ghisalberti of the University of Western Australia in Perth developed and conducted the modeling in collaboration with Jacobs and Gold, who developed the paleo-biomechanical conceptual models to be tested, assembled the research team and directed the research. The research is funded by the NASA Astrobiology Institute.

Publication: Marco Ghisalberti, et al., “Canopy Flow Analysis Reveals the Advantage of Size in the Oldest Communities of Multicellular Eukaryotes,” *Current Biology*, 23 January 2014; DOI: 10.1016/j.cub.2013.12.017

<http://phys.org/news/2014-01-evidence-animals-evolved-ability-air.html>

## **Evidence that land animals evolved the ability to breathe air as ancient fish**

***Evidence showing four-legged animals first developed ability to breathe air as ancient fish in water***

Phys.org - In a major evolutionary discovery, Flinders University palaeontologist Professor John Long (pictured) has found evidence to show that four-legged animals first developed the ability to breathe air as ancient fish in water. Published yesterday (Thursday, January 23) in the international journal *Nature Communications*, the research shows the *Polypterus*, the most primitive living bony fish, breathes air through large canals on top of

its head called spiracles. The discovery marks the first step in the evolutionary transition of similar ancient fishes to the land as tetrapods, or four-legged animals.

Professor Long, the Strategic Professor in Palaeontology at Flinders, said the research points to the likely conclusion that the ancient Gogonasus – which belonged to a group of fish widely regarded by scientists as the ancestors from whom the first land animals evolved – originally developed its breathing abilities using its spiracles. He said the groundbreaking discovery signals the origins of breathing for the four-legged descendants of these ancient fish. "Polypterus had holes on top of its head but we never knew what they were actually for until we observed the fish over a long period of time and found they were breathing through their spiracles," Professor Long said.

"Until now we've only had theories about the origins of breathing in the evolution of fish to land animals – some early 19th Century scientists had these wacky ideas that fish just jumped onto the land and started gasping for breath and developing limbs," he said. "But our research shows that the transformation actually started happening within the fish themselves while they were still in water."

As part of the study, a team based at The Scripps Research Institute in the US observed species of Polypterus for 360 hours and measured the amount of oxygen it was taking in.

He said the findings on Polypterus is the "smoking gun" that points to fossils such as Gogonasus as being capable of breathing in air through their spiracles. "Other lobed-finned fish fossils of that age show large spiracles on top of their heads and the earliest known tetrapod fossils also have large open spiracles on their heads. "All this points to the ability of these fishes to take in air from their spiracles as the first type of breathing, which ultimately helped them leave the water and invade the land."

Professor Long said once the four-legged descendants of the lobed-finned fish abandoned the water, the ability to breathe through their spiracles declined as they switched to breathing using their mouths and nostrils, as humans do today.

"The spiracles eventually became the hearing canal in which tetrapods transmitted sound to the brain via tiny inner ear bones, and this has remained throughout the evolution of fish right through to humans," he said.

"If not for the bold evolutionary experiments of these prehistoric fish breathing in air through the top of their heads, we might not have evolved such a keen sense of hearing."

*More information: "Spiracular air breathing in polypterid fishes and its implications for aerial respiration in stem tetrapods." Jeffrey B. Graham, Nicholas C. Wegner, Lauren A. Miller, Corey J. Jew, N Chin Lai, Rachel M. Berquist, Lawrence R. Frank, John A. Long. Nature Communications 5, Article number: 3022 DOI: 10.1038/ncomms4022*

[http://www.eurekalert.org/pub\\_releases/2014-01/qub-rif012414.php](http://www.eurekalert.org/pub_releases/2014-01/qub-rif012414.php)

### **Rainforests in Far East shaped by humans for the last 11,000 years**

***New research from Queen's University Belfast shows that the tropical forests of South East Asia have been shaped by humans for the last 11,000 years.***

The rain forests of Borneo, Sumatra, Java, Thailand and Vietnam were previously thought to have been largely unaffected by humans, but the latest research from Queen's Palaeoecologist Dr Chris Hunt suggests otherwise. A major analysis of vegetation histories across the three islands and the SE Asian mainland has revealed a pattern of repeated disturbance of vegetation since the end of the last ice age approximately 11,000 years ago. The research, which was funded by the Arts and Humanities Research Council and the British Academy, is being published in the Journal of Archaeological Science. It is the culmination of almost 15 years of field work by Dr Hunt, involving the collection of pollen samples across the region, and a major review of existing palaeoecology research, which was completed in partnership with Dr Ryan Rabett from Cambridge University. Evidence of human activity in rainforests is extremely difficult to find and traditional archaeological methods of locating and excavating sites are extremely difficult in the dense forests. Pollen samples, however, are now unlocking some of the region's historical secrets.

Dr Hunt, who is Director of Research on Environmental Change at Queen's School of Geography, Archaeology and Palaeoecology, said: "It has long been believed that the rainforests of the Far East were virgin wildernesses, where human impact has been minimal. Our findings, however, indicate a history of disturbances to vegetation. While it could be tempting to blame these disturbances on climate change, that is not the case as they do not coincide with any known periods of climate change. Rather, these vegetation changes have been brought about by the actions of people.

"There is evidence that humans in the Kelabit Highlands of Borneo burned fires to clear the land for planting food-bearing plants. Pollen samples from around 6,500 years ago contain abundant charcoal, indicating the occurrence of fire. However, while naturally occurring or accidental fires would usually be followed by specific weeds and trees that flourish in charred ground, we found evidence that this particular fire was followed by the



growth of fruit trees. This indicates that the people who inhabited the land intentionally cleared it of forest vegetation and planted sources of food in its place.

"One of the major indicators of human action in the rainforest is the sheer prevalence of fast-growing 'weed' trees such as Macaranga, Celtis and Trema. Modern ecological studies show that they quickly follow burning and disturbance of forests in the region. "Nearer to the Borneo coastline, the New Guinea Sago Palm first appeared over 10,000 years ago. This would have involved a voyage of more than 2,200km from its native New Guinea, and its arrival on the island is consistent with other known maritime voyages in the region at that time – evidence that people imported the Sago seeds and planted them."

The findings have huge importance for ecological studies of rainforests as the historical role of people in managing the forest vegetation has rarely been considered. It could also have an impact on rainforest peoples fighting the advance of logging companies.

Dr Hunt continued: "Laws in several countries in South East Asia do not recognise the rights of indigenous forest dwellers on the grounds that they are nomads who leave no permanent mark on the landscape. Given that we can now demonstrate their active management of the forests for more than 11,000 years, these people have a new argument in their case against eviction."

*The full article can be found on the Journal of Archaeological Science website at*

<http://www.sciencedirect.com/science/article/pii/S030544031300441X>

1. Dr Chris Hunt is available for interview.

2. Full title of research paper: *Holocene landscape intervention and plant food production strategies in island and mainland Southeast Asia* (C.O. Hunt and R.J. Rabett)

[http://www.eurekalert.org/pub\\_releases/2014-01/ehs-pdt012414.php](http://www.eurekalert.org/pub_releases/2014-01/ehs-pdt012414.php)

### **Psychologists document the age our earliest memories fade** ***Study is first empirical demonstration of the onset of childhood amnesia***

Although infants use their memories to learn new information, few adults can remember events in their lives that happened prior to the age of three. Psychologists at Emory University have now documented that age seven is when these earliest memories tend to fade into oblivion, a phenomenon known as "childhood amnesia."

The journal *Memory* published the research, which involved interviewing children about past events in their lives, starting at age three. Different subsets of the group of children were then tested for recall of these events at ages five, six, seven, eight and nine. "Our study is the first empirical demonstration of the onset of childhood amnesia," says Emory psychologist Patricia Bauer, who led the study. "We actually recorded the memories of children, and then we followed them into the future to track when they forgot these memories."

The study's co-author is Marina Larkina, manager of research projects for Emory's Department of Psychology. The Bauer Memory Development Lab focuses on how episodic, or autobiographical memory, changes through childhood and early adulthood. "Knowing how autobiographical memory develops is critically important to understanding ourselves as psychic beings," Bauer says. "Remembering yourself in the past is how you know who you are today."

Scientists have long known, based on interviews with adults, that most people's earliest memories only go back to about age 3. Sigmund Freud coined the term "childhood amnesia" to describe this loss of memory from the infant years. Using his psychoanalytic theory, Freud made the controversial proposal that people were repressing their earliest memories due to their inappropriate sexual nature.

In recent years, however, growing evidence indicates that, while infants use memory to learn language and make sense of the world around them, they do not yet have the sophisticated neural architecture needed to form and hold onto more complex forms of memory. Instead of relying on interviews with adults, as previous studies of childhood amnesia have done, the Emory researchers wanted to document early autobiographical memory formation, as well as the age of forgetting these memories.

The experiment began by recording 83 children at the age of three, while their mothers or fathers asked them about six events that the children had experienced in recent months, such as a trip to the zoo or a birthday party. "We asked the parents to speak as they normally would to their children," Bauer says.

She gives a hypothetical example: "The mother might ask, 'Remember when we went to Chuck E. Cheese's for your birthday party?' She might add, 'You had pizza, didn't you?'" The child might start recounting details of the Chuck E. Cheese experience or divert the conversation by saying something like, "Zoo!" Some mothers might keep asking about the pizza, while another mother might say, "Okay, we went to the zoo, too. Tell me about that."

Parents who followed a child's lead in these conversations tended to elicit richer memories from their three-year-olds, Bauer says. "This approach also related to the children having a better memory of the event at a later age."

After recording these base memories, the researchers followed up with the children years later, asking them to recall the events that they recounted at age three. The study subjects were divided into five different groups, and each group of children returned only once to participate in the experiment, from the ages of five to nine.

While the children between the ages of five and seven could recall 63 to 72 percent of the events, the children who were eight and nine years old remembered only about 35 percent of the events.

"One surprising finding was that, although the five-and-six year-old children remembered a higher percentage of the events, their narratives of these events were less complete," Bauer says. "The older children remembered fewer events, but the ones they remembered had more detail."

Some reasons for this difference may be that memories that stick around longer may have richer detail associated with them and increasing language skills enable an older child to better elaborate the memory, further cementing it in their minds, Bauer says.

Young children tend to forget events more rapidly than adults do because they lack the strong neural processes required to bring together all the pieces of information that go into a complex autobiographical memory, she explains. "You have to learn to use a calendar and understand the days of the week and the seasons. You need to encode information about the physical location of the event. And you need development of a sense of self, an understanding that your perspective is different from that of someone else."

She uses an analogy of pasta draining in a colander to explain the difference between early childhood and adult memories. "Memories are like orzo," she says, referring to the rice-grained-sized pasta, "little bits and pieces of neural encoding." Young children's brains are like colanders with large holes trying to retain these little pieces of memory. "As the water rushes out, so do many of the grains of orzo," Bauer says. "Adults, however, use a fine net instead of a colander for a screen."

Now that Bauer has documented the onset of childhood amnesia, she hopes to hone in on the age that people acquire an adult memory system, which she believes is between the age of nine and the college years.

"We'd like to know more about when we trade in our colanders for a net," she says. "Between the ages of 9 and 18 is largely a no-man's land of our knowledge of how memory forms."

<http://bit.ly/1aXgRXv>

### **A treasure trove of Arabic terms**

*Are the terms alcohol and kohl related? Yes, if we trace their origins. An Arabic etymological term base, the first of its kind, can provide new knowledge about Arab identity and cultural history.*

**By Mari Kildahl, journalist**

Arabic is one of the world's most widely spoken languages, with an estimated 250 to 300 million native speakers. Despite this fact, there is still no Arabic etymological dictionary. However, the dictionary is on its way. Stephan Guth, Professor of Arabic at the University of Oslo, has taken the initiative to pursue this research project.

"There has been a lot of etymological research, but it has not been collected anywhere," the professor explains. The plan is to establish an electronic database, EtymArab. In an upstart phase, the website will be based on words and concepts from Modern Standard Arabic (MSA) only, but these are also chosen to shed light on roots and concepts that have a special importance in Arab intellectual and cultural history, from ancient times until the present day.

"The history of their language helps us understand who the Arabs are – and were," Guth says. He points out that the database will also present the narratives that emerge when a word is traced back in time. As such, EtymArab will be more than a standard etymological dictionary.

#### **Words unlock the doors to history**

"Alcohol is a word that you will not find in dictionaries of Classical Arabic. In the final analysis, however, this word is of Arabic origin. It is derived from the Arabic al-kuḥl, which means 'kohl'. When the Europeans became familiar with this substance in Andalusia, which was also used for medical purposes, they referred to it and gradually all other fine powders, and subsequently all kinds of volatile essences, as alcohol. In Catalan, kohl is still called alcofol.

In the meaning "essence of wine, spirit", the word later returned to the Arabs and became al-kuḥūl, Guth explains. "Today, we thus have two Arabic words: The one that started this development, i.e. al-kuḥl, which still means 'kohl', and the loan word al-kuḥūl, which means 'alcohol'.

"When a word is opened, several doors to history are unlocked," Guth points out. Kohl (kuḥl) turns out to have been a commodity which was widely used in the Orient, and it was probably already known in Ancient Egypt and Mesopotamia. "Almost each time I go to the root of a word, I discover new nuances, new narratives," the professor says.

### **The first step: a thousand-word prototype**

The research project, launched in 2012, builds upon the many studies undertaken so far in the West and in Arab countries. “It’s a comprehensive work we have ahead of us. As for myself, I do not expect to see the database completed,” Guth says. The first step is a prototype that will contain approximately 1,000 words and concepts. “Everything will need quality assurance, of course. This is a major challenge. We need expertise from a number of other disciplines to interpret our findings correctly. For example philosophy, theology and medicine, as well as all the major philologies of the Ancient Orient, in particular Semitic languages such as Akkadian, Aramaic, Hebrew, Ethiopic and Old South Arabian. But also all stages of Persian. Gradually, we wish to open the database to the entire world, according to the Wikipedia model.”

Etymology is a sensitive issue

#### **“Why a European project, and not an Arabic one?”**

“The fact that the Arabs themselves have not produced an etymological dictionary so far is probably due to the sacred status of the Arabic language. A historic approach, such as ours, is more common in the European tradition than in the Arabic one,” Guth explains. He has previously lived in Arabic-speaking countries, in Cairo and Beirut.

“Arabs tend to be hesitant about cooperating with the West with regard to projects that touch upon Arab and Muslim identity. Etymology, like archaeology, can be a very sensitive area. It was not always like this, however. Until the mid-20th century such cooperation was far more relaxed. Matters were later complicated by the establishment of the state of Israel, the Palestine refugee tragedy, and other traumatic experiences such as the invasion of Lebanon in 1982 and the Gulf Wars.”

He adds, however, that attitudes to the West have changed somewhat in recent years. “We now have contact with scholars in Qatar. A group of Arab researchers have embarked on a promising project, a dictionary that addresses Arabic language history.”

#### **Even the Koran is full of loanwords**

“Many Arabs claim that Arabic is essentially a pure language,” Professor Guth points out. “As a result of the anticolonial national movement, several purist language academies emerged, striving to keep the language ‘pure’.” According to etymological research, however, Arabic has always been a linguistic cocktail.

“But Arabic is also a conservative language. Loanwords tend to be Arabized,” he says, using the word ‘train’ as an example. “The Arabs became familiar with trains as a means of transport in the 19th century. But instead of adopting the French or English word ‘train’, as the Turks did, they chose an old Arabic word instead: qitār, which until then had been used to describe a train of camels.”

Throughout various historical epochs, Arabic has been influenced by several other languages.

“Even though most Arabic words look ‘purely Arabic’, many of them are loanwords, which points to the fact that there has always been close contact between the cultures. Even the Koran is full of loanwords, most of which originate from Syrian-Aramaic and Hebrew. This is a result of the presence of Christian and Jewish groups in Arabia at the time.”

#### **Islamic theology impossible without Hellenism**

“Islamic theology and other sciences would look much different, or perhaps would not exist at all, had the Arabs not absorbed the Hellenist legacy,” Guth points out. “The culture of the Arab royal courts during the ‘Golden Age’ is basically Persian royal court culture.” The culture and history of the Arabs are hidden in their words. “That’s why this research project is important. That’s why it is essential to put in place an etymological dictionary such as this one. It may provide answers to questions such as: Who are the Arabs today? Who were the Arabs before the birth of Islam?”

<http://news.discovery.com/earth/plants/lingonberry-fights-fat-in-mice-140124.htm#mkcpgn=rssnws1>

### **Lingonberry (Not Acai Berry) Shown to Fight Fat**

*Studies suggest lingonberries, black currants and bilberries could be wonder fruits for the waist line*

People struggling to keep their New Year’s promise to lose weight may feel tempted to click on the Internet ads that promise to tell one weird secret doctor’s don’t want you to know about açai berries’ fat-fighting power. But the pop-ups may be promoting the wrong berry.

Swedish scientists published experimental results that suggest lingonberries, black currants and bilberries could be wonder fruits for the waist line, while fruit-fed mice fattened on açai berries.

The experiment didn’t start out as an açai berry mythbuster. The Lund University team included the berries because of their reputation as a weight-loss supplement.

“Instead, the opposite happened,” said Karin Berger, diabetes researcher at Lund University, in a press release.

“In our study, the açai berries led to weight gain and higher levels of fat in the liver.”

The rodent in the experiment held a genetic predisposition to put on fat. Biologists used that mouse breed as a model for overweight humans. Most mice received a high fat diet along with either lingonberry, bilberry, raspberry, crowberry, blackberry, prune, blackcurrant, açai berry or no berries. Another group of mice kept their New Years resolutions and were fed a low-fat diet.

### **Berry Bling Shines on Forever**

After 13 weeks of the various diets, the biologists measured the mice's weight and other health indicators. Lingonberries emerged as the health food champ, while several other berries also proved beneficial.

"This study demonstrated that daily supplementation with lingonberries and also blackcurrants and bilberries had pronounced antiobesity and beneficial metabolic effects in high-fat fed mice," wrote the study authors in the Journal of Nutrition and Metabolism.

### **Can Fruit Kick Candy to the Curb?**

Lingonberry-fed mice gained only slightly more weight than the low-fat diet mice, and both groups maintained similar blood sugar and insulin levels, important factors for diabetes patients. Lingonberry, blackcurrant, raspberry or bilberry munching mice all gained less weight than mice that ate high-fat, berries-free diets. Mice in the lingonberry group also had lower cholesterol and less fatty livers than the high-fat, no berry mice. However, people would have a hard time eating enough fresh lingonberries to match the quantity eaten by the mice.

"Up to 20 percent of our mice's diet was lingonberries. It isn't realistic for humans to eat such a high proportion. However, the goal is not to produce such dramatic effects as in the 'high-fat' mice, but rather to prevent obesity and diabetes by supplementing a more normal diet with berries," said Berger.

Certain chemicals, called polyphenols, in the berries may relate to their health benefits, suggested the Swedish researchers. In particular, the mice fed on lingonberries and blackcurrants had high levels of particular polyphenols known as quercetin glucosides.

<http://www.bbc.co.uk/news/science-environment-25885756>

## **Genetically-modified purple tomatoes heading for shops**

*The prospect of genetically modified purple tomatoes reaching the shelves has come a step closer.*

David Shukman By David Shukman Science editor, BBC News

Their dark pigment is intended to give tomatoes the same potential health benefits as fruit such as blueberries. Developed in Britain, large-scale production is now under way in Canada with the first 1,200 litres of purple tomato juice ready for shipping. The pigment, known as anthocyanin, is an antioxidant which studies on animals show could help fight cancer. Scientists say the new tomatoes could improve the nutritional value of everything from ketchup to pizza topping.

### *The new tomatoes could improve the nutritional value of everyday foods*

The tomatoes were developed at the John Innes Centre in Norwich where Prof Cathie Martin hopes the first delivery of large quantities of juice will allow researchers to investigate its potential. "With these purple tomatoes you can get the same compounds that are present in blueberries and cranberries that give them their health benefits - but you can apply them to foods that people actually eat in significant amounts and are reasonably affordable," she said.

The tomatoes are part of a new generation of GM plants designed to appeal to consumers - the first types were aimed specifically at farmers as new tools in agriculture. The purple pigment is the result of the transfer of a gene from a snapdragon plant - the modification triggers a process within the tomato plant allowing the anthocyanin to develop.

Although the invention is British, Prof Martin says European Union restrictions on GM encouraged her to look abroad to develop the technology. Canadian regulations are seen as more supportive of GM and that led to a deal with an Ontario company, New Energy Farms, which is now producing enough purple tomatoes in a 465 square metre (5,000sq ft) greenhouse to make 2,000 litres (440 gallons) of juice.

According to Prof Martin, the Canadian system is "very enlightened". "They look at the trait not the technology and that should be a way we start changing our thinking - asking if what you're doing is safe and beneficial, not 'Is it GM and therefore we're going to reject it completely'." "It is frustrating that we've had to go to Canada to do a lot of the growing and the processing and I hope this will serve as a vanguard product where people can have access to something that is GM but has benefits for them."

The first 1,200 litres are due to be shipped to Norwich shortly - and because all the seeds will have been removed, there is no genetic material to risk any contamination.

The aim is to use the juice in research to conduct a wide range of tests including examining whether the anthocyanin has positive effects on humans. Earlier studies show benefits as an anti-inflammatory and in slowing cancers in mice.

A key question is whether a GM product that may have health benefits will influence public opinion. A major survey across the European Union in 2010 found opponents outnumbered supporters by roughly three to one. The last approval for a GM food crop in the EU came in 1998.

Prof Martin hopes that the purple tomato juice will have a good chance of being approved for sale to consumers in North America in as little as two years' time. She and other plant researchers in the UK hope that GM will come to be seen in a more positive light.

### **Legacy of distrust**

Earlier on Friday, scientists at Rothamsted Research in Hertfordshire announced that they were seeking permission for field trials for a GM plant that could produce a "fish oil". In a parallel project, they have been cultivating a type of GM wheat that is designed to release a pheromone that deters aphids.

Professor Nick Pidgeon, an environmental psychologist at Cardiff University, has run opinion polls and focus groups on GM and other technologies. He says that a legacy of distrust, including from the time of mad cow disease, will be causing lasting concern.

"Highlighting benefits will make a difference but it's only one part of the story which is quite complex.

"People will still be concerned that this is a technology that potentially interferes with natural systems - they'll be concerned about big corporations having control over the technology and, at the end of the day, you feed it to yourself and your children and that will be a particular concern for families across the UK."

"To change that quite negative view that people had 10-15 years ago will take quite a long time - it'll take a demonstration of safety, a demonstration of good regulation and of the ability to manage the technology in a safe way. And that doesn't happen overnight."

<http://www.sciencedaily.com/releases/2014/01/140123222055.htm>

### **Ultrasound training should be implemented early into medical education programs**

*A new paper advocates including ultrasound in medical education programs to realize the full benefits of the technology as early as possible.*

A paper in this month's edition of *Global Heart* (the journal of the World Heart Federation) advocates including ultrasound in medical education programmes to realise the full benefits of the technology as early as possible.

The review is by J. Christian Fox, Professor of Clinical Emergency Medicine and Director of Instructional Ultrasound at the University of California Irvine School of Medicine, CA, USA, and colleagues.

Ultrasound technology has advanced to the point that many point-of-care examinations can be carried out using ultrasound, including the advent of hand-held devices similar in size to smartphones. "Emergency physicians, intensivists, and other acute care clinicians are using and relying on critical care ultrasound imaging to better triage and diagnose patients at the point of care. As this new frontier of medicine continues to forge forward using this new and improving technology, we strongly believe in integrating ultrasound training earlier into the medical education curriculum," say the authors.

They outline a number of medical scenarios such as patients with chest pain, shortness of breath, and shock, and detail how ultrasound can be much more accurate in helping healthcare workers diagnosing problems in these circumstances. However, they also caution about the limitations of ultrasound, saying that "it is sometimes difficult to determine the difference between acute versus chronic problems in an individual. This can be a confounding finding in an acute setting, in the event that a physician needs to make a treatment decision that could be attributed more to a chronic diagnosis."

However, overall they point to findings that show "Not only is ultrasound more comprehensive and accurate than physical examination, but it also helps with earlier detection of potentially life-threatening conditions, such as cardiac tamponade\* and confirmation of pulseless electrical activity... it is argued that point-of-care ultrasound should be, rather than optional, an essential part of any examination to help physicians develop and narrow down their differential diagnosis."

The authors also refer to a study by Kobal et al demonstrating the potential in extending ultrasound education into the medical school curriculum. Their study compared the physical exam (using non-ultrasound devices such as stethoscopes) done by trained cardiologists to the diagnostic accuracy of ultrasounds done by medical students. This study concluded that not only were students capable of capturing images of cardiac pathology on patients, but their diagnostic skills were far superior in detecting valvular disease, left ventricular hypertrophy, and cardiac dysfunction than those of trained cardiologists performing physical exams.

The authors conclude: "It is becoming increasingly apparent that training our medical students to use ultrasound earlier in their careers can allow them to develop diagnostic skills that far exceed the traditional exam that physicians have been taught for centuries. Thus, it is impossible to ignore the impact ultrasound has made within medical education. Ultrasound has played an essential role in point-of-care cardiac diagnostics, and

implementing ultrasound training into medical education is the next logical step to enable the progression of point-of-care ultrasonography."

J. Christian Fox, Heather Marino, Chanel Fischetti. *Differential Diagnosis of Cardiovascular Symptoms. Global Heart, 2013; 8 (4): 289 DOI: 10.1016/j.ghcart.2013.11.007*

<http://www.sciencedaily.com/releases/2014/01/140124082600.htm>

### **Birch helps wounds heal faster**

*Pharmaceutical researchers elucidate the effect of a natural extract -- from birch trees.*

Extracts from the birch tree have served for centuries as a traditional means of helping the damaged skin around wounds to regenerate more quickly. Prof. Dr. Irmgard Merfort from the Institute of Pharmaceutical Sciences of the University of Freiburg and her team have now explained the molecular mechanism behind the wound-healing effect of an extract from the outer white layer of the tree's bark. The scientists published their findings in the journal Plos One. The team cooperated with several other departments and institutes, such as a research group from the Institute of Molecular Medicine and Cell Research and the Institute of Experimental and Clinical Pharmacology of the University of Freiburg as well as a research group from the Dermatological Clinic of the University of Hamburg.

In the first phase of wound healing, the damaged skin cells release certain substances that lead to a temporary inflammation. They attract phagocytes, which remove foreign bacteria and dead tissue. The Freiburg scientists determined that the birch bark extract, in particular its main ingredient betulin, does in fact temporarily increase the amount of these inflammatory substances. The natural substance activates proteins that extend the half-life of the messenger ribonucleic acid (mRNA). A gene must first be translated into mRNA for the blueprint of a protein to be read by the genome. The substance triples the time in which the mRNA of a particular messenger remains stable. This messenger enables more of the protein in question, in this case the inflammatory substances, to be produced. In addition, the birch bark extract and betulin also stabilize the mRNA of further messengers.

In the second phase of wound healing the skin cells migrate and close the wound. The natural substance aids in this process: The birch bark extract and its components betulin and lupeol activate proteins that are involved in the restructuring of the actin cytoskeleton, which gives the cell its shape with the help of the structural protein actin. In this way, the substances from the birch cause keratinocytes -- the most common type of cell in the outermost layer of skin -- to migrate more quickly into the wound and close it.

Sandra Ebeling, Katrin Naumann, Simone Pollok, Tina Wardecki, Sabine Vidal-y-Sy, Juliana M. Nascimento, Melanie Boerries, Gudula Schmidt, Johanna M. Brandner, Irmgard Merfort. *From a Traditional Medicinal Plant to a Rational Drug: Understanding the Clinically Proven Wound Healing Efficacy of Birch Bark Extract. PLoS ONE, 2014; 9 (1): e86147 DOI: 10.1371/journal.pone.0086147*

<http://www.sciencedaily.com/releases/2014/01/140124082658.htm>

### **Simple protein test could improve prediction of survival rates for patients with head, neck cancer**

*Scientists used a simple protein test that could prove more useful in predicting survival chances for patients with head-and-neck cancer compared to existing methods.*

The team believes the test could allow doctors to choose more appropriate and tailored treatments. Oral cancers, including the tongue and tonsils, are usually associated with tobacco and alcohol intake. However, increasing numbers of cases are instead linked to human papillomaviruses (HPV).

Simple protein test could improve prediction of survival rates for patients with head and neck cancer  
Scientists from The University of Manchester -- part of the Manchester Cancer Research Centre -- used a simple protein test that could prove more useful in predicting survival chances for patients with head-and-neck cancer compared to existing methods. The team, funded by Cancer Research UK, believe the test could allow doctors to choose more appropriate and tailored treatments. Oral cancers, including the tongue and tonsils, are usually associated with tobacco and alcohol intake.

However, increasing numbers of cases are instead linked to human papillomaviruses (HPV) -- which occur in younger people and have a different biology and a better prognosis. One approach for detecting HPV-associated oral cancer relies on finding HPV DNA in the tumour sample but these DNA-based tests may not accurately classify the tumour.

Another approach is to use a marker of HPV rather than testing for HPV DNA directly. The p16 protein usually disappears in tumours that are not caused by HPV infection and has been proposed as a surrogate marker of HPV.

The researchers looked at differences in clinical characteristics, treatment and survival between p16-positive and p16-negative oral cancers in a large group of 217 patients.

Professor Catharine West, from The University of Manchester and Manchester Cancer Research Centre who led the research, said: "We know that in most cases, p16 is linked to differences in survival. We wanted to see how it compared to other measures such as the stage of disease -- which tells us the size and spread of the cancer. Anything that allows us to predict outcome could help doctors plan more personalised treatments for individual patients."

The study, published in the journal *Clinical Oncology*, shows that the presence of p16 in a tumour was strongly linked to increased survival. They found that tumour stage was linked to survival in p16-negative tumours, but not in p16-positive tumours.

Professor West said: "Despite presenting with a more advanced stage of cancer, patients whose tumours tested positive for p16 had greater survival when compared with p16-negative patients. "Applying this test in the clinic could help guide treatment decisions and potentially allow doctors to choose more appropriate and tailored treatments." "Many studies have now shown p16 status is strongly linked to survival. Now we have shown the test works better than routine staging for some cancers, we would recommend this test be offered as standard," added Professor West.

Jessica Kirby, Cancer Research UK's senior health information manager, said: "This study clearly shows that testing for HPV status using p16 levels can be valuable as one of a number of ways doctors determine their patients' prognosis. HPV-associated head and neck cancers are becoming much more common over time, and there's a wealth of evidence that patients with HPV-positive tumours tend to have better outcomes than HPV-negative patients."

*Oguejiofor KK, Hall JS, Mani N, Douglas C, Slevin NJ, Homer J, Hall G, West CM. The prognostic significance of the biomarker p16 in oropharyngeal squamous cell carcinoma. Clinical Oncology, January 2014*