Slate Magazine **medical examiner**

Kidney Mitzvah

Israel's remarkable new steps to solve its organ shortage.

By Sally Satel

This month, Israel launched a new policy to encourage organ donation: Anyone who registers to allow his organs to be taken posthumously gets slight priority if he needs one in the future. When two comparably ill patients are in need, the tie will go to the organ-donation cardholder. The new policy garnered publicity in the Australian, Canadian, South African, and British press. Meanwhile, under the radar, another, more dramatic Israeli initiative took place: giving compensation to families of deceased organ donors.

On Jan. 20, the relatives of a 51-year-old deceased man named Nachis Yafim gathered to accept a check for 10,000 Israeli shekel (roughly $2,700) in recognition of his wife Clara's decision to allow his liver, kidneys, and lungs to be taken for transplantation. The funds will be used by Clara and their 10-year-old son to memorialize Nachis - by paying for his headstone, for example.

In legalizing such a "memorial," Israel thus becomes the first country in the world to reward deceased organ donors. The Organ Donation Law, passed by the Knesset in 2008, says that families who agree to donate the organs of deceased loved ones may accept money to "memorialize" the deceased. Currently, the Israeli Ministry of Health has allowed up to 50,000 shekel, or $13,400, to do so. The money - given by nonprofit groups and taken out of their own pool of charitable contributions - may be used in any way the families see fit to memorialize the deceased.

According to the law, the donor, while alive, must not have refused to become a posthumous donor. This quells anxiety about a family benefiting over the objections of the donor himself. The money for Nachis Yafim's family was given by ADI, a nonprofit organization outside of Tel Aviv that was established to encourage organ donation. It is named for Adi Ben Dror, who died of complications of kidney disease.

In the ceremony held in honor of Yafim, who emigrated from Russia and worked as a security guard in Be'er Sheva, Gadi Ben Dror, the director of ADI, said, in handing the check to Clara, "In this country we always talk about military heroism. ... [T]his is clearly a case of civilian heroism. [His organs] saved four lives. ... [T]he family should be blessed."

Donation at death is a big deal in Israel because of its infrequency. The country is lodged far down on the list of developed countries regarding the availability of deceased organs for transplantation: Nine donors per 1 million people. In comparison, that number is 35 in Spain and 25 in the United States. As of last year, only 8 percent of adult Israelis held organ-donor cards. In Europe, the rates are between 30 percent and 40 percent. In the United States, about 38 percent of adults with a driver's license were registered organ donors in 2009. In addition, the "conversion rate" - that is, the percentage of times a death meeting eligible criteria for donation becomes an actual donor - is 60 percent to 70 percent in the United States. (The rate depends, in large part, on whether families of deceased people agree when asked to give permission to retrieve the organs of loved ones - yes, even if one signs a card, hospitals will allow families to override the deceased donor's indicated preference.) In Spain, the conversion rate is around 80 percent. Israel's conversion rate is 45 percent.

Why such low rates? "Most Jews are under the mistaken impression that traditional Jewish law requires a body be buried whole at all costs," according to Robby Berman, director of the Halachic Organ Donor Society, an organization that encourages Jews all over the world to donate organs to the general population.

Another barrier to deceased donation has been the definition of death. Some ultra-Orthodox rabbis reject brain death as the definition of death because the ventilator is providing oxygen that allows the heart to beat for a few more days after brain death. They insist that the heart must cease to beat before a person can be pronounced dead - a condition making it difficult to obtain suitable organs in a timely manner. To facilitate donation, Israel passed a law in 2008 establishing "brain death" as the definition of death relevant for all legal purposes, including organ donation.

Why is Israel working so hard to increase donation now? Because Israelis can no longer participate in transplant tourism - that is, go abroad to obtain organs.

In 2008, a new law mandated that the Israeli Ministry of Health stop paying for transplants that were obtained in countries that themselves outlaw organ sales. This brought a stop to a policy that was in effect since 1998, when the ministry began covering the cost of transplants obtained from foreign donors. Israelis seeking organs had traveled to places such as Turkey, China, Eastern Europe, and the Philippines, though the exact number of transplant "tourists" is not known. As more Israelis received transplants this way, rates of donation by living relatives went down, according to the Ministry of Health.

Israel should be commended for moving to solve its organ problem, and save lives, by making two moral choices: first, to reduce transplant tourism; second, to provide compensation for deceased donation and priority

ranking to encourage donations. This symmetry is critical to reducing the organ shortage in Israel and all over the world. Incentives must be paired with efforts to combat trafficking.

Alas, the World Health Organization, the Council of Europe, the United Nations, and the International Transplantation Society fail to grasp the need for such a two-pronged strategy. Instead, these groups endorse a strictly unilateral policy that bans organ trafficking. At first blush, yes, this seems reasonable. After all, corrupt brokers deceive indigent donors about the nature of surgery, cheat them out of payment, and ignore their post-surgical needs.

But clamping down on unlawful organ sales without first expanding the organ pool means more patient deaths, not less criminal activity. It drives corruption rings further underground or causes markets to blossom elsewhere around the globe. This is happening now. As China, Pakistan, and the Philippines have begun to curb illicit organ sales, places like Egypt, Eastern Europe, and South and Central America are becoming popular "tourist" sites.

Indeed, the global transplant establishment is so leery of benefiting donors or families directly - as in, for example, allowing Clara to use the 10,000 shekel to pay bills now that her husband is gone - that Israel had to put limits on how the cash was spent. I think this is too bad. Yafim would surely want his family to have some short-term financial cushion. Moreover, freedom to use the benefit as the family decides might be an even better incentive to donate.

Nonetheless, the compensation-for-memorialization is an important development that more countries should adopt.

When Gadi Ben Dror presented the check to Yafim's family, he said, "[We] owe the family our appreciation [which] we express with a gift. It's important to publicize their courage to donate organs in order to encourage others to donate as well." Within those sentiments lies the solution to the organ shortage: expressions of gratitude for a life-saving act intended to encourage others to do the same.

Sally Satel, M.D., a resident scholar at the American Enterprise Institute, is editor of When Altruism Isn't Enough: The Case for Compensating Kidney Donors. ***Article URL:*** ***http://www.slate.com/id/2242791/***

Study suggests that healthy adults may need less sleep as they age

WESTCHESTER, Ill. - A study in the Feb. 1 issue of the journal SLEEP suggests that healthy older adults without sleep disorders can expect to have a reduced "sleep need" and to be less sleepy during the day than healthy young adults.

Results show that during a night of eight hours in bed, total sleep time decreased significantly and progressively with age. Older adults slept about 20 minutes less than middle-aged adults, who slept 23 minutes less than young adults. The number of awakenings and the amount of time spent awake after initial sleep onset increased significantly with age, and the amount of time spent in deep, slow-wave sleep decreased across age groups. Yet even with these decreases in sleep time, intensity and continuity, older adults displayed less subjective and objective daytime sleep propensity than younger adults.

Furthermore, two additional nights involving experimental disruption of slow-wave sleep led to a similar response in all age groups. Daytime sleep propensity increased, and slow-wave sleep rebounded during a night of recovery sleep. According to the authors, this suggests that the lack of increased daytime sleepiness in the presence of an age-related deterioration in sleep quality cannot be attributed to unresponsiveness to variations in homeostatic sleep pressure. Instead, healthy aging appears to be associated with reductions in the sleep duration and depth required to maintain daytime alertness.

"Our findings reaffirm the theory that it is not normal for older people to be sleepy during the daytime," said principal investigator Derk-Jan Dijk, PhD, professor of sleep and physiology at the University of Surrey in the U.K. "Whether you are young or old, if you are sleepy during the day you either don't get enough sleep or you may suffer from a sleep disorder."

The study was conducted at the Clinical Research Centre of the University of Surrey and involved 110 healthy adults without sleep disorders or sleep complaints; 44 were young (20 to 30 years), 35 were middle-aged (40 to 55 years) and 31 were older adults (66 to 83 years). After an eight-hour baseline sleep test, subjects were randomized to two nights with or without selective slow-wave sleep disruption by acoustic stimuli, followed by one recovery night. Nighttime sleep was evaluated by polysomnography, while sleep propensity was assessed using the Multiple Sleep Latency Test (MSLT) and the Karolinska Sleepiness Scale.

During the baseline night, mean objective total sleep time decreased from 433.5 minutes for young adults to 409.9 minutes for middle-aged adults and 390.4 minutes for older adults. Average minutes of slow-wave sleep decreased from 118.4 minutes for young adults to 85.3 minutes for middle-aged adults and 84.2 minutes for older adults. Mean number of minutes spent awake after initial sleep onset increased from 21 for young adults to 49.9 for middle-aged adults and 70.7 for older adults.

Objective daytime sleepiness measured by the MSLT decreased with age. When asked to lie in a comfortable position on the bed and try to fall asleep, young adults fell asleep in an average of 8.7 minutes, compared with 11.7 minutes for middle-aged adults and 14.2 minutes for older adults.

The authors noted that the cause of the age-related reductions in slow-wave sleep and sleep need still must be established. Related factors could include alterations in reproductive hormones or changes in the brain. They added that the study did not address sleep propensity during the evening hours, when it is possible that older adults may be sleepier than young adults.

According to the authors, the study also has implications for the treatment of insomnia in older adults, who may be unaware of their reduced sleep need. Therefore, sleep restriction, which leads to increased homeostatic sleep pressure, may be a successful behavioral therapy for insomnia in healthy older adults.

For a copy of the study, "Age-related Reduction in Daytime Sleep Propensity and Nocturnal Slow Wave Sleep," or to arrange an interview with an AASM spokesperson, please contact Kelly Wagner, AASM public relations coordinator, at (708) 492-0930, ext. 9331, or kwagner@aasmnet.org.

A Record Gust Gets Blown Away

By ANAHAD O'CONNOR

An extreme-weather record has been shattered. Barrow Island, off the coast of Australia, last week claimed the new record for the fastest gust of wind ever recorded - during a cyclone, at 253 miles an hour - surpassing the old mark, 231 miles an hour, set in New Hampshire in 1934.

Strong winds are a phenomenon just about everywhere - but at over 200 miles an hour?
Those are big numbers, almost too weighty to appreciate. To put such a force in perspective, imagine walking into an onrushing linebacker, say, the 6-foot-4, 260-pound Brian Urlacher of the Chicago Bears. Yet that collision still fails to come close to the experience of a 200-mile-an-hour gust of wind, said Brian Clark, a meteorologist for the Mount Washington Observatory in New Hampshire, where the old wind record was set.

Working on Mount Washington, Mr. Clark has experienced 100-mile-an-hour gusts on many days, "and it's enough to take you off your feet," he said. "At anything over 100, it gets very difficult to even stand outside. And that's not even approaching the 200-mile-per-hour mark."

New Hampshire might seem like an odd place for such extreme winds. But it has several factors going for it (or against it, depending on your view). For one, the state lies directly in the path of three major storm tracks. Storms barrel up the East Coast, a jet stream comes in from the west and powerful storms head down from the Canadian Maritimes.

At roughly 6,300 feet, Mount Washington is far shorter than the tallest mountains in the Rockies. But it happens to be the tallest point in the Northeast, which means that it gets the brunt of that confluence of severe winds. It also sits in the Presidential Mountain Range, which creates a funnel effect that squeezes and forces the winds over the peak. Imagine sticking your finger over the mouth of a running garden hose, creating a smaller hole from which the water can escape. It forces the water to speed up. A similar effect occurs with wind on Mount Washington.

But Mount Washington has only held the record for so long because it had the instruments (and staff) to withstand such weather. Tornados and tropical cyclones can produce winds far exceeding 200 miles an hour, said Mary Stampone, the New Hampshire state climatologist. Such speeds have been detected by Doppler radar. But few anemometers, more accurate devices that measure wind speed on the ground, would survive a tornado or cyclone in one piece.

The new record of 253 m.p.h. was set by Tropical Cyclone Olivia, which passed an automated weather station back in 1996. A few scientists noticed at the time, but no one made an issue of it until the World Meteorological Organization stumbled upon the data and made an announcement last week. "It came as a bit of a shock to us," said Mr. Clark at Mount Washington.

"But I wouldn't argue that there hasn't been a wind even higher than 253 m.p.h. at some point in time on this planet," he added. "It's just where do you have the instruments to record it and report it."

Scientists discover enzyme that 'cleans' cancer cells

Scientists have discovered that an enzyme can rid cells of a gene believed to be responsible for a wide range of cancers.

Dr Joerg Hartkamp and Dr Stefan Roberts have found that the protease HtrA2 can "clean" cells of the oncogene WT1, which is found at high levels in many leukaemias and solid cancers such as breast and lung cancer.

Their work has given drug designers a new target which will allow them to develop treatments for all these cancers in which WT1 expression is elevated.

WT1 is a well-known factor in cancer, having been discovered 20 years ago. It suppresses the development of Wilms' tumour of the kidney, a rare cancer that affects one in 10,000 children. However it has a cancer

causing role in other forms of the disease, particularly leukemias such as acute myeloid leukaemia (AML) and chronic myeloid leukaemia (CML).

In addition high expression of WT1 is associated with a bad prognosis in AML patients, while trials using peptide vaccines against WT1 in patients with lung cancer, breast cancer and leukaemia were promising.

This latest study – published in the journal Molecular Cell and funded by the Wellcome Trust, Cancer Research UK and the Association of International Cancer Research (AICR) – is the first to identify the enzyme that can rid cells of WT1.

Dr Hartkamp, at the University of Manchester's Faculty of Life Sciences, said: "The cancer causing role of WT1 has been known for many years, but how it worked was not understood so we studied a regulatory domain of WT1 to see what modified its activity. We carried out a fishing experiment and discovered the role of the protease HtrA2 instead, by accident. This discovery has a much bigger impact.

"We have filled in the black box of WT1. It is this protease that is doing the trick – it can clean cells of WT1."

Dr Roberts, who initiated the work at Manchester and is now at the University at Buffalo, added: "There are great prognostic implications in leukaemias but this protease may have even more targets. It is unlikely that a protease cleaves only one transcription factor such as WT1."

Dr Lesley Walker, director of cancer information at Cancer Research UK, said: "This research sheds new light about how levels of WT1 are controlled and will help us understand more about its role in cancer. Although still at an early stage, this research is an exciting advance and could help to improve the treatment of types of cancer where WT1 is known to have an influence."

AICR's Scientific Adviser Dr Mark Matfield said: "This exciting new finding shows why it is so important to carry out basic research into cancer. More and more these days, we see basic research discovering something unexpected about cancer that could be a major new step forward. The more we find out about cancer the closer we get to beating it."

The team plans to study HtrA2 further, to find out how it is inactivated in cancer cells (allowing WT1 to proliferate) and what other targets HtrA2 has. This will help pharmaceutical companies design a drug to reactivate HtrA2 and apply the protease to different diseases.

It is hoped that patients will be screened for a high level of WT1 and, if this is the case, clinicians can reactivate HtrA2. And as WT1 expression is low in healthy adults, oncogenic expression of WT1 has been found to be tumour specific so targeting WT1 will be less damaging to the patient's general health.

Notes for editors *The paper 'The Wilms' Tumour Suppressor Protein WT1 is processed by the serine protease HtrA2/Omi' is available at http://www.cell.com/molecular-cell/fulltext/S1097-2765(09)00954-X*

MicroRNA: a glimpse into the past

Small molecules give EMBL scientists bigger picture of animal evolution

The last ancestor we shared with worms, which roamed the seas around 600 million years ago, may already have had a sophisticated brain that released hormones into the blood and was connected to various sensory organs. The evidence comes not from a newly found fossil but from the study of microRNAs – small RNA molecules that regulate gene expression – in animals alive today. Scientists at the European Molecular Biology Laboratory (EMBL) in Heidelberg, Germany, have discovered that these molecules are found in the exact same tissues in animals as diverse as sea anemones, worms, and humans, hinting at an early origin of these tissues in animal evolution. Their findings, published today in Nature, also open new avenues for studying the current functions of specific microRNAs.

Animals from different branches of the evolutionary tree – different lineages – possess specific microRNAs that evolved only in their lineage. But they also have microRNAs in common: ones which they inherited from their last common ancestor, and which have been conserved throughout animal evolution.

The EMBL scientists looked at the marine annelid Platynereis dumerilii, which is thought to have changed little over the past 600 million years. They visualised where these conserved microRNAs are expressed, and compared Platynereis with other animals. They found that in Platynereis these microRNAs are highly specific for certain tissues and cell types and, what is more, discovered that tissue specificity was conserved over hundreds of millions of years of evolutionary time.

The scientists reasoned that if an ancient microRNA is found in a specific part of the brain in one species and in a very similar location in another species, then this brain part probably already existed in the last common ancestor of those species. Thus, they were able to glean a glimpse of the past, an idea of some of the traits of the last common ancestor of worms and humans.

"By looking at where in the body different microRNAs evolved, we can build a picture of ancestors for which we have no fossils, and uncover traits that fossils simply cannot show us," says Detlev Arendt, who

headed the study: “But uncovering where these ancient microRNAs are expressed in animals from different branches of the evolutionary tree has so far been very challenging.”

“We found that annelids such as Platynereis and vertebrates such as ourselves share some microRNAs that are specific to the parts of the central nervous system that secrete hormones into the blood, and others that are restricted to other parts of the central or peripheral nervous systems, or to gut or musculature”, explains Foteini Christodoulou, who carried out most of the experimental work. “This means that our last common ancestor already had all these structures.”

Knowing where microRNAs were expressed in our ancestors could also help scientists understand the role of specific microRNA molecules today, as it gives them a clue of where to look.

“If a certain microRNA is known to have evolved in the gut, for instance, it is likely to still carry out a function there”, explains EMBL scientist Peer Bork, who also contributed to the study. Next, Arendt and colleagues would like to investigate the exact function of each of these conserved microRNAs – what genes they regulated, and what processes those genes were involved in – in an attempt to determine what their role might have been in the ancient past.

Source Article

Christodoulou, F., Raible, F., Tomer, R., Simakov, O., Trachana, K., Klaus, S., Snyman, H., Hannon, G.J., Bork, P. & Arendt, D. Ancient animal microRNAs and the evolution of tissue identity. Nature, Advance Online Publication 31st January 2010.

Mass drug overdose – none dead

*** Updated 16:03 03 February 2010 by Andy Coghlan**

No ill effects were reported by hundreds of volunteers who took part in a mass-overdose stunt around the world to demonstrate that homeopathic remedies are nothing more than sugar pills.

"There were no casualties at all, as far as I know," says Martin Robbins, spokesman for the "10:23" campaign, created to highlight the alleged ineffectiveness of homeopathic remedies.

"No one was cured of anything either," says Robbins. Like an estimated 300 volunteers in several cities in the UK, Australia, New Zealand, Canada and the US, he swallowed a bottleful of around 80 homeopathic "pillules" at exactly 10.23 am on Saturday. Each pillule is a tiny sugar pill dabbed with a drop of a homeopathic remedy, produced through "infinite" dilution – the process whereby a solution is diluted to the point where no molecules of an active component are likely to remain.

They want to believe

Robbins says that the aim of the stunt was to draw attention to homeopathic medicine's lack of scientific foundation and to embarrass the British high-street pharmacist Boots into withdrawing its treatments from sale.

Responding to the stunt, Boots said: "We know that many people believe in the benefits of complementary medicines and we aim to offer the products we know our customers want."

Robbins said that the campaign, conceived and orchestrated by the Merseyside Skeptics Society, would be a success if it prompted the public to ask more questions about what homeopathy actually is.

Jayney Goddard of the UK's Complementary Medical Association condemned the action. "The stunt was just that – a simple, rather silly and irresponsible stunt," she told New Scientist. " There was no real understanding if the principles of homeopathy.

Compound found that targets wide range of viruses

Cell-culture and animal tests show antiviral could provide protection against HIV, Ebola, hepatitis C, herpes and more

GALVESTON, Texas - The development of antibiotics gave physicians seemingly miraculous weapons against infectious disease. Effective cures for terrible afflictions like pneumonia, syphilis and tuberculosis were suddenly at hand. Moreover, many of the drugs that made them possible were versatile enough to knock out a wide range of deadly bacterial threats.

Unfortunately, antibiotics have a fundamental limitation: They're useless against viruses, which cause most infectious diseases. Antiviral drugs have proven far more difficult to create, and almost all are specifically directed at a few particular pathogens - namely HIV, herpes viruses and influenza viruses. The two "broad-spectrum" antivirals in use, ribavirin and interferon-alpha, both cause debilitating side effects.

Now, researchers from the University of Texas Medical Branch at Galveston, UCLA, Harvard University, the U.S. Army Medical Research Institute of Infectious Diseases and Cornell University have teamed up to develop and test a broad-spectrum antiviral compound capable of stopping a wide range of highly dangerous viruses, including Ebola, HIV, hepatitis C virus, West Nile virus, Rift Valley fever virus and yellow fever virus, among others.

UCLA researchers led by Dr. Benhur Lee - corresponding author on a paper on the work appearing this week on the Proceedings of the National Academy of Science Web site - identified the compound (which they

call LJ001), after screening a "library" of about 30,000 molecules to find a one that blocked the host cell entry of deadly Nipah virus. Subsequent experiments revealed that LJ001 blocked other viruses that, like Nipah, were surrounded by fatty capsules known as lipid envelopes. It had no effect on nonenveloped viruses.

"Once we started testing more and more, we realized that it was only targeting enveloped viruses," said Alexander Freiberg, director of UTMB's Robert E. Shope, M.D. Laboratory, the Biosafety Level 4 lab where much of the cell-culture work was done, as well as mouse studies with Ebola and Rift Valley fever viruses. "We followed up and determined that it was somehow changing the lipid envelope to prevent the fusion of the virus particle with the host cell."

Additional experiments indicated that while LJ001 also interacted with cell membranes, whose composition is nearly identical with that of virus envelopes, it caused them no ill effects. The reason, according to the researchers: Cells can rapidly repair their membranes, but viruses can't fix their envelopes.

"At antiviral concentrations, any damage it does to the cell's membrane can be repaired, while damage done to static viral envelopes, which have no inherent regenerative capacity, is permanent and irreversible," said Lee.

UTMB authors of the PNAS paper include graduate student Sara Woodson and adjunct associate professor Michael Holbrook, former director of the Shope BSL4 lab and principal investigator on the UTMB portion of the project. UCLA contributors are Mike Wolf, Tinghu Zhang, Zeynep Akyol-Ataman, Andrew Grock, Patrick Hong, Natalya Watson, Angela Fang, Hector Aguilar, Robert Damaoiseaux, John Miller, Steven Chantasirivisal, Vanessa Fontanes, Oscar Negrete, Paul Krogstad, Asim Dasgupta, Kym Faull and Michael Jung. Other authors are Jianrong Li and Sean Whelan of Harvard; Matteo Porotto and Anne Moscona of Cornell; and Anna Honko and Lisa Hensley of USAMRIID.

The National Institutes of Health, the UCLA Center for AIDS Research, the Burroughs Wellcome fund, the March of Dimes, the California Nanosystems Institute and the Warsaw Fellowship Endowment supported this research.

New form of stem cell communication rescues diseased neurons

International effort demonstrates cross-talk between implanted stem cells and diseased cells in mouse model

LA JOLLA, Calif. - Investigators at Sanford-Burnham Medical Research Institute (Sanford-Burnham, formerly Burnham Institute for Medical Research), the Karolinska Institutet, Beth Israel Deaconess Medical Center (BIDMC), Harvard Medical School and Université Libre de Bruxelles have demonstrated in mouse models that transplanted stems cells, when in direct contact with diseased neurons, send signals through specialized channels that rescue the neurons from death. These direct cell-to-cell connections may also play a role in normal development by laying down the blueprint for more mature electrical connections between neurons and other cells. The research was published in the journal Proceedings of the National Academy of Sciences on February 1.

While it was already known that stem cells will seek out diseased cells in the brain, the international group of scientists showed, both in tissue culture and in mice, that the stem cells actively bring diseased neurons back from the brink via cross-talk through gap junctions, the connections between cells that allow molecular signals to pass back and forth. Significantly, the stem cells do not need to differentiate into the specific type of neuron to provide this therapeutic effect. The researchers also believe this protective mechanism may be active in other cell types and play a role in many diseases. For example, some of their preliminary work shows that these mechanisms may rescue damaged neural fibers in adult spinal cord injuries.

"We showed a while ago that stems cells may exert a therapeutic effect on damaged or diseased host systems by secreting therapeutic factors and 'bathing' the dying cells," said Evan Snyder, M.D., Ph.D., director of the Stem Cell and Regenerative Biology program at Sanford-Burnham. "However, we did not know that stem cells can also exert their action through direct cell-to-cell contact. Indeed, we believe that this may be a newly-recognized way in which stem cells communicate with the cells around them, not only under diseased conditions but during normal development."

"Grafted neural stem cells of mouse and human origin make early gap junction contact with cells in the host brain that benefit endangered host neurons, even rescuing them from impending cell death," added Richard L. Sidman, M.D., Professor of Neuropathology (Neuroscience) at BIDMC, Boston and Harvard Medical School.

Beginning with tissue culture studies, the team found that neural stem cells (NSCs, including human NSCs) integrated into the neural circuitry, coordinated signaling (as measured by calcium fluxes) and protected injured neurons. The team replicated these findings in diseased mice (including those that have a disorder similar to Huntington's disease) and spinal-injured rats. The scientists, led by Eric Herlenius, Ph.D., of the Karolinska Institutet and Dr. Snyder, hypothesized that communication through gap junctions was the mechanism for the protective effect. Subsequently, the researchers disabled gap junctions, which diminished the therapeutic effect and validated the gap junction hypothesis.

Are stem cell scientists sabotaging rivals' work?

*** 17:06 02 February 2010 by Andy Coghlan**

Would top-flight scientists stoop so low as to sabotage disclosure of rival research that threatens to scoop their own?

Although short of proof, a group of senior stem cell researchers warn that it may be happening. They are calling for journal editors to be alert to referees who might abuse their position in the peer-review process to discredit or block rival research. "It's all done in secret, so it's very hard to gather information on this," says Robin Lovell-Badge of the National Institute for Medical Research in London.

He and Shinya Yamanaka of Kyoto University, Japan, who famously reprogrammed ordinary cells to become similar to embryonic stem cells, are among 14 signatories to a letter of complaint sent in July 2009 to major scientific journals, including Nature and Science. Frustrated by the lack of response, some signatories decided to publicise the letter's content more widely this week.

The letter called on journals to publish anonymised comments from referees alongside published papers, so that the fairness and scientific validity of the comments can be judged by all, a practice already adopted by The EMBO Journal.

Beyond anecdotal

"It is hard to get beyond anecdotal evidence of reviewers making extravagant demands," says co-signatory Austin Smith at the University of Cambridge, also publicising the letter this week. "The more serious issue is that papers are getting through review in the same journals with serious holes, or interpretations that go way beyond the data," he says.

"Because all comments would be published, it would hopefully make biased or careless refereeing less common, and it would embarrass journals if people could spot biased or stupid comments," says Lovell-Badge.

The fact that only two signatories were from the US hinted that most disenchantment lies elsewhere, he adds. "There does seem to be this bias against groups from the rest of the world."

Philip Campbell, editor-in-chief at Nature, says The EMBO Journal model "is still on the table", but says it's up to journal editors to decide if referees' demands for extra experiments are justified, and to spot referees who appear to be causing delays.

Virus pulls bait and switch on insect vectors

A common plant virus lures aphids to infected plants by making the plants more attractive, but when the insects taste the plant, they quickly leave for tastier, healthier ones. In the process, the insects rapidly transmit the disease, according to Penn State entomologists.

"The virus improves the cues that insects use to identify food by elevating some aspect of a trait that is already in the plant," said Mark C. Mescher, assistant professor of entomology. "In this case they appear to elevate the odor cue, without changing it."

This type of host alteration has implications beyond agriculture. If pathogens can alter hosts to make transmission more efficient, they may be doing it in such insect-transmitted human diseases as malaria or dengue fever.

This is a wingless morph of Myzus persicae aphid on squash plant. **Kerry Mauck (courtesy of De Moraes and Mescher labs), Penn State**

Some plant viruses entice insects to visit infected plants and stay awhile, incorporating the virus into the insect's system. Then, when they fly to another plant, they transfer the virus. This is a persistent mode of transmission because the plants will infect all the subsequent plants the insects dine on. However, the insects needed to spend a sizable amount of time on the original infected plant.

The researchers are looking at the cucumber mosaic virus because it is not a persistent virus. Insects pick up the virus when they take their first taste of leaf. The virus binds chemically to mouth parts and when the insect feeds on another leaf, the virus is transferred, but in most cases only to the first plant and not to subsequent ones, making this a non-persistent virus. They reported their findings in this week's online Proceedings of the National Academy of Sciences.

"Viruses like these (non-persistent ones) use a different system to ensure transmission," said Kerry E. Mauck, graduate student in entomology. "They have not been examined as closely as persistent systems."

Aphids transmit cucumber mosaic virus, which will infect the entire squash family of plants. The researchers investigated two species of aphids that can transmit the virus, one that prefers squash but will eat other things, and one that prefers turnips but will also eat squash. They used a special insect arena developed for testing aphid responses to plant odors. The aphids could not see or alight on the plants so they did not have color or taste cues. The insects could only access the chemicals the plants released into the surrounding air.

"We wanted to see where they aggregated most often," said Mauck. "They tended toward the plants that were infected rather than the healthy leaves."

Mauck, Mescher and Consuelo De Moraes, associate professor of entomology, next tested the aphids to see which plant allowed them to reproduce the best. They found that the aphids reproduced less well on the infected plants than they did on the healthy plants.

Next the researchers tested the aphids to see how long they stayed on infected or healthy plants. While the sick plants initially attracted the aphids, probably because of the increased odor cues, the insects remained on the healthy plants much longer.

"We demonstrated that there were attraction cues combined with a repellant response when the plant was eaten," said Mauck. "We used two species of aphid to ensure that it was not a fluke that one aphid behaved this way."

This is a wingless morph of Myzus persicae aphid on squash plant. **Kerry Mauck (courtesy of De Moraes and Mescher labs), Penn State**

The researchers have not done a time study to see how many aphids actually visit sick and healthy plants over time. All the studies so far have been only a snapshot in time. They have tested the sick plants and determined that these plants produce much more volatile chemicals than healthy plants, but that the chemicals are the same as those produced by healthy plants.

"If the viruses caused the sick plants to produce altered volatile cues, then the insects could learn how the sick plants smelled and avoid them," said Mescher. "Because the virus only increases the amount of chemicals, there may be no way for the insects to distinguish between sick and healthy plants until they feed on them."

Mescher notes that the team is working on similar questions in human disease systems.

"We know that malaria-infected people are more attractive to malaria-transmitting mosquitoes," said Mescher. "We do not know if the same principles as in cucumber mosaic virus apply to malaria, but we are working on it." *The U.S. Department of Agriculture supported this work.*

The Miracle of Vitamin D: Sound Science, or Hype?

By TARA PARKER-POPE

Imagine a treatment that could build bones, strengthen the immune system and lower the risks of illnesses like diabetes, heart and kidney disease, high blood pressure and cancer.

Some research suggests that such a wonder treatment already exists. It's vitamin D, a nutrient that the body makes from sunlight and that is also found in fish and fortified milk.

Yet despite the health potential of vitamin D, as many as half of all adults and children are said to have less than optimum levels and as many as 10 percent of children are highly deficient, according to a 2008 report in The American Journal of Clinical Nutrition.

Stuart Bradford

As a result, doctors are increasingly testing their patients' vitamin D levels and prescribing daily supplements to raise them. According to the lab company Quest Diagnostics, orders for vitamin D tests surged more than 50 percent in the fourth quarter of 2009, up from the same quarter a year earlier. And in 2008, consumers bought $235 million worth of vitamin D supplements, up from $40 million in 2001, according to Nutrition Business Journal.

But don't start gobbling down vitamin D supplements just yet. The excitement about their health potential is still far ahead of the science.

Although numerous studies have been promising, there are scant data from randomized clinical trials. Little is known about what the ideal level of vitamin D really is, whether raising it can improve health, and what potential side effects are caused by high doses. And since most of the data on vitamin D comes from observational research, it may be that high doses of the nutrient don't really make people healthier, but that healthy people simply do the sorts of things that happen to raise vitamin D.

"Correlation does not necessarily mean a cause-and-effect relationship," said Dr. JoAnn E. Manson, a Harvard professor who is chief of preventive medicine at Brigham and Women's Hospital in Boston.

"People may have high vitamin D levels because they exercise a lot and are getting ultraviolet-light exposure from exercising outdoors," Dr. Manson said. "Or they may have high vitamin D because they are health-conscious and take supplements. But they also have a healthy diet, don't smoke and do a lot of the other things that keep you healthy."

Dr. Manson is leading a major study over the next five years that should provide answers to these questions and more. The nationwide clinical trial is recruiting 20,000 older adults, including men 60 and older and women 65 and older, to study whether high doses of vitamin D and omega-3 fatty acids from fish-oil supplements will lower risk for heart disease and cancer. (Learn about taking part in the study at www.vitalstudy.org.)

Dr. Manson said fish-oil supplements were included in the study because they are another promising treatment that suffers from a dearth of clinical trial evidence. In addition, both vitamin D and fish oil are known to have an anti-inflammatory effect, but each works through a different pathway in the body, so there may be an added health benefit in combining them.

Study participants will be divided into four groups. One will take both vitamin D and fish oil pills. Two will take either a vitamin D or a fish-oil supplement and a placebo. The fourth will take two placebo pills.

Vitamin D is found throughout the body and acts as a signaling mechanism to turn cells on and off. Right now, the recommended dose from food and supplements is about 400 international units a day for most people, but most experts agree that is probably too low. The Institute of Medicine is reviewing guidelines for vitamin D and is expected to raise the recommended daily dose.

Study participants will take 2,000 I.U.'s of vitamin D3, believed to be the form most easily used by the body. The study will use one-gram supplements of omega-3 fish oil, about 5 to 10 times the average daily intake.

The vitamin D dose is far higher than what has been used in other studies. The well-known Women's Health Initiative study, for instance, tracked women taking 400 units of vitamin D and 1,000 milligrams of calcium. The study found no overall benefit from the supplements, although women who consistently took their pills had a lower risk of hip fracture. Even so, many experts think 400 units is far too low for any additional health benefits.

Another study, of 1,200 women, looked at the effects of 1,500 milligrams of calcium and 1,000 units of vitamin D. Women who took both supplements showed a lower risk for breast cancer over the next four years, but the numbers of actual cases — seven breast cancers in the placebo group and four in the supplement group — were too small to draw meaningful conclusions.

Although consumers may be tempted to rush out and start taking 2,000 I.U.'s of vitamin D a day, doctors warn against it. Several recent studies of nutrients, including vitamins E and B, selenium and beta carotene, have proved disappointing — even suggesting that high doses do more harm than good, increasing risk for heart problems, diabetes and cancer, depending on the supplement.

Despite the promise of vitamin D in observational studies, research into other supplements shows it's difficult to document a benefit in otherwise healthy people, and virtually impossible to predict potential harms, notes Dr. Eric A. Klein, chairman of the Glickman Urological and Kidney Institute at the Cleveland Clinic. Dr. Klein recently worked as national coordinator for Select, a study of vitamin E and selenium for prostate cancer. The study seemed promising, but in the end it showed no benefit from the supplements and a potentially higher risk for diabetes in selenium users.

"My sentiment is that the lesson we have learned form large trials with other vitamin supplements, including Select, is that there is no proven health or preventative benefit for dietary supplements in nutritionally replete populations, which accounts for most of the people who enter this sort of clinical trial," Dr. Klein said. "It makes more sense to me to study dietary supplements or vitamins in populations who are deficient."

People most at risk for vitamin D deficiency are older, have diabetes or kidney disease, stay indoors or have darker skin. African-American teenagers are at particularly high risk, possibly because in addition to their dark skin, they are less likely at that age to drink milk or play outside.

The scientific community continues to debate the optimum level of vitamin D. In general, people are considered to be deficient if they have blood levels below 15 or 20 nanograms per milliliter. But many doctors now believe vitamin D levels should be above 30. The ideal level isn't known, nor is it known at what point a person is getting too much vitamin D, which can lead to kidney stones, calcification in blood vessels and other problems.

People's vitamin D levels are influenced by whether they have light or dark skin, where they live, how much time they spend outdoors and by fish and milk consumption. To raise vitamin D without supplements, a person could increase sun exposure for 10 to 15 minutes a day. Eating more fish can help — a 3.5-ounce serving of wild fresh salmon has 600 to 1,000 I.U.'s of vitamin D — but it would take a quart of milk a day to get the recommended dose of vitamin D.

"What we know is that there are a lot of people who are vitamin D deficient based on estimates from national surveys," said Dr. Michal L. Melamed, assistant professor of medicine at Albert Einstein College of Medicine in the Bronx. "But we don't know what happens when the curve shifts to the other end. There probably is a risk to having too much vitamin D in the system."

Anesthetic approach stops pain without affecting motor function

Surprise finding may have implications for labor anesthesia, orthopedics and more

BOSTON, Mass. - One of the holy grails of local anesthesia is the ability to achieve a long-lasting nerve block that eliminates pain sensation while not affecting motor function. Now, researchers at Children's Hospital Boston have discovered an anesthetic approach that seems to do just that. If it proves to work in humans as well as it did in rats, it could be useful in a variety of medical applications, providing, for example, a local anesthetic for childbirth that would block pain without interfering with the mother's ability to push, or for musculoskeletal disorders in which it is important to maintain mobility.

The discovery was reported in the online Early Edition of the Proceedings of the National Academy of Sciences during the week of February 1.

The researchers, led by Daniel Kohane, MD, PhD, of the Division of Critical Care Medicine at Children's, originally sought only to find an agent that would prolong the anesthetics' effects. They focused on surfactants, a subclass of so-called "chemical permeability enhancers" that enable drugs to spread more easily throughout a tissue.

In testing three kinds of surfactant along with the anesthetics QX-314 and QX-222 (both derivatives of lidocaine), they found that this approach did prolong the sensory block in rats' sciatic nerves, for up to 7 hours or more depending on the surfactant, but didn't prolong motor impairment; in some cases the motor block was absent or of very short duration. In the rats, this meant they were able to tolerate having their paws on a hot plate for long periods, yet still able to balance and bear weight on their legs.

"This was a surprise finding," says Kohane, who also directs the Laboratory for Biomaterials and Drug Delivery (LBDD) at Children's. "What we've discovered really is a new approach; the question now is to figure out the mechanism by which it works and look at the effects of other chemical permeability enhancers."

Kohane speculates that surfactant made the anesthetic better able to penetrate sensory nerves, which have little or none of the fatty coating known as myelin, whereas in motor neurons, which have abundant myelin, the active drug gets trapped in the myelin, never entering the nerve itself.

The lab's next steps will be to explore the effects of different permeability enhancers and examine their safety, since at high doses the drug combination could potentially be toxic to the nerves. The eventual plan is to test the approach in larger animals.

A parallel approach to achieving a pain-specific nerve block was proposed in 2007 by Clifford Woolf, MD, PhD, recently appointed director of the Children's Hospital Boston Program in Neurobiology. Woolf's team combined QXT-314 with capsaicin, which opens cellular gates that are only present in sensory neurons, and achieved pain-specific blocks in rats lasting 2 hours or more.

The new study was funded by the National Institutes of General Medical Sciences. Itay Sagie, a research associate at the LBDD was the paper's first author. For licensing information, see: www.childrensinnovations.org/SearchDetails.aspx?id=1679.

Citation: Sagie I and Kohane D. Prolonged sensory-selective nerve blockade. PNAS online early edition, week of February 1, 2010.

Infection Persists, Despite Vaccine

By NICHOLAS BAKALAR

A vaccine introduced in 2000 has been highly effective in reducing the number of severe lung, blood and brain infections in infants and children. But at the same time, a serious and sometimes fatal complication has become more common.

Researchers report that the rate of the complication, pneumococcal empyema (pronounced em-pye-EE-ma), an accumulation of dense pus between the outer surface of the lung and the chest wall, increased after the vaccine came into widespread use. The infected material is so thick that it interferes with breathing; surgery is often required.

Before the 7-valent pneumococcal conjugate vaccine, or PCV7, was available, pneumococcal disease in the United States annually caused more than 700 cases of meningitis in children, 13,000 blood infections, about 5 million ear infections and 200 deaths. Children under 2 are at highest risk for serious disease, which can be hard to treat because some pneumococcus strains have become drug-resistant.

Researchers using information from hospital discharge data found that while the hospitalization rate for children with pneumococcal disease had sharply declined, those hospitalized were more likely to be so sick they needed surgery. The analysis appears in the January issue of Pediatrics.

One reason, the scientists believe, is that other known strains of pneumococcus have flourished without competition from the seven covered by the vaccine. Dr. Su-Ting T. Li, the lead author of the study, said newly evolving pneumococcal strains might also be a problem.

Dr. Li, an assistant professor of pediatrics at the University of California, Davis, said the PCV7 vaccine was unquestionably effective. “Vaccination is working to decrease the incidence of pneumococcal pneumonia, sepsis and meningitis,” she said, referring to infections of the lungs, blood and brain. “But it’s not decreasing the incidence of empyema.” Compared with 1997, she found, children hospitalized with pneumococcus infections in 2006 were twice as likely to have empyema.

Pneumococcal vaccines for adults have been available for more than 30 years, but until the introduction of PCV7, none would work in children under 2. The Centers for Disease Control and Prevention now recommends the vaccine for all children under 5.

The researchers came to their conclusion by analyzing the Kids’ Inpatient Database, a nationally representative sample of hospital inpatient stays for children. In 2006, an estimated 2,898 children under 18 were hospitalized with empyema. Most were younger than 5, and for unknown reasons, the greatest increase was among children 2 to 4. The overall empyema rate in 2006 was 3.7 per 100,000 children, compared with 2.2 per 100,000 in 1997, an increase of almost 70 percent.

Catherine A. Lexau, an epidemiologist with the Minnesota Department of Health, mentioned some of the study’s weaknesses. Discharge data may not be accurate, she said, and the study has fewer findings for the particular organisms that caused the pneumonia or empyema.

The criticism is apt because other organisms besides pneumococcus can cause empyema, and the database the researchers used does not consistently identify which germs were involved.

But looking only at the cases that specified pneumococcal disease, researchers found that children were less likely to be hospitalized than before the advent of the vaccine but much more likely to have empyema as a complication. Other researchers found the work valuable and persuasive.

Dr. Carrie L. Byington, a professor of pediatrics at the University of Utah, said that the broad national sample gave the study strength and that the findings were consistent with smaller regional studies. She also noted that pneumococcal disease was a global problem, much worse in many countries than it is in the United States.

While PCV7 all but eliminated disease caused by the seven strains it was designed for, there are more than 80 other pneumococcal strains. This may soon change, Dr. Byington said: a new vaccine, already approved in Europe and now under review by the Food and Drug Administration, will cover six additional strains of pneumococcus, including the ones suspected of causing the most serious disease.

Second Opinion

A Lasting Gift to Medicine That Wasn’t Really a Gift

By DENISE GRADY

Fifty years after Henrietta Lacks died of cervical cancer in the “colored” ward at Johns Hopkins Hospital, her daughter finally got a chance to see the legacy she had unknowingly left to science. A researcher in a lab at Hopkins swung open a freezer door and showed the daughter, Deborah Lacks-Pullum, thousands of vials, each holding millions of cells descended from a bit of tissue that doctors had snipped from her mother’s cervix.

Ms. Lacks-Pullum gasped. “Oh God,” she said. “I can’t believe all that’s my mother.”

When the researcher handed her one of the frozen vials, Ms. Lacks-Pullum instinctively said, “She’s cold,” and blew on the tube to warm it. “You’re famous,” she whispered to the cells.

Minutes later, peering through a microscope, she pronounced them beautiful. But when she asked the researcher which were her mother’s normal cells and which the cancer cells, his answer revealed that her precious relic was not quite what it seemed. The cells, he replied, were “all just cancer.”

The vignette comes from a gripping new book, “The Immortal Life of Henrietta Lacks” (Crown Publishers), by the journalist Rebecca Skloot. The story of Mrs. Lacks and her cells, and the author’s own adventures with Mrs. Lacks’s grown children (one fries her a pork chop, and another slams her against a wall) is by turns heartbreaking, funny and unsettling. The book raises troubling questions about the way Mrs. Lacks and her family were treated by researchers and about whether patients should control or have financial claims on tissue removed from their bodies.

The story began in January 1951, when Mrs. Lacks was found to have cervical cancer. She was treated with radium at Johns Hopkins, the standard of care in that day, but there was no stopping the cancer. Her doctor had never seen anything like it. Within months, her body was full of tumors, and she died in excruciating pain that October. She was 31 and left five children, the youngest just a year old. She had been a devoted mother, and the children suffered terribly without her.

Neither Mrs. Lacks nor any of her relatives knew that doctors had given a sample of her tumor to Dr. George Gey, a Hopkins researcher who was trying to find cells that would live indefinitely in culture so researchers could experiment on them. Before she came along, his efforts had failed. Her cells changed everything: they multiplied like crazy and never died.

A cell line called HeLa (for Henrietta Lacks) was born. Those immortal cells soon became the workhorse of laboratories everywhere. HeLa cells were used to develop the first polio vaccine, they were launched into space for experiments in zero gravity and they helped produce drugs for numerous diseases, including Parkinson's, leukemia and the flu. By now, literally tons of them have been produced.

Dr. Gey did not make money from the cells, but they were commercialized. Now they are bought and sold every day the world over, and they have generated millions in profits.

The Lacks family never got a dime. They were poor, with little education and no health insurance, and some had serious physical or mental ailments. But they didn't even know that tissue had been taken or that HeLa cells even existed until more than 20 years after Mrs. Lacks's death. And they found out only by accident, when her daughter-in-law met someone from the National Cancer Institute who recognized her surname and said he was working with cells from "a woman named Henrietta Lacks."

The daughter-in-law rushed home and told Mrs. Lacks's son, Lawrence, "Part of your mother, it's alive!"

When they learned that their mother's cells had saved lives, the family felt proud. But they also felt confused, a bit frightened, used and abused. It had never occurred to anyone to ask permission to take their mother's tissue, tell them that her cells had changed scientific history or even to say thank you. And certainly no one had ever suggested that they deserved a share of the profits.

Some of the Lackses later gave blood to Hopkins researchers, thinking they were being tested for cancer, when really the scientists wanted their genetic information to help determine whether HeLa cells were contaminating other cultures. When Ms. Lacks-Pullum asked a renowned geneticist at the hospital, Victor McKusick, about her mother's illness and the use of her cells, he gave her an autographed copy of an impenetrable textbook he had edited, and, Ms. Skloot writes, "beneath his signature, he wrote a phone number for Deborah to use for making appointments to give more blood."

The bounds of fairness, respect and simple courtesy all seem to have been breached in the case of the Lacks family. The gulf between them and the scientists — race, class, education — was enormous and made communication difficult.

A less charitable view is that it might have made the Lackses easier to ignore. When the family's story became known in the black community in Baltimore, Ms. Skloot writes, it was seen as the case of a black woman whose body had been exploited by white scientists.

Ideas about informed consent have changed in the last 60 years, and the forms now given to people having surgery or biopsies usually spell out that tissue removed from them may be used for research. But Ms. Skloot points out that patients today don't really have any more control over removed body parts than Mrs. Lacks did. Most people just obediently sign the forms.

Which is as it should be, many scientists say, arguing that Mrs. Lacks's immortal cells were an accident of biology, not something she created or invented, and were used to benefit countless others. Most of what is removed from people is of no value anyway, and researchers say it would be too complicated and would hinder progress if ownership of such things were assigned to patients and royalties had to be paid.

But in an age in which people can buy songs with the click of a mouse, that argument may become harder to defend.

So far, the courts have sided with scientists, even in a case in the 1980s in which a leukemia patient's spleen and other tissues turned out to be a biomedical gold mine — for his doctor. The patient, John Moore, sued his doctor after discovering that the doctor had filed for a patent on his cells and certain proteins they made, and had created a cell line called Mo with a market value estimated at $3 billion. Mr. Moore ultimately lost before the California Supreme Court.

As Ms. Skloot writes in her last chapter, this issue is not going away. If anything, it may become increasingly important, because the scale of tissue research is growing, and people are becoming savvier about the money to be made and also the potential for abuse if tissue samples are used to ferret out genetic information.

The notion of "tissue rights" has inspired a new category of activists. The question that comes up repeatedly is, if scientists or companies can commercialize a patient's cells or tissues, doesn't that patient, as provider of the raw material, deserve a say about it and maybe a share of any profits that result? Fewer people these days may be willing to take no for an answer.

This article has been revised to reflect the following correction: Correction: *February 4, 2010*

The Second Opinion column on Tuesday, about Henrietta Lacks, who unknowingly contributed cancer cells to medical researchers before her death in 1951, misstated the surname of one of her children at one point. As noted elsewhere in the column, she is Deborah Lacks-Pullum, not Pullum-Lacks.

New research rejects 80-year theory of 'primordial soup' as the origin of life

Earth's chemical energy powered early life through 'the most revolutionary idea in biology since Darwin'

For 80 years it has been accepted that early life began in a 'primordial soup' of organic molecules before evolving out of the oceans millions of years later. Today the 'soup' theory has been over turned in a pioneering paper in BioEssays which claims it was the Earth's chemical energy, from hydrothermal vents on the ocean floor, which kick-started early life.

"Textbooks have it that life arose from organic soup and that the first cells grew by fermenting these organics to generate energy in the form of ATP. We provide a new perspective on why that old and familiar view won't work at all," said team leader Dr Nick lane from University College London. "We present the alternative that life arose from gases (H2, CO2, N2, and H2S) and that the energy for first life came from harnessing geochemical gradients created by mother Earth at a special kind of deep-sea hydrothermal vent – one that is riddled with tiny interconnected compartments or pores."

The soup theory was proposed in 1929 when J.B.S Haldane published his influential essay on the origin of life in which he argued that UV radiation provided the energy to convert methane, ammonia and water into the first organic compounds in the oceans of the early earth. However critics of the soup theory point out that there is no sustained driving force to make anything react; and without an energy source, life as we know it can't exist.

"Despite bioenergetic and thermodynamic failings the 80-year-old concept of primordial soup remains central to mainstream thinking on the origin of life," said senior author, William Martin, an evolutionary biologist from the Institute of Botany III in Düsseldorf. "But soup has no capacity for producing the energy vital for life."

In rejecting the soup theory the team turned to the Earth's chemistry to identify the energy source which could power the first primitive predecessors of living organisms: geochemical gradients across a honeycomb of microscopic natural caverns at hydrothermal vents. These catalytic cells generated lipids, proteins and nucleotides giving rise to the first true cells.

The team focused on ideas pioneered by geochemist Michael J. Russell, on alkaline deep sea vents, which produce chemical gradients very similar to those used by almost all living organisms today - a gradient of protons over a membrane. Early organisms likely exploited these gradients through a process called chemiosmosis, in which the proton gradient is used to drive synthesis of the universal energy currency, ATP, or simpler equivalents. Later on cells evolved to generate their own proton gradient by way of electron transfer from a donor to an acceptor. The team argue that the first donor was hydrogen and the first acceptor was CO2.

"Modern living cells have inherited the same size of proton gradient, and, crucially, the same orientation – positive outside and negative inside – as the inorganic vesicles from which they arose" said co-author John Allen, a biochemist at Queen Mary, University of London.

"Thermodynamic constraints mean that chemiosmosis is strictly necessary for carbon and energy metabolism in all organisms that grow from simple chemical ingredients [autotrophy] today, and presumably the first free-living cells," said Lane. "Here we consider how the earliest cells might have harnessed a geochemically created force and then learned to make their own."

This was a vital transition, as chemiosmosis is the only mechanism by which organisms could escape from the vents. "The reason that all organisms are chemiosmotic today is simply that they inherited it from the very time and place that the first cells evolved – and they could not have evolved without it," said Martin.

"Far from being too complex to have powered early life, it is nearly impossible to see how life could have begun without chemiosmosis", concluded Lane. "It is time to cast off the shackles of fermentation in some primordial soup as 'life without oxygen' – an idea that dates back to a time before anybody in biology had any understanding of how ATP is made."

Basics

Abstract Thoughts? The Body Takes Them Literally

By NATALIE ANGIER

The theory of relativity showed us that time and space are intertwined. To which our smarty-pants body might well reply: Tell me something I didn't already know, Einstein.

Researchers at the University of Aberdeen found that when people were asked to engage in a bit of mental time travel, and to recall past events or imagine future ones, participants' bodies subliminally acted out the metaphors embedded in how we commonly conceptualized the flow of time.

Serge Bloch

As they thought about years gone by, participants leaned slightly backward, while in fantasizing about the future, they listed to the fore. The deviations were not exactly Tower of Pisa leanings, amounting to some two or three millimeters' shift one way or the other. Nevertheless, the directionality was clear and consistent.

"When we talk about time, we often use spatial metaphors like 'I'm looking forward to seeing you' or 'I'm reflecting back on the past,' " said Lynden K. Miles, who conducted the study with his colleagues Louise K. Nind and C. Neil Macrae. "It was pleasing to us that we could take an abstract concept such as time and show that it was manifested in body movements."

The new study, published in January in the journal Psychological Science, is part of the immensely popular field called embodied cognition, the idea that the brain is not the only part of us with a mind of its own.

"How we process information is related not just to our brains but to our entire body," said Nils B. Jostmann of the University of Amsterdam. "We use every system available to us to come to a conclusion and make sense of what's going on."

Research in embodied cognition has revealed that the body takes language to heart and can be awfully literal-minded.

You say you're looking forward to the future? Here, Ma, watch me pitch forward!

You say a person is warm and likable, as opposed to cold and standoffish? In one recent study at Yale, researchers divided 41 college students into two groups and casually asked the members of Group A to hold a cup of hot coffee, those in Group B to hold iced coffee. The students were then ushered into a testing room and asked to evaluate the personality of an imaginary individual based on a packet of information.

Students who had recently been cradling the warm beverage were far likelier to judge the fictitious character as warm and friendly than were those who had held the iced coffee.

Or maybe you are feeling the chill wind of social opprobrium. When researchers at the University of Toronto instructed a group of 65 students to remember a time when they had felt either socially accepted or socially snubbed, those who conjured up memories of a rejection judged the temperature of the room to be an average of five degrees colder than those who had been wrapped in warm and fuzzy thoughts of peer approval.

The body embodies abstractions the best way it knows how: physically. What is moral turpitude, an ethical lapse, but a soiling of one's character? Time for the Lady Macbeth Handi Wipes. One study showed that participants who were asked to dwell on a personal moral transgression like adultery or cheating on a test were more likely to request an antiseptic cloth afterward than were those who had been instructed to recall a good deed they had done.

When confronted with a double entendre, a verbal fork in the road, the body heeds Yogi Berra's advice, and takes it. In a report published last August in Psychological Science, Dr. Jostmann and his colleagues Daniel Lakens and Thomas W. Schubert explored the degree to which the body conflates weight and importance. They learned, for example, that when students were told that a particular book was vital to the curriculum, they judged the book to be physically heavier than those told the book was ancillary to their studies.

The researchers wanted to know whether the sensation of weightiness might influence people's judgments more broadly.

In a series of experiments, study participants were asked to answer questionnaires that were attached to a metal clipboard with a compartment on the back capable of holding papers. In some cases the compartments were left empty, and so the clipboard weighed only 1.45 pounds. In other cases the compartments were filled, for a total clipboard package of 2.29 pounds.

Participants stood with either a light or heavy clipboard cradled in their arm, filling out surveys. In one, they were asked to estimate the value of six unfamiliar foreign currencies. In another, students indicated how important they thought it was that a university committee take their opinions into account when deciding on the size of foreign study grants. For a third experiment, participants were asked how satisfied they were with (a) the city of Amsterdam and (b) the mayor of Amsterdam.

In every study, the results suggested, the clipboard weight had its roundabout say. Students holding the heavier clipboard judged the currencies to be more valuable than did those with the lightweight boards. Participants with weightier clipboards insisted that students be allowed to weigh in on the university's financial affairs. Those holding the more formidable board even adopted a more rigorous mind-set, and proved more likely to consider the connection between the livability of Amsterdam and the effectiveness of its leader.

As Dr. Jostmann sees it, the readiness of the body to factor physical cues into its deliberations over seemingly unrelated and highly abstract concerns often makes sense. Our specific clipboard savvy notwithstanding, "the issue of how humans view gravity is evolutionarily useful," he said.

"Something heavy is something you should take care of," he continued. "Heavy things are not easily pushed around, but they can easily push us around." They are weighty affairs in every tine of the word.

The cogitating body prefers a hands-on approach, and gesturing has been shown to help children master math.

Among students who have difficulty with equations like 4 + 5 + 3 = __ + 3, for example, performance improves markedly if they are taught the right gestures: grouping together the unique left-side numbers with a two-fingered V, and then pointing the index finger at the blank space on the right.

To learn how to rotate an object mentally, first try a pantomime. “If you encourage kids to do the rotation movement with their hands, that helps them subsequently do it in their heads,” said Susan Goldin-Meadow of the University of Chicago, “whereas watching others do it isn’t enough.”

Yesterday is regrettable, tomorrow still hypothetical. But you can always listen to your body, and seize today with both hands.

Victoria Roberts

Q & A

Meeting the Heat

By C. CLAIBORNE RAY

Q. What causes hot flashes in menopausal women?

A. “It is truly amazing that although these feelings of intense heat, often followed by sweating, have been described in the medical literature since the 17th century, we still do not know the actual cause,” said Dr. Lila E. Nachtigall, a professor of obstetrics and gynecology at the New York University School of Medicine and an expert on menopause.

What is known, Dr. Nachtigall said, is that the flashes, also known as hot flushes, almost always occur as the estrogen production from the ovaries is decreasing or when estrogen is no longer produced at all.

“Yet careful research has shown that the specific level of estrogen is not what causes flushes,” she said, and estrogen levels do not differ between women who have severe flushes at menopause and women who have none.

“What seems to make the difference,” she said, “is the number of estrogen receptors in an area of the brain called the hypothalamus. When these receptors are not satisfied, they give off a substance that researchers are calling brain norepinephrine.” This substance has not yet been isolated, but it seems to be similar to epinephrine made by the adrenal gland.

The presence of this substance seems to narrow the body’s thermoneutral zone — the range of temperatures that induce neither sweating nor shivering in the body — making it much more likely to flush and feel hot even at reasonable temperatures.

Women are much more likely to have hot flushes when they have a sudden onset of menopause.

Tiny dinos perished in footprint death pits

*** 02 February 2010 by Jeff Hecht**

FOLLOWING in someone's footsteps was a bad idea for a few unlucky dinosaurs. A rare fossil haul of feathered dinosaurs suggests they perished after falling into the deep muddy footprints of larger beasts.

David Eberth of the Royal Tyrrell Museum in Drumheller, Alberta, Canada, found partial skeletons of 18 small two-legged dinosaurs in the 160-million-year-old sediments from an ancient marsh in China. They were stacked on top of each other, apparently after becoming trapped in roughly circular swampy pits.

The pits contain distinctive red fragments of crust mixed into the mud. The palaeontologists reckon this is the result of large, heavy sauropod feet breaking through a crusty surface layer to watery mud beneath. A thin crust would have formed hiding the trap from an unsuspecting small dinosaur but unable support its weight. The thin crust would have hidden the trap from an unsuspecting small dinosaur

Fifteen of the fossils were Limusaurus inextricabilis, an odd bipedal dinosaur with short arms and a beak. It appears to have eaten plants, although it belonged to a group of predators.

The victims were less than 1 metre tall and 1 to 3 metres long, says Eberth, so they would have been too short to push against the bottom, which was 1 or 2 metres beneath the surface of the watery mud. Their arms would have been covered with mud-slicked feathers and too small to pull them out of the hole (PALAIOS, DOI: 10.2110/palo.2009.p09-028r). "Finding any fossil remains like these, whose presence depends on the behaviour of other dinosaurs is bizarre," Eberth says.

There are few small dinosaur fossils from the period. "It's a really interesting find," and expands the known behaviours of two-legged dinosaurs, says David Fastovsky of the University of Rhode Island, Kingston.

Weight-loss supplement burns as many calories as 20-minute walk

Norman, Okla.—A new weight-loss supplement tested by the University of Oklahoma Health and Exercise Science Department has the potential to burn as many calories as a 20-minute walk, according to Joel T. Cramer, assistant professor of exercise physiology.

Cramer says General Nutrition Centers contracted with OU to test the weight-loss benefits of the nutritional supplement called the tri-pepper blend, which contains black pepper, caffeine and a concentrated form of capsaicin—the ingredient that makes red peppers hot. The OU study showed energy expenditures of three to six percent, results which are statistically significant enough to validate product weight-loss claims, Cramer said.

A group of participants in the study were given the supplement or a placebo followed by a metabolic rate test. The study measured oxygen consumed and carbon dioxide produced by participants to determine the arresting metabolic rate of each after receiving the supplements. The study confirmed the viability of the weight loss supplement.

OU has developed relationships within the nutritional supplement industry because of the department's ability to provide research support needed for new product development. Since Cramer arrived at OU in 2005 with a model of funding for industry grants, departmental funds have increased to nearly $3 million. The outcome has been an increase in the number of nutritional studies, which can provide vital information to industry.

For more information about the OU Department of Health and Exercise Science, visit http://hes.ou.edu

Wanted: elderly human guinea pigs

*** 16:35 02 February 2010 by Jessica Hamzelou**

Clinical trials must include more older recruits if thousands of lives are to be saved, say researchers who have drawn up a charter calling for such a change.

The team told the British Medical Association on Monday that the elderly are under-represented in clinical trials, and that in a quarter of cases the reasons for excluding them are unjustified.

Paul Dieppe at Bristol University in the UK says that non-steroidal anti-inflammatory drugs, which are not trialled in patients over the age of 70 but are prescribed to people of this age, may have caused thousands of avoidable deaths because these drugs are more toxic in over-70s.

Because many clinical trials exclude older patients, trial results can't be generalised to them, says Paul Dieppe, describing the situation as "the Achilles heel of evidence-based medicine".

Older bodies are physiologically different from younger ones says Frank Lally, participating researcher at Keele University, UK. Older people have different amounts of fat and water in their bodies, which affects the metabolism of drugs, he says.

Biological age

Lally adds that while young bodies are pretty similar to each other in their functioning, older bodies can vary greatly. "The charter encourages researchers to take into account the biological age of a person rather than their chronological age," he says, adding that imposing upper age limits on clinical trials is unjustifiable.

Andrew Beswick of the UK Medical Research Council, and Bristol University, says that the elderly may experience more underlying health issues and interference from other drugs, but that this isn't a reason to exclude them as it "represents the real-life situation".

Focus group studies revealed that older people across Europe feel that they have the right to be invited to clinical trials, and that they could make the decision to participate themselves.

While the problem is a global one, European clinical trials exclude more elderly people than those in the US, say the researchers.

The charter calls on trial sponsors, regulators and ethics committees to offer support to those with communication or mobility problems that might hamper their participation.

Doctors Miss Major Cause of Infertility and Obesity

Women often misdiagnosed after weight gain from hormonal disorder

By Marla Paul

CHICAGO -- Gail Donnelly's classmates nicknamed her "Knobby" because she was so skinny all her bones seemed to poke out from under her skin. But when Donnelly turned 27, that once knobby frame disappeared under mysteriously ballooning weight. Her diet hadn't changed, she was still walking several miles a day, but she gained 50 pounds in just six months.

Her doctor thought the cause was ovarian cysts. It took 10 years and two surgeries before a new doctor accurately diagnosed her with polycystic ovary syndrome (PCOS). It's a serious metabolic disorder and one of the major causes of hormonally related infertility, yet the disorder remains largely undiagnosed and unknown. About 5 million women in the U.S. are affected by it.

"Women are told they are too fat and aren't taken seriously for a long time," said Andrea Dunaif, M.D., the Charles F. Kettering Professor of Medicine at Northwestern University Feinberg School of Medicine and a physician at Northwestern Memorial Hospital. "They go to an average of four doctors before they are diagnosed. They have been to physicians who say 'there is nothing wrong with you, don't worry'."

Before she received the news about PCOS, Donnelly, an ordinarily happy person, had sunk into a deep depression and her boyfriend accused her of letting herself go.

Dunaif, a national expert, knows otherwise. The complex genetic disease has long-term health risks throughout a woman's lifespan, including obesity and double the rate of metabolic syndrome, a constellation of risk factors for diabetes and heart disease.

Not only women are affected. Dunaif recently published a paper showing that brothers and fathers of women with PCOS also have a greater prevalence of obesity and metabolic syndrome. "It's essential that women and men are diagnosed and treated for this," Dunaif said.

She recently was awarded a $5 million, two-year grant from the National Institutes of Health to continue her ongoing research into the syndrome's genetic causes.

Symptoms of PCOS in women often show up in adolescence and may include irregular periods and excess hair on the face, chest or back - all caused by high levels of male hormones.

Dunaif blames the syndrome's low profile on its name. "It has the word ovary in the name and that has led people to think it's just 'female' troubles and nothing important," she said.

PCOS gets its name from the small ovarian cysts found in the first women studied, though not all women who suffer from PCOS have these cysts. Dunaif would like to rename the syndrome "Syndrome XX" to bring it into the spotlight.

After Dunaif began treating Donnelly with medication for insulin resistance - which had caused her rapid weight gain -- Donnelly's excess pounds dropped off and she was able to become pregnant. "If I had known about this sooner, my life would have been entirely different," Donnelly said.

She couldn't take the medication when she was pregnant or nursing, however, so her weight soared 80 pounds with each pregnancy. At one point, she weighed 280 pounds. Of her struggle with PCOS, she said, "It's like having a battle with my body at all times."

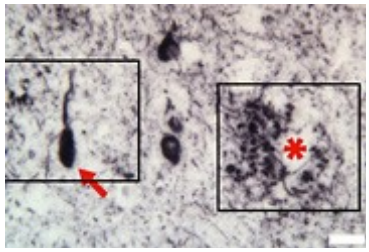
Now a 40 year-old mother of three from the Chicago suburbs, Donnelly worries about her children inheriting the disease. She realizes many of her relatives -- who developed diabetes as adults -- likely had PCOS.

Dunaif is currently recruiting women with PCOS as well as their daughters, brothers and fathers -- to participate in her studies to determine the genetic causes of the disease. For information, call 800-847-6060 or visit http://www.pcos.northwestern.edu.

Three Brain Diseases Linked by Toxic Form of Same Neural Protein, According to Penn Study

PHILADELPHIA - For the first time, researchers from the University of Pennsylvania School of Medicine have found that three different degenerative brain disorders are linked by a toxic form of the same protein. The protein, called Elk-1, was found in clumps of misshaped proteins that are the hallmarks of Parkinson's disease, Alzheimer's disease, and Huntington's disease.

"These results suggest a molecular link between the presence of inclusions and neuronal loss that is shared across a spectrum of neurodegenerative disease," notes senior author, James Eberwine, PhD, co-director of the Penn Genome Frontiers Institute and the Elmer Holmes Bobst Professor of Pharmacology. "Identifying these links within the diseased microenvironment will open up novel avenues for therapeutic intervention. For example it is reasonable to now ask, "Is this molecule a possible new biomarker for these neurodegenerative diseases?" says Eberwine.



The toxic form of Elk-1 is present in plaque found in brain tissue from an Alzheimer disease patient (red asterisk). A neuronal process of a dying neuron is denoted by the red arrow.

Eberwine, co-first authors Anup Sharma, an MD-PhD student, Jai-Yoon Sul, PhD, Assistant Professor of Pharmacology, both from Penn, Linda M. Callahan, PhD, from the University of Rochester Medical Center, and colleagues, report their findings this week in the online journal PLoS One.

Neurodegenerative diseases are characterized by a number of features including the protein clumps called inclusions; decline of nerve-cell synapses; and the selective loss of the nerve cells themselves.

Elk-1 resides within multiple brain areas, both in the nucleus and the cell body. Interestingly, when it is present in extensions of nerve cells called dendrites, it can initiate the death of that neuron. With this in mind the team assessed whether there is a specific dendrite form of Elk-1 or a modified form called phospho-Elk-1 (pElk-1) that might be associated with a spectrum of human neurodegenerative diseases.

First, they determined the importance of this specific modification of Elk-1 on its ability to initiate regionalized cell death. This was accomplished through site-directed mutations and insertion of the mutated Elk-1 mRNA into dendrites and cell bodies. These studies showed that a specific position on the protein could be modified in the dendrite to cause neuronal cell death.

Next, they screened tissue from a post-mortem human brain bank, specifically samples representative of the three major neurodegenerative diseases, to look for higher levels of the toxic form of Elk-1 protein and compared their findings to levels in brain tissue from age-matched control samples.

By comparing the immunoreactivity for the pElk-1 protein in diseased tissue versus control tissue, they found that pElk-1 strongly associates with the pathological markers present in cases of Parkinson's disease, Alzheimer's disease, and Huntington's disease versus disease-free tissue.

The team hopes to next expand these preliminary findings to a larger sample size of tissues from neurodegenerative disease banks, and to screen blood samples from affected individuals to assess the biomarker capacity of this form of Elk-1 and to use animal models of these illnesses to assess the biological role of this modified form of Elk-1 in the disease processes. They also will be looking for other sites of toxic changes on the Elk-1 protein and will look in other disease tissue for modified Elk-1.

The study was funded by the National Institute on Aging and the National Institute of Mental Health.

Native Americans First Tamed Turkeys 2,000 Years Ago

The turkeys we eat today ultimately descended from breeds raised by the Aztecs.

By Jennifer Viegas Mon Feb 1, 2010 03:01 PM ET

THE GIST:

* Native Americans first domesticated turkeys around 800 B.C.
* Turkeys weren't initially used for their meat, but rather their feathers.
* Native American groups may have shared turkey-raising tips.

More than 1,500 years before Christopher Columbus and his crew sailed to the New World, Native

Americans had already domesticated turkeys twice: first in south-central Mexico at around 800 B.C. and again in what is now the southwestern U.S. at about 200 B.C., according to a new study.

Domestic turkeys were initially raised for their feathers; however, around 1100 A.D., Native Americans began to rely on these birds as a food source. **Courtesy of The Amerind Foundation, Inc., Dragoon, Arizona. Eric J. Kaldahl, Photographer**

The two instances of domestication appear to have been separate, based on DNA analysis of ancient turkey remains. However, the different Native American groups could have been in contact with each other, sharing turkey-raising tips.

While turkeys today conjure up thoughts of bountiful roast meat meals and deli sandwiches, Native Americans were not driven by their dinner needs, according to the study, published in the latest Proceedings of the National Academy of Sciences.

"Interestingly, the domestic turkeys were initially raised for their feathers, which were used in rituals and ceremonies, as well as to make feather robes or blankets," lead author Camilla Speller told Discovery News. "Only later, around 1100 A.D., did the domestic turkeys become an important food source for the Ancestral Puebloans."

Speller's colleague, Dongya Yang, said the new study came together when two groups joined forces. Their group was busy studying ancient turkey bones, while another research team from Washington State University was analyzing early turkey coprolites, i.e. fossilized dung from the birds.

The scientists combined their efforts for the study, which involved DNA analysis of 149 turkey bones and 29 coprolites from 38 different archaeological sites.

Speller said their investigations revealed that pre-Aztec people around south-central Mexico first domesticated turkeys. The birds appear to either have either been penned or "allowed to roam around the village," according to Speller.

The southwestern turkeys, on the other hand, "were raised by the Ancestral Puebloans who lived on the Colorado Plateau, around the Four Corners region of the southwest United States," Speller said.

These Puebloans, also known as the Anasazi, appear to have not only raised domestic turkeys, but also incorporated local wild turkeys into their domestic stocks, according to Yang.

DNA tests determined that the southwestern domestic turkey breed probably is most closely related to the eastern and Rio Grande wild turkeys that are still found in the U.S. today. It is possible, however, that the original southwestern domestic breed has since become extinct.

"It seems that only the Aztec turkey breed survived into the present day," Speller said. "It's fascinating to think that the turkeys that we eat today were ultimately descended form the turkey breeds raised by the Aztecs."

The researchers weren't able to precisely identify these Aztec turkey breeds, but they ruled out at least one early progenitor: the South Mexican domestic turkey, which previously was thought to be a mother of all modern domestic turkeys.

The connection to today's domestic turkeys is a complicated one, because when the Spanish arrived in the New World, they transported the Aztec turkey breeds from Mexico to Europe, where they were a huge hit.

"Over the following two centuries, several varieties of turkey were developed in Europe. And then in the 18th century, these European turkey breeds were imported back to the United States, where they eventually became the forerunners to the turkeys we eat today," Speller explained.

Anthropologist R.G. Matson of the University of British Columbia is an expert in the archaeology of the southwestern United States.

He told Discovery News that Speller and her team "have provided convincing evidence that two turkey domestication events took place." Matson, however, indicated that questions remain.

"Clearly more wild, museum and archaeological samples need to be analyzed to fill out the history of turkey domestication in the Southwest and elsewhere," he said.

Star students, beware bipolar disorder

* 00:01 03 February 2010 by **Ewen Callaway**

Talk about a lousy graduation present. Straight-A students are more likely to develop bipolar disorder than their more mediocre peers, at least in Sweden, according to a new study of more than 700,000 former high-school students.

Within 15 years of sitting their final high-school exams, aged 15 and 16, at least 280 of the students were diagnosed with bipolar disorder. After taking into account their parents' income and education – factors that are known to affect exam scores – the highest-achieving students were more than three times more likely to suffer from the mental illness than their average peers.

Male overachievers, meanwhile, developed the disease 4.4 times more often than their average male classmates.

A mixed bag

Good grades don't cause bipolar disorder, but creativity and intelligence could be a reflection of common underlying biological traits, says James MacCabe, an epidemiologist at the Institute of Psychiatry, Kings College London, who led the study.

The stereotype of the brilliant but tortured artist aside, some aspects of manic episodes could reflect increased intelligence, he says. "People who have a biological predisposition to bipolar disorder have advantages, I suppose you could call them, in that they're able to think clearly, think fast and concentrate," MacCabe says.

Students who scored highest on creative topics, such as music and Swedish, were more likely to develop bipolar syndrome than students who did well on more fact-based topics such as chemistry, physics and maths.

On the flipside, the students who did worst in the exams were also at increased risk of eventually developing the condition. These students could have a form of bipolar that's more like schizophrenia, MacCabe speculates: among the same group of Swedes, he found that students who scored the worst marks were at the greatest risk of schizophrenia.

Journal references: bipolar: British Journal of Psychiatry, vol 196, p 109; schizophrenia: Psychological Medicine, vol 38, p 1133

Super-Hard Diamonds Found in Meteorite

The ultra-hard rocks may not end up on your finger, but they could help scientists learn how to create harder diamonds in the lab.

By Larry O'Hanlon

THE GIST:

* Two new ultra-hard types of diamond have been found in a meteorite from Finland.

* The ultra-hard carbon crystals were created out of graphite under the intense heat and pressure of the meteorite impact.

* Though the new diamonds are definitely harder than regular diamonds, the crystals were too small to test for their exact hardness.

Researchers using a diamond paste to polish a slice of meteorite stumbled onto something remarkable: crystals in the rock that are harder than diamonds.

A closer look with an array of instruments revealed two totally new kinds of naturally occurring carbon, which are harder than the diamonds formed inside the Earth.

"The discovery was accidental but we were sure that looking in these meteorites would lead to new findings on the carbon system," said Tristan Ferroir of the Universite de Lyon in France. Ferroir is the lead author of a report in the new diamond in the Feb. 15 issue of the journal Earth and Planetary Science Letters.
The researchers were polishing a slice of the carbon-rich Havero meteorite that fell to Earth in Finland in 1971. When they then studied the polished surface they discovered carbon-loaded spots that were raised well above the rest of the surface –- suggesting that these areas were harder than the diamonds used in the polishing paste.

"That in itself is not surprising," said diamond researcher Changfeng Chen of the University of Nevada in Las Vegas. He explained that sometimes during the shock of impact graphite can create jumbled "amorphous" zones that can resist diamonds, at least those coming at them from one direction.
But what apparently happened in the Havero meteorite is that graphite layers were shocked and heated enough to create bonds between the layers -- which is exactly how humans manufacture diamonds, Chen explained.

Ferroir's team took the next step and put the diamond-resistant crystals under the scrutiny of some very rigorous mineralogical analyzing instruments to learn how its atoms are lined up. That allowed them to confirm that they had, indeed, found a new "phase" or polymorph of crystalline carbon as well as a type of diamond that had been predicted to exist decades ago, but had never been found in nature until now.

"The new structure is very interesting," Chen told Discovery News. "It gives us some clues so we can try to make it in the laboratory, and then investigate it."

Among the things that would be interesting to learn, Chen said, is how hard are the new kinds of diamonds. The sample from the meteorite was far too small to test for hardness, except to show that it is certainly harder than regular diamonds.

"The only evidence we have for a higher hardness than diamond is the fact that we polished the rock section with a diamond paste and that our polymorph and polytypes were not polished by this material," said Ferroir. "This why we do think that its hardness is harder than diamond."

However, there is no way at the present to compare them to the artificial ultra-hard diamonds known as lonsdaleite and boron nitride, Ferroir said.

Nature's hot green quantum computers revealed

* 03 February 2010 **by Kate McAlpine**

WHILE physicists struggle to get quantum computers to function at cryogenic temperatures, other researchers are saying that humble algae and bacteria may have been performing quantum calculations at life-friendly temperatures for billions of years.

The evidence comes from a study of how energy travels across the light-harvesting molecules involved in photosynthesis. The work has culminated this week in the extraordinary announcement that these molecules in a marine alga may exploit quantum processes at room temperature to transfer energy without loss. Physicists had previously ruled out quantum processes, arguing that they could not persist for long enough at such temperatures to achieve anything useful.

Photosynthesis starts when large light-harvesting structures called antennas capture photons. In the alga called Chroomonas CCMP270, these antennas have eight pigment molecules woven into a larger protein structure, with different pigments absorbing light from different parts of the spectrum. The energy of the photons then travels across the antenna to a part of the cell where it is used to make chemical fuel.

The route the energy takes as it jumps across these large molecules is important because longer journeys could lead to losses. In classical physics, the energy can only work its way across the molecules randomly. "Normal energy transfer theory tells us that energy hops from molecule to molecule in a random walk, like the path taken home from the bar by a drunken sailor," says Gregory Scholes at the University of Toronto, Canada, one of the co-authors of the paper published in Nature this week (DOI: 10.1038/nature08811).

But Scholes and his colleagues have found that the energy-routeing mechanism may actually be highly efficient. The evidence comes from the behaviour of pigment molecules at the centre of the Chroomonas antenna. The team first excited two of these molecules with a brief laser pulse, causing electrons in the pigment molecules to jump into a quantum superposition of excited states. When this superposition collapses, it emits photons of slightly different wavelengths which combine to form an interference pattern. By studying this pattern in the emitted light, the team can work out the details of the quantum superposition that created it.
This is going to change the way we think about photosynthesis and quantum computing

The results are a surprise. Not only are the two pigment molecules at the centre of the antenna involved in the superposition; so are the other six pigment molecules. This "quantum coherence" binds them together for a fleeting 400 femtoseconds ($4 \times 10\text{-}13$ seconds). But this is long enough for the energy from the absorbed photon to simultaneously "try out" all possible paths across the antenna. When the shared coherence ends, the energy settles on one path, allowing it to make the journey without loss.

The discovery overturns some long-held beliefs about quantum mechanics, which held that quantum coherence cannot occur at anything other than cryogenic temperatures because a hot environment would destroy the effect. However, the Chroomonas algae perform their work at 21 °C.

"Scholes's work is fantastic," says Gregory Engel at the University of Chicago. "The difficulty of this experiment is extraordinary." Engel demonstrated the same principle in 2007 at the University of California, Berkeley, though at a frigid -196 °C. His team examined a bacteriochlorophyll complex found in green sulphur bacteria and discovered that the pigment molecules were similarly wired together in a quantum mechanical network. His experiment showed that the quantum superposition allows the energy to explore all possible routes and settle on the most efficient one (DOI: 10.1038/nature05678). In a sense, he says, the antenna performs a quantum computation to determine the best way to transfer energy.

Engel and his group at Chicago have just repeated the experiment at a more life-friendly 4 °C. They found the duration of the coherence to be about 300 femtoseconds (arxiv.org/abs/1001.5108v1).

Exactly how these molecules remain coherent for so long, at such high temperatures and with relatively large gaps between them, is a mystery, says Alexandra Olaya-Castro of University College London, who has been collaborating with Scholes to understand the underlying mechanisms and apply them elsewhere. She believes that the antenna's protein structure plays a crucial role. "Coherence would not survive without it," she says.

The hope is that quantum coherence could be used to make solar cells more efficient. The work is going to change the way we think about photosynthesis and quantum computing, Engel says. "It's an enormous result."

'Imaginary rabbit' breaks out of the body

* 17:22 03 February 2010 **by Ewen Callaway**

In a new twist on an old illusion, people have been made to feel an "imaginary rabbit" hopping along a stick resting between their fingers.

The trick is a variation on a tactile illusion called the cutaneous rabbit in which a series of discrete taps to two areas of skin are perceived as movement between those two areas. For instance, two taps to the elbow followed by a single tap to the wrist will feel as if a "rabbit" is hopping towards the wrist.

Makoto Miyazaki, a cognitive neuroscientist at Kochi University of Technology in Japan, was using this decades-old trick to test perception when he realised that the effect seemed to jump from his body onto the object he was holding at the time.

To investigate further, Miyazaki used an electrically operated device to administer taps to eight volunteers while they held a 10-centimetre aluminium rod between two fingers. The volunteers were then asked to describe where they felt the taps.

Finger tapping

The device delivered two taps to the first finger, 800 milliseconds apart, then tapped the second finger 50 or 80 milliseconds later.

As with the classical version of the illusion, volunteers did not sense discrete taps to one finger and then the other. Instead, they felt the taps move up or down the stick, depending on the order in which they were delivered.

The participants sensed the first tap as being on their finger, the second tap (which was actually on the same finger) as being halfway down the rod, and the third tap on the second finger, which is where it actually was.

In control experiments, volunteers not holding the rod who were given the same sequence of taps reported no sensation passing between their fingers.

"It is a bit astonishing," says Felix Blankenburg, a neuroscientist at the Bernstein Center for Computational Neuroscience in Berlin, Germany, who in a separate experiment scanned the brains of people experiencing the cutaneous rabbit illusion.

Body map

Blankenburg's study pinpointed activity in a part of the brain called the somatosensory cortex, an area that maintains an internal body map.

"According to common-sense physiology, this stick should not be included in the body map," Miyazaki says. To feel the "rabbit" hop onto the stick, so to speak, could mean that the body map is more changeable than previously thought, he says.

He plans to run experiments which scan brain activity during the illusion, in the hope that this will pinpoint the exact mechanisms responsible.

Journal reference: The Journal of Neuroscience, DOI: 10.1523/jneurosci.3887-09-2010

Mood controller linked to cot death

Ewen Callaway, reporter

Low levels of a brain chemical important to breathing have been found in the brains of infants who died of cot death.

As well as possibly explaining the mysterious condition - also known as sudden infant death syndrome (SIDS) - the new study, led by researchers at Children's Hospital and Harvard Medical School in Boston, also offers hope of a test to predict which infants are most at risk of the mysterious condition.

According to the Boston Globe:

"Dr. Hannah Kinney and her colleagues compared the brainstems of 41 babies who had died of SIDS to the brainstems of seven babies who died of other causes and five babies who were hospitalized with low oxygen levels before their deaths. Researchers have suspected that SIDS involves problems with inadequate oxygen, so Kinney wanted to compare the SIDS babies to the two groups."

In 35 of those infants' brainstems, levels of the neurotransmitter serotonin were on average 26 percent lower, compared with babies who died of other causes. Also, levels of an enzyme involved in the production of serotonin were 22 percent lower, Kinneys' team reports. SIDS kills about 2,500 infants annually, and is the leading cause of death in that age group, says the Wall Street Journal.

Serotonin's most famous role is as a mood-controlling neurotransmitter, but it is also known to be involved in automatic body functions such as breathing, which may explain its link with SIDS, ***according to a Washington Post report***.

"The findings suggest that SIDS occurs when babies born with this abnormality are placed face-down to sleep during their first year of life. Their ability to stabilize their breathing is still developing. Most children would be able to their faces or heads and wake up if they were having trouble breathing face down. But babies born with this intrinsic abnormality may be unable to respond properly."

Nature News notes that it is unclear whether low serotonin levels actually cause cot death or are merely a reflection of another underlying cause - but that in any case "such work could lead to a test to identify such babies or an intervention to protect them".

This isn't the first time serotonin has been implicated in SIDS. Kinney's team previously reported that infants who died of the syndrome had fewer serotonin receptors in their brain.

Meanwhile, in 2008 an Italian team found that mice with a mutation that made them less sensitive to serotonin as pups died suddenly.

Scan unlocks vegetative patients

By Fergus Walsh Medical correspondent, BBC News

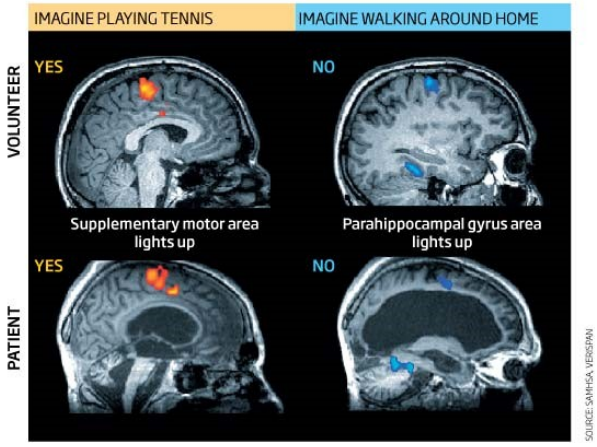
Scientists have been able to reach into the mind of a brain-damaged man and communicate with his thoughts. The research, carried out in the UK and Belgium, involved a new brain scanning method. Awareness was detected in three other patients previously diagnosed as being in a vegetative state.

The study in the New England Journal of Medicine shows that scans can detect signs of awareness in patients thought to be closed off from the world.

Patients in a vegetative state are awake, not in a coma, but have no awareness because of severe brain damage.

Talking to the brain

By asking people to imagine one activity for yes and another for no, researchers can use brain imaging techniques to identify the answers to simple questions in both healthy volunteers and some "vegetative "patients



Scanning technique

The scientists used functional magnetic resonance imaging (fMRI) which shows brain activity in real time.

They asked patients and healthy volunteers to imagine playing tennis while they were being scanned. In each of the volunteers this stimulated activity in the pre-motor cortex, part of the brain which deals with movement.

This also happened in four out of 23 of the patients presumed to be in a vegetative state.

I volunteered to test out the scanning technique. I gave the scientists two women's names, one of which was my mother's. I imagined playing tennis when they said the right name, and within a minute they had worked out her name. They were also able to guess correctly whether I had children.

Questions

This is a continuation of research published three years ago, when the team used the same technique to establish initial contact with a patient diagnosed as vegetative. But this time they went further.

With one patient - a Belgian man injured in a traffic accident seven years ago - they asked a series of questions.

He was able to communicate "yes" and "no" using just his thoughts.

The team told him to use "motor" imagery like a tennis match to indicate "yes" and "spatial" imagery like thinking about roaming the streets for a "no".

The patient responded accurately to five out of six autobiographical questions posed by the scientists.

For example, he confirmed that his father's name was Alexander.

The study involved scientists from the Medical Research Council (MRC), the Wolfson Brain Imaging Centre in Cambridge and a Belgian team at the University of Liege.

Dr Adrian Owen from the MRC in Cambridge co-authored the report:

"We were astonished when we saw the results of the patient's scan and that he was able to correctly answer the questions that were asked by simply changing his thoughts."

Dr Owen says this opens the way to involving such patients in their future treatment decisions: "You could ask if patients were in pain and if so prescribe painkillers and you could go on to ask them about their emotional state."

It does raise many ethical issues - for example - it is lawful to allow patients in a permanent vegetative state to die by withdrawing all treatment, but if a patient showed they could respond it would not be, even if they made it clear that was what they wanted.

The Royal Hospital for Neurodisability in London is a leading assessment and treatment centre for adults with brain injuries.

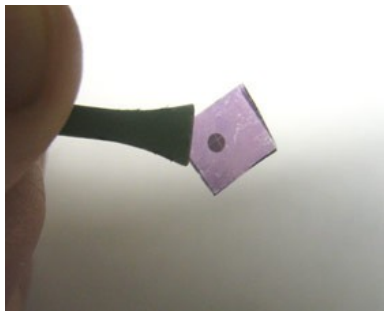
Helen Gill, a consultant in low awareness state, welcomed the new research but cautioned that it was still early days for the research: "It's very useful if you have a scan which can show some activity but you need a detailed sensory assessment as well. A lot of patients are slipping through the net and this adds another layer to ensure patients are assessed correctly."

She said the hospital did a study of 60 patients admitted with a diagnosis of vegetative state and 43% could communicate.

World's First Light-Powered Circuit Created

This new circuit could eventually lead to a whole new generation of touchscreen devices that power themselves.

By Eric Bland Wed Feb 3, 2010 12:00 PM ET



THE GIST:

* Scientists have created a self-powered circuit.
* The circuit runs on solar power.
* The new technology could have a range of applications from touchscreen technology to modeling the human brain.

The iPad has yet to hit store shelves, and yet the technology that powers Apple's latest gadget may already be yesterday's news.

Although this self-powered circuit is a major breakthrough, it is unlikely to replace its silicon counterpart any time soon. **Dawn Bonnell**

For the first time, scientists have created a circuit that can power itself, as long as it's left in a beam of sunshine. Created by scientists from the University of Pennsylvania, the world's first photovoltaic circuit could eventually power a new line of consumer devices or even model the human brain.

"This as the potential to create a new generation of optical and electronic devices," said Dawn Bonnell, a scientist from the University of Pennsylvania who co-authored a recent ACS Nano paper describing the research. "The touchscreen of your computer could act as both the electrical charger and the computer chip." Right now Bonnell and her colleagues can only coax minuscule amounts of electricity from their photovoltaic circuits, far too little to power consumer electrical devices. Those amounts could quickly skyrocket.

"We would have one amp with one volt in a sample the diameter of a human hair and an inch long," said Bonnell. "If the efficiency scaled up without any additional limits."

There are plenty of other ways Bonnell can squeeze more electricity from light. Right now only about 10 percent of the photovoltaic circuits on a glass side work. Increasing that number will boost the power output.

Yet another way to get more power is by turning their 2D structures into 3D structures. Stacking multiple layers of light-collecting and electricity-using circuits would also boost power.

The photovoltaic circuit developed by Bonnell and her colleagues is a scientific breakthrough, not a technological one. These new circuits will most likely never replace their silicon counterparts.

Photovoltaic circuits could be ideal for other applications, however, such as powering tiny robotic devices or running computer calculations at the speed of light. Far into the future, these circuits could even be used to set up as artificial neural networks that could model the brain.

At their most basic, computers represent data as on or off, a "0" or a "1." Using light instead of electrons, these photovoltaic circuits could store data from, say, one, two, three or four. Each number would correspond to a certain wavelength or color of light -- red, green, blue and yellow, for example. To model the human nervous system, each color of light could correspond to a different neurotransmitter, say red for dopamine and blue for serotonin.

"This could open the door for many kinds of new devices," agrees Lukas Novotny, a scientist at the Institute of Optics at the University of Rochester. Novotny notes that right now the circuit turns light into energy. He wonders if the circuit could turn energy into light, creating an entirely new class of lighting materials.

The potential applications of the technology are huge, but will take years to develop into any kind of practical equipment.

3 years out, safety checklist continues to keep hospital infections in check

Johns Hopkins' cheap, low-tech approach can be sustained, save lives over time, study shows

The state of Michigan, which used a five-step checklist developed at Johns Hopkins to virtually eliminate bloodstream infections in its hospitals' intensive care units , has been able to keep the number of these common, costly and potentially lethal infections near zero — even three years after first adopting the standardized procedures. A report on the work is being published in the February 20 issue of BMJ (British Medical Journal).

Peter Pronovost, M.D., Ph.D., a professor of anesthesiology and critical care medicine at Johns Hopkins University School of Medicine and a patient safety expert, says the widely heralded success in Michigan — the first state system to tackle in a wholesale fashion infections in central-line catheters ubiquitous in intensive-care units — has significantly changed the way physicians think about these infections.

"Prior to our work, we thought these were largely inevitable infections and that they were simply a cost of being in the hospital," says Pronovost, the report's leader and the developer of the checklist. "Now we know they are universally preventable. We've reset the benchmark."

Many quality improvement innovations, Pronovost says, are a flash in the pan — successful while they are being implemented and monitored, only to fall by the wayside once no one is watching anymore. Sustainability of the kind seen in Michigan requires a "complete culture change" that goes well beyond checklists and reminders to wash hands and use chlorhexidine antiseptic, he says.

Culture change means a work environment in which "nurses question doctors who don't wash their hands or use the checklist diligently," Pronovost says. "It means clinicians no longer thinking central-line infections are inevitable.

"They now believe these infections are preventable and they are creating a culture where they are," he adds.

Pronovost says his new paper is one of the first large studies to demonstrate that the results of a quality-improvement program can be sustained.

The checklist contains five basic steps for doctors to follow when placing a central-line catheter: wash their hands; clean a patient's skin with chlorhexidine; wear a mask, hat, gown, and gloves and put sterile drapes over the patient; avoid placing a catheter in the groin where infection rates are higher and remove the catheter as soon as possible, even if there's a chance it might be needed again at some point.

Central lines are used regularly for patients in the ICU to administer medication or fluids, obtain blood tests, and directly gauge cardiovascular measurements such as central venous blood pressure. Each year roughly 80,000 patients become infected and 30,000 to 60,000 die at a cost of $3 billion nationally. Before heading to Michigan, Pronovost tested the checklist at Johns Hopkins Hospital, where catheter infections have also been virtually eliminated.

The new study covered more than 100 ICUs in the Michigan hospital system, which was a large pilot site for Pronovost's infection-prevention measures. Alongside the use of the cockpit-style checklist, the program included training physicians and nurses about infection control and using special, standardized central-line supply carts controlled for one-time use.

The safety plan also required immediate "stop now" orders by any member of the health care team when a checklist is not followed to the letter and feedback to each member of the care team about the number and rates of catheter-related bloodstream infections at weekly and quarterly meetings.

The Centers for Disease Control and Prevention estimates that between 10 percent and 20 percent of inpatients acquire some type of infection while in the hospital.

Before the checklist project in Michigan, the median rate of central-line infections there was about 3 per 1,000 catheter-hours, above the national average. After 18 months, most Michigan ICUs reported none of these bloodstream infections. The new research shows that after three years, the same was true — a "breathtaking" result, Pronovost says.

Pronovost and his team from the Hopkins Quality and Safety Research Group are taking the checklist system across the globe, with rollouts in the United Kingdom, Spain, parts of Peru and even Pakistan. They are also bringing the program to all 50 states. Last summer U.S. Health and Human Services Secretary Kathleen Sebelius called for a 75 percent reduction in these catheter infections over the next three years. Pronovost and his colleagues are partnering with state health departments and hospital associations across the country to make sure there is buy-in from the many stakeholders involved in preventing these bloodstream infections.

The key to success is not just following standardized checklist steps, he says. To change culture, what's more important is that hospitals also search for errors on a continuing basis, know their infection rates and monitor them after implementing safety innovations. Doctors and nurses need to know the measures they are taking are working, to realize that the science behind the checklist is valid, he says.

"The use of checklists is not the endgame. Reduced infection rates are," Pronovost says. "The public wants to know: Am I going to get infected? If hospitals had to make these rates public, these infections would end."

Other Hopkins researchers on the study include Christine A. Goeschel, R.N., M.P.A., M.P.S., Sc.D.; Elizabeth Colantuoni, Ph.D.; Lisa H. Lubomski, Ph.D.; Sean M. Berenholtz, M.D.; David A. Thompson, D.N.Sc., M.S., R.N.; David Sinopoli; Sara Cosgrove, M.D.; J. Bryan Sexton, Ph.D., M.A.; Jill A. Marsteller, Ph.D.; and Dale Needham, Ph.D.

The study was funded by the Agency for Healthcare Research and Quality.

For more information: http://www.safercare.net/OTCSBSI/Home.html
http://www.hopkinsmedicine.org/anesthesiology/Team/summaries/Pronovost_Peter_bio.cfm
http://www.hopkinsmedicine.org/quality/safety/pronovost/index.html

York study maps the effects of acupuncture on the brain

Important new research about the effects of acupuncture on the brain may provide an understanding of the complex mechanisms of acupuncture and could lead to a wider acceptability of the treatment.

The study, by researchers at the University of York and the Hull York Medical School published in Brain Research, indicates that acupuncture has a significant effect on specific neural structures. When a patient receives acupuncture treatment, a sensation called deqi can be obtained; scientific analysis shows that this deactivates areas within the brain that are associated with the processing of pain.

Dr Hugh MacPherson, of the Complementary Medicine Research Group in the University's Department of Health Sciences, says: "These results provide objective scientific evidence that acupuncture has specific effects within the brain which hopefully will lead to a better understanding of how acupuncture works."

Neuroscientist Dr Aziz Asghar, of the York Neuroimaging Centre and the Hull York Medical School, adds: "The results are fascinating. Whether such brain deactivations constitute a mechanism which underlies or contributes to the therapeutic effect of acupuncture is an intriguing possibility which requires further research."

Last summer, following research conducted in York, acupuncture was recommended for the first time by the National Institute for Health and Clinical Excellence (NICE) as a treatment option for NHS patients with lower back pain. NICE guidelines now state that GPs should 'consider offering a course of acupuncture comprising a maximum of 10 sessions over a period of up to 12 weeks' for patients with this common condition.

Current clinical trials at the University of York are investigating the effectiveness and cost-effectiveness of acupuncture for Irritable Bowel Syndrome (IBS) and for depression. Recent studies in the US have also shown that acupuncture can be an effective treatment for migraines and osteoarthritis of the knee.

The York team believe that the new research could help to clear the way for acupuncture to be more broadly accepted as a treatment option on the NHS for a number of medical conditions.

Audio of Dr Hugh Macpherson discussing the research is available at http://www.york.ac.uk/news-and-events/nes/2010/acupuncture/ or by request.
The paper 'Acupuncture needling sensation: The neural correlates of deqi using fMRI', Asghar, A.U.R., et al is available at http://dx.doi.org/10.1016/j.brainres.2009.12.019.

Melatonin Precursor Stimulates Growth Factor Circuits in Brain

Scientists at Emory University School of Medicine have discovered unexpected properties for a precursor to melatonin, the hormone that regulates sleep cycles.

Melatonin is produced from the neurotransmitter serotonin in a daily rhythm that peaks at night. Melatonin's immediate precursor, N-acetylserotonin, was not previously thought to have effects separate from those of melatonin or serotonin.

Now an Emory team has shown that N-acetylserotonin can stimulate the same circuits in the brain activated by the growth factor BDNF (brain-derived neurotrophic factor). The results will be published online this week in the Proceedings of the National Academy of Sciences. The team was led by Keqiang Ye, associate professor of pathology and laboratory medicine, and P. Michael Iuvone, professor of pharmacology and director of research at Emory Eye Center. Researchers from Morehouse School of Medicine and the University of Wisconsin contributed to the paper.

The discovery has implications for the study of how some antidepressants function and may also explain previous observations that N-acetylserotonin has antidepressant activity in animal models of depression.

"Our results suggest that the molecules and pathways involved in mood regulation and circadian rhythms are intertwined," Ye says.

A lack of BDNF, which pushes brain cells to grow and helps them resist stress, is thought to lie behind depression and several neurodegenerative diseases. Ye and his colleagues have been searching for chemicals that can mimic BDNF by activating TrkB, the receptor for BDNF on cells' surfaces.

Several widely prescribed antidepressants (selective serotonin reuptake inhibitors such as fluoxetine/Prozac) increase levels of serotonin in the brain, but the connections between serotonin levels and depression are complex. Because antidepressants seem to take weeks to display their effects, scientists have proposed that their real targets are BDNF and TrkB.

"We were exploring whether the serotonin system is involved in TrkB signaling," Ye says. "We were surprised to find that N-acetylserotonin, but not serotonin or melatonin, can activate TrkB."

N-acetylserotonin could stimulate TrkB even when BDNF was not present, both in cell culture dishes and in mice, Ye and his colleagues found. It could also protect neurons from overstimulation in the same way that BDNF can.

Melatonin is produced at several sites in the body: the pineal gland, the retina and the intestine. One of the most common strains of laboratory mice (C57Bl6) is deficient in making N-acetylserotonin and melatonin and develops retinal degeneration.

The authors observed that in the retinas of mice that produce adequate melatonin, TrkB is turned on at night, a pattern that matches the appearance of N-acetylserotonin. However, the pattern of TrkB activation is flat in C57Bl6 melatonin-deficient mice.

Ye's laboratory is now investigating the mechanism by which N-acetylserotonin activates TrkB. He says that N-acetylserotonin has a short lifetime in the body but similar compounds that are more stable may be useful in treating neurological diseases.

The research was supported by the National Institutes of Health and Research to Prevent Blindness Writer: Quinn Eastman

Headache pill could save earthquake crush victims

* Updated 14:26 04 February 2010 by **Andy Coghlan**

JUST one tablet of paracetamol (acetaminophen) could help save earthquake survivors who otherwise risk dying from kidney failure after rescue. Experiments in rats have shown that the drug prevents "crush syndrome", or rhabdomyolysis, in which muscle debris from crushed limbs floods the kidneys soon after the limb is freed from rubble, causing them to fail.

"When you release the pressure on muscle through rescue, debris goes to the kidney. It's like a chain reaction, and acetaminophen blocks it," says Olivier Boutaud of Vanderbilt University in Nashville, Tennessee, and head of the research team.

The destruction of muscle through crushing leads to the release of myoglobin, a protein vital for delivering oxygen to muscle and other tissue. When the myoglobin reaches the kidneys it clogs the tubules and produces harmful chemical agents called free radicals.

These free radicals destroy fatty membranes in the kidney, which die and turn black. They also trigger constriction of blood vessels, cutting off blood flow to the kidney and halting filtration of blood, rapidly leading to death through kidney failure. The condition became known as the "smiling death" in China after apparently uninjured victims died.

After inducing crush syndrome in rats via muscular injections of sugar, Boutaud and colleagues demonstrated that the human-equivalent dose of acetaminophen successfully blocked both of these processes, whether given before or shortly after the injury (Proceedings of the National Academy of Sciences, DOI: 10.1073/pnas.0910174107).

Although the finding has come too late to save lives following the quake in Haiti, Boutaud is hopeful that the treatment can be validated in humans before, or even during, the next big quake. "We don't know yet whether it would work, or how soon we'd need to give it to prevent kidney damage," he says, "but we must try because it could save thousands of lives."

We don't know whether it would work, but we must try because it could save thousands of lives

Martin de Smet of Médecins Sans Frontières will refer Boutaud's results to the International Society of Nephrology's Renal Disaster Relief Task Force, which has developed validated protocols for treating crush-syndrome victims, involving the rapid infusion of saline fluids. The drug might be testable as a supportive treatment, he says.

Use of acetaminophen in pregnancy associated with increased asthma symptoms in children

First study to demonstrate association between asthma and acetaminophen is linked to gene involved in detoxification of foreign substances

February 4, 2010 -- Children who were exposed to acetaminophen prenatally were more likely to have asthma symptoms at age five in a study of 300 African-American and Dominican Republic children living in New York City. Building on prior research showing an association between both prenatal and postnatal acetaminophen and asthma, this is the first study to demonstrate a direct link between asthma and an ability to detoxify foreign substances in the body. The findings were published this week in the journal Thorax.

The study, conducted by the Columbia Center for Children's Environmental Health at Columbia University's Mailman School of Public Health, found that the relationship was stronger in children with a variant of a gene, glutathione S transferase, involved in detoxification of foreign substances. The variant is common among African-American and Hispanic populations. The results suggest that less efficient detoxification is a mechanism in the association between acetaminophen and asthma.

The researchers assessed the use of analgesics during pregnancy and found that 34 percent of mothers reported acetaminophen use during pregnancy, and 27 percent of children had wheeze, an asthma-related symptom. The children whose mothers had taken acetaminophen were more likely to wheeze, visit the emergency room for respiratory problems, and develop allergy symptoms, compared to those children whose mothers did not take acetaminophen. The risk increased with increasing number of days of prenatal acetaminophen use. The children in this study live in neighborhoods of New York City that have been the hardest hit by the asthma epidemic: Northern Manhattan and the South Bronx.

Acetaminophen use among children in the U.S. has increased substantially since the early 1980s and has become increasingly common among women during pregnancy so that most women in the U.S. take acetaminophen during pregnancy. This increase coincided with a doubling of the prevalence of asthma among children in the country between 1980 and 1995.

"These findings might provide an explanation for some of the increased asthma risk in minority communities and suggest caution in the use of acetaminophen in pregnancy," says Matthew S. Perzanowski, PhD, assistant professor of Environmental Health Sciences at the Mailman School of Public Health.

Reasons for prenatal acetaminophen use vary, but in this study population the observed associations with headaches suggest pain management as likely; however, other host factors that caused mothers to take acetaminophen and also cause asthma may explain their association. While infection is one such potential confounder, the Mailman School researchers found no association between the reported use of antibiotics and acetaminophen, and adjustment for antibiotic use during pregnancy did not affect the results.

According to the researchers, the prevalence of current wheeze diminished as the children aged, from 40 percent at age one year to 25 percent, 17 percent and 27 percent at ages two, three, and five, respectively. However, the association between prenatal acetaminophen exposure and current wheeze strengthened as the children aged.

The Columbia Center for Children's Environmental Health study adjusted relative risks for sex, race/ethnicity, birth order, maternal asthma, maternal hardship, exposure to environmental tobacco smoke, antibiotic use and postnatal acetaminophen use.

In a similar study conducted in the UK, the frequency of acetaminophen use during pregnancy and the magnitude of association in the UK study were similar to that in New York City.

The study was supported by the National Institute of Environmental Health Sciences (NIEHS) and the U.S. Environmental Protection Agency (EPA)

Study Reveals Potential Evolutionary Role for Same-Sex Attraction

Male homosexuality doesn't make complete sense from an evolutionary point of view. It appears that the trait is heritable, but because homosexual men are much less likely to produce offspring than heterosexual men, shouldn't the genes for this trait have been extinguished long ago? What value could this sexual orientation have, that it has persisted for eons even without any discernible reproductive advantage?

One possible explanation is what evolutionary psychologists call the "kin selection hypothesis." What that means is that homosexuality may convey an indirect benefit by enhancing the survival prospects of close relatives. Specifically, the theory holds that homosexual men might enhance their own genetic prospects by being "helpers in the nest." By acting altruistically toward nieces and nephews, homosexual men would perpetuate the family genes, including some of their own.

Two evolutionary psychologists, Paul Vasey and Doug VanderLaan of the University of Lethbridge, Canada tested this idea for the past several years on the Pacific island of Samoa. They chose Samoa because males who prefer men as sexual partners are widely recognized and accepted there as a distinct gender category—called fa'afafine—neither man nor woman. The fa'afafine tend to be effeminate, and exclusively attracted to adult men as sexual partners. This clear demarcation makes it easier to identify a sample for study.

Past research has shown that the fa'afafine are much more altruistically inclined toward their nieces and nephews than either Samoan women or heterosexual men. They are willing to babysit a lot, tutor their nieces and nephews in art and music, and help out financially—paying for medical care and education and so forth. In a new study, the scientists set out to unravel the psychology of the fa'afafine, to see if their altruism is targeted specifically at kin rather than kids in general.

They recruited a large sample of fa'afafine, and comparable samples of women and heterosexual men. They gave them all a series of questionnaires, measuring their willingness to help their nieces and nephews in various ways—caretaking, gifts, teaching—and also their willingness to do these things for other, unrelated kids. The findings, reported on-line this week in the journal Psychological Science, a journal of the Association for Psychological Science, lend strong support to the kin selection idea. Compared to Samoan women and heterosexual men, the fa'afafine showed a much weaker link between their avuncular - or uncle like - behavior and their altruism toward kids generally. This cognitive dissociation, the scientists argue, allows the fa'afafine to allocate their resources more efficiently and precisely to their kin—and thus enhance their own evolutionary prospects.

To compensate for being childless, each fa'afafine would have to somehow support the survival of two additional nieces or nephews who would otherwise not have existed. "If kin selection is the sole mechanism by which genes for male same-sex sexual attraction are maintained over time," the fa'afafine must be "super uncles" to earn their evolutionary keep, explains Vasey. Consequently, Vasey suggests "that the fa'afafine's avuncularity probably contributes to the evolutionary survival of genes for male same-sex sexual attraction, but is unlikely to entirely offset the costs of not reproducing."

Do these findings have any meaning outside of Samoa? Yes and no. Samoan culture is very different from most Western cultures. Samoan culture is very localized, and centered on tight-knit extended families, whereas Western societies tend to be highly individualistic and homophobic. Families are also much more geographically dispersed in Western cultures, diminishing the role that bachelor uncles can play in the extended family, even if they choose to. But in this sense, the researchers say, Samoa's communitarian culture may be more—not less—representative of the environment in which male same-sex sexuality evolved eons ago. In that sense, it's not the bachelor uncle who is poorly adapted to the world, but rather the modern Western world that has evolved into an unwelcoming place.

For more information about this study, please contact: Paul Vasey at paul.vasey@uleth.ca

First discovery of the female sex hormone progesterone in a plant

In a finding that overturns conventional wisdom, scientists are reporting the first discovery of the female sex hormone progesterone in a plant. Until now, scientists thought that only animals could make progesterone. A steroid hormone secreted by the ovaries, progesterone prepares the uterus for pregnancy and maintains pregnancy. A synthetic version, progestin, is used in birth control pills and other medications. The discovery is reported in the American Chemical Society's Journal of Natural Products, a monthly publication.

"The significance of the unequivocal identification of progesterone cannot be overstated," the article by Guido F. Pauli and colleagues, states. "While the biological role of progesterone has been extensively studied in mammals, the reason for its presence in plants is less apparent." They speculate that the hormone, like other steroid hormones, might be an ancient bioregulator that evolved billions of years ago, before the appearance of modern plants and animals. The new discovery may change scientific understanding of the evolution and function of progesterone in living things.

Scientists previously identified progesterone-like substances in plants and speculated that the hormone itself could exist in plants. But researchers had not found the actual hormone in plants until now. Pauli and colleagues used two powerful laboratory techniques, nuclear magnetic resonance and mass spectroscopy, to detect progesterone in leaves of the Common Walnut, or English Walnut, tree. They also identified five new progesterone-related steroids in a plant belonging to the buttercup family.

Leaves of the walnut tree contain progesterone, the female sex hormone, discovered for the first time in a plant. **iPhoto**

The full text of their paper is available at http://pubs.acs.org/stoken/presspac/presspac/full/10.1021/np9007415.

Evidence Builds on Color of Dinosaurs

By CARL ZIMMER

Until last week, paleontologists could offer no clear-cut evidence for the color of dinosaurs. Then researchers provided evidence that a dinosaur called Sinosauropteryx had a white-and-ginger striped tail. And now a team of paleontologists has published a full-body portrait of another dinosaur, in striking plumage that would have delighted that great painter of birds John James Audubon.

An illustration showing the likely colors of Anchiornis huxleyi.

"This is actual science, not 'Avatar,' " said Richard O. Prum, an evolutionary biologist at Yale and co-author of the new study, published in Science.

Dr. Prum and his colleagues took advantage of the fact that feathers contain pigment-loaded sacs called melanosomes. In 2009, they demonstrated that melanosomes survived for millions of years in fossil bird feathers. The shape and arrangement of melanosomes help produce the color of feathers, so the scientists were able to get clues about the color of fossil feathers from their melanosomes alone.

That discovery prompted British and Chinese scientists to examine fossils of dinosaurs that are covered with featherlike structures. The 125-million-year-old species Sinosauropteryx, for example, has bristles on its skin, and scientists found melanosomes in the tail bristles. They concluded that the dinosaur had reddish-and-white rings along its tail.

The discovery, which the researchers reported last week in Nature, supports research showing that birds are dinosaurs, having descended from a group of bipedal dinosaurs called theropods.

Dr. Prum and his colleagues, meanwhile, had set out on a similar quest. "We had a dream: to put colors on a dinosaur," said Jakob Vinther, a graduate student at Yale.

Working with paleontologists at the Beijing Museum of Natural History and Peking University, the researchers began to study a 150-million-year-old species called Anchiornis huxleyi. The chicken-sized theropod was festooned with long feathers on its arms and legs.

The researchers removed 29 chips, each the size of a poppy seed, from across the dinosaur's body. Mr. Vinther put the chips under a microscope and discovered melanosomes.

To figure out the colors of Anchiornis feathers, Mr. Vinther and his colleagues turned to Matthew Shawkey, a University of Akron biologist who has made detailed studies of melanosome patterns in living birds. Dr. Shawkey can accurately predict the color of feathers from melanosomes alone. The scientists used the same method to decipher Anchiornis's color pattern.

Anchiornis had a crown of reddish feathers surrounding dark gray ones, and its face was mottled with reddish and black spots. Its body was dark gray, but its limb feathers were white with black tips.

Given the full detail of the findings, Dr. Prum said, "it was like writing the first entry in a Jurassic field guide to feathered dinosaurs."

Luis M. Chiappe, a paleontologist at the Natural History Museum of Los Angeles County who was not involved in the research, praised the rigor and detail of the new study. "For a dinosaur scientist, this is like the birth of color TV," Dr. Chiappe said.

The color pattern of Anchiornis is reminiscent of living birds. A breed of chickens called Silver Spangled Hamburgs, for example, has white, black-tipped wing feathers. Dr. Prum speculated that studying these chickens might allow scientists to determine the specific mutations that gave rise to Anchiornis's plumage.

The color pattern on Anchiornis was so extravagant that the scientists are confident it served some visual function. "It was definitely for showing off," Mr. Vinther said.

Some features, like the crest, might have allowed the dinosaur to attract mates. But white and black limb feathers might have helped Anchiornis escape predators. A number of living animals like zebras use similar color patterns to dazzle predators, so that they can run away.

The researchers expect many more surprises as scientists look at other dinosaur fossils.

"There is a big chapter of dinosaur biology that we can open up now," Mr. Vinther said.

The Universe is Precisely 13.75 Billion Years Old

By Ian O'Neill

The Universe is 13.75 billion years old, primordial helium has been spotted for the first time and key evidence for the inflationary period immediately after the Big Bang has been found. But not all the new discoveries by NASA's Wilkinson Microwave Anisotropy Probe (WMAP) appear to fit cosmological theory.

Previously, scientists using data from WMAP measured the time since the Big Bang to be an incredibly precise 13.73 billion years (give or take 0.12 billion years). And now, using the same space-based observatory, the age of the universe has been refined even further, adding another 20 million years to the total (plus or minus 0.11 billion years).*

Using data from the first 7 years of operation, this refined universal age could be arrived at. Previously, the first 5 years of WMAP observations were used; the longer the observatory is operational, the longer the exposure time, therefore the results become more precise.

This news comes as a series of papers from the WMAP team have been published concerning several different aspects of the observations.

WMAP is constantly surveying the furthermost reaches of the universe, measuring the very faint "echo" of the Big Bang. This echo is known as cosmic microwave background (CMB) radiation, a remnant of the vast energies unleashed as the universe burst into being.

By mapping the slight variations of temperature in this background radiation, a lot of information about the conditions of the early universe can be gleaned, but cosmologists aren't only interested how long ago the Big Bang occurred. They are trying to find further evidence for what we believe happened in the moments after the Big Bang and now WMAP is filling in the gaps of our knowledge.

In addition to the precise age measurement, WMAP has been able to detect small acoustic oscillations (the cosmic equivalent to sound waves) in the CMB radiation, and the signature detected suggests primordial helium was generated in predicted quantities in the early stages of universal evolution.

Also, by measuring the fluctuations of the CMB radiation over all scales, there is evidence that suggests there was a very rapid expansion just after the Big Bang. This supports inflation theory and provides further evidence for the mysterious "Dark Energy" that is predicted to permeate through the universe, causing space-time to expand at an accelerated rate.

Although this all sounds great, there's one observation that can't be explained by theory. The amount of CMB radiation spotted near clusters of galaxies is greater than expected. According to theory, CMB photons should interact with these clusters, getting kicked to higher energies. WMAP cannot detect these higher energy photons, so there should be a deficit of CMB photons around clusters. This is not the case and scientists will probably be confused by this for some time to come.

WMAP continues to open our eyes to the nature of our universe by measuring the Big Bang echo, supporting current theories about how the cosmos started out, but challenges other theories as to how CMB radiation should behave. Although the WMAP mission is set to end in the fall of 2010, its results will reverberate for years to come.

*The uncertainties in the measurements don't come from astronomers lack of accuracy, far from it. When measuring cosmic times and distances, very slight errors may creep into the calculations. Some errors might be down to slight instrumental irregularities or fuzziness in datasets, so as a matter of good practice, scientists calculate a "margin for error" in their results. Ideally this margin should be as small as possible, but it will never disappear all together. ***Sources: Wired, PhysicsToday.org***

Nearly half of Americans believe H1N1 outbreak is over, poll finds

Majority of parents got or intend to get their children vaccinated, but majority of adults will not get H1N1 vaccine themselves

Boston, MA – The latest poll from researchers at the Harvard School of Public Health (HSPH) shows that almost half of Americans believe the H1N1 flu outbreak is over (44%), and levels of concern about getting sick with the virus continue to decline. Few (18%) think it is "very likely" there will be another widespread outbreak of the H1N1 virus in the U.S. during the next 12 months, although a larger share of the population (43%) does say such an outbreak is "somewhat likely." After an initial period of vaccine shortage, 70% of adults said there is now enough vaccine in their community for everyone who wants it. The national poll was conducted January 20-24, 2010.

At this point, more than half of parents (53%) either got the vaccine for their children (40%) or intend to get it before the end of February 2010 (13%). The Centers for Disease Control and Prevention (CDC) had identified children as a priority group for the vaccine. Among adults, 37% either got the H1N1 vaccine for themselves (21%) or intend to do so before February ends (16%). If perceptions that the outbreak is over spread, those who

now say they intend to get the vaccine may ultimately decide not to. The poll also revealed a substantial share of adults who said they have not gotten the vaccine and do not intend to (61%).
"Many parents heeded the public health message to vaccinate their children against this virus, which hit young people unexpectedly hard," said Professor [[Robert Blendon]], Director of the Harvard Opinion Research Program and an expert in understanding the public response to emergencies that involve health threats. "But there remains a steady core of adults who, regardless of messaging and other efforts, has chosen not to get the H1N1 vaccine. This group's set of attitudes has proven very difficult for public health officials to change."

The poll, which examines the American public's attitudes and response to distribution of H1N1 vaccine this winter, is the eighth in a series on public views concerning the H1N1 flu outbreak undertaken by the Harvard Opinion Research Program at HSPH.
"Our results show there was broad awareness of public health messages on H1N1; approximately three-fourths of the public reported seeing ads regarding the importance of getting the H1N1 vaccine since December, but many people did not respond to the message," said Gillian K. SteelFisher, research scientist in the HSPH Department of Health Policy and Management and assistant director of the Harvard Opinion Research Program.

Almost Half of People Think the H1N1 Outbreak is Already Over

When asked if they think there are "still many cases of people getting sick from the H1N1 flu," almost half of adults (44%) said that "the outbreak is over," while 39% thought there are still many cases of people getting sick. Concern levels are correspondingly down from a peak in September when more than half of adults (52%) were concerned that they or someone in their immediate family might get sick from H1N1 during the next 12 months. The latest poll showed only 32% still concerned.

Adequacy of Vaccine Supply

After an initial period of vaccine shortage, 70% of adults said there is now enough vaccine in their community for everyone who wants it, which is significantly more than in December (48%) or November (21%). However, 12% think there is still a shortage in their community.

Only 5% of the public currently believes there is "too much" vaccine in their community, but there may ultimately be more vaccine available than will be immediately used by the public. Findings from this poll suggest that a majority of the public nonetheless believes it is more appropriate for public health officials to purchase "enough vaccine so there is no possibility of a shortage in the long run, even if this decision means that they will spend money on vaccines that are not used" rather than order a more limited supply of vaccine that might mean "there is a shortage if it turns out more people than estimated want the vaccine" (59% vs. 38%).

Majority of Adults Do Not Intend to Get the Vaccine, but a Majority of Children Have Been or Will be Vaccinated

Since the beginning of November, according to this latest poll, there has been an increase in the number of adults overall who have gotten the H1N1 vaccine (21% in January vs. 14% in December vs. 5% in November). Of those adults who did get the vaccine, 90% received the injectable form, while 10% received the nasal spray. However, a significant majority of all adults (61%) did not get the vaccine and do not intend to. Most frequently, adults indicated that the "major" reasons for not getting the vaccine for themselves were: They don't think the H1N1 outbreak is as serious now as public officials once thought (37%); they are concerned about safety risks from the vaccine (35%); they do not think they are at risk of getting a serious case of H1N1 (30%); and they believe that they can get medication to treat the illness if they do get sick (27%).

"The skepticism of this group indicates that, going forward, it may be difficult to get more movement in the percentage of adults vaccinated for H1N1 or for a similarly behaving new flu virus," said Blendon.
Parents, however, have made more efforts to vaccinate their children. This latest poll found that 53% of parents got the vaccine for all or some of their children or intend to get it for them before the end of February 2010. Parents who say they intend to get the vaccine may decide not to if perceptions that the outbreak is over spread.

Among parents who did get their children vaccinated, most got their children vaccinated at traditional sites including a physician's/other health care provider's office (46%) or a health clinic (22%). However, following significant efforts by public health officials to engage schools in H1N1 vaccination programs, nearly a third (29%) say their children were vaccinated at a school. The majority of parents say their children got the injectable vaccine (61%) while 35% got the nasal spray.

For those parents who did not get the vaccine for their children and do not intend to (44%), the most commonly cited "major" reason for this decision was a concern about the safety of the vaccine (56%). Secondarily, parents who made this decision explained that they could treat H1N1 with medication if their children got sick with it (33%), and they don't think the H1N1 outbreak is as serious now as public officials once thought (32%).

Satisfaction With Public Health Response

A majority of adults (59%) rated the overall response of public health officials to the H1N1 outbreak as "excellent" or "good." Conversely, 39% rated the overall response as "fair" or "poor." In the view of more than half of adults (54%), public health officials spent "the right amount" of attention on the H1N1 flu outbreak, but 26% said they spent "too much" attention, and 16% said they spent "too little." Intensive public health advertising about the importance of getting the H1N1 flu vaccine, including posters, billboards, web-based ads, television or newspaper ads, was reported as seen by 76% of adults since the beginning of December 2009.

DNA testing on 2,000-year-old bones in Italy reveal East Asian ancestry

HAMILTON, ON, – Researchers excavating an ancient Roman cemetery made a surprising discovery when they extracted ancient mitochondrial DNA (mtDNA) from one of the skeletons buried at the site: the 2,000-year-old bones revealed a maternal East Asian ancestry.

The results will be presented at the Roman Archeology Conference at Oxford, England, in March, and published in the Journal of Roman Archaeology.

According to Tracy Prowse, assistant professor of Anthropology, and the lead author on the study, the isotopic evidence indicates that about 20% of the sample analyzed to-date was not born in the area around Vagnari. The mtDNA is another line of evidence that indicates at least one individual was of East Asian descent.

"These preliminary isotopic and mtDNA data provide tantalizing evidence that some of the people who lived and died at Vagnari were foreigners, and that they may have come to Vagnari from beyond the borders of the Roman Empire," says Prowse. "This research addresses broader issues relating to globalization, human mobility, identity, and diversity in Roman Italy."

Based on her work in the region, she thinks the East Asian man, who lived sometime between the first to second centuries AD—the early Roman Empire—was a slave or worker on the site. His surviving grave goods consist of a single pot (which archaeologists used to date the burial). What's more, his burial was disturbed in antiquity and someone was buried on top of him.

Prowse's team cannot say how recently he, or his ancestors, left East Asia: he could have made the journey alone, or his East Asian genes might have come from a distant maternal ancestor. However, the oxygen isotope evidence indicates that he was definitely not born in Italy and likely came here from elsewhere in the Roman Empire.

During this era, Vagnari was an Imperial estate owned by the emperor in Rome and controlled by a local administrator. Workers were employed in industrial activities on the site, including iron smelting and tile production. These tiles were used for roofing buildings on the site and were also used as grave covers for the people buried in the cemetery. Fragmentary tiles found in and around Vagnari are marked "Gratus Caesaris", which translates into "slave of the emperor."

In addition to the mystery the find uncovers, Prowse sees the broader scientific impact for archaeologists, physical anthropologists, and classicists: The grave goods from this individual's burial gave no indication that he was foreign-born or of East Asian descent.

"This multi-faceted research demonstrates that human skeletal remains can provide another layer of evidence in conjunction with archaeological and historical information," says Prowse.

For the last seven years, Prowse has been digging the cemetery at the site of Vagnari, just west of the city of Bari in southern Italy. The cemetery was first discovered in 2002 by her colleague, Alastair Small (University of Edinburgh), who directs the excavations at Vagnari and continues to excavate other areas of the site. Prowse's research focuses on the bioarchaeological analysis of the people buried in the cemetery, including isotopic, palaeopathological, and aDNA analysis. The ancient DNA analyses were conducted by her coauthors on the paper, Jodi Barta and Tanya vonHunnius, at McMaster University.

The research was funded by the Social Sciences and Humanities Research Council of Canada.

Ancient Mongolian Tomb Holds Skeleton of Western Man

The remains of a 2,000-year-old skeleton found in eastern Mongolia reveal a man of multi-ethnic heritage.

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THE GIST:

* DNA analysis of 2,000-year-old bones found in eastern Mongolia reveal a man of Western heritage.
* At the time, the vast territory in and around Mongolia included ethnically and linguistically diverse nomadic tribes.
* Two other skeletons found at the site show genetic links to people living in northeastern Asia.

Dead men can indeed tell tales, but they speak in a whispered double helix.

Consider an older gentleman whose skeleton lay in one of more than 200 tombs recently excavated at a 2,000-year-old cemetery in eastern Mongolia, near China's northern border. DNA extracted from this man's

bones pegs him as a descendant of Europeans or western Asians. Yet he still assumed a prominent position in ancient Mongolia's Xiongnu Empire, say geneticist Kyung-Yong Kim of Chung-Ang University in Seoul, South Korea, and his colleagues.

On the basis of previous excavations and descriptions in ancient Chinese texts, researchers suspect that the Xiongnu Empire -- which ruled a vast territory in and around Mongolia from 209 B.C. to A.D. 93 -- included ethnically and linguistically diverse nomadic tribes. The Xiongnu Empire once ruled the major trading route known as the Asian Silk Road, opening it to both Western and Chinese influences.

Researchers have yet to pin down the language spoken by Xiongnu rulers and political elites, says archaeologist David Anthony of Hartwick College in Oneonta, N.Y. But the new genetic evidence shows that the 2,000-year-old man "was multi-ethnic, like the Xiongnu polity itself," Anthony remarks.

This long-dead individual possessed a set of genetic mutations on his Y chromosome, which is inherited from paternal ancestors, that commonly appears today among male speakers of Indo-European languages in eastern Europe, central Asia and northern India, Kim's team reports in an upcoming American Journal of Physical Anthropology. The same man displayed a pattern of mitochondrial DNA mutations, inherited from maternal ancestors, characteristic of speakers of modern Indo-European languages in central Asia, the researchers say. "We don't know if this 60- to 70-year-old man reached Mongolia on his own or if his family had already lived there for many generations," says study co-author Charles Brenner, a DNA analyst based in Oakland, Calif.

Two other skeletons from the Xiongnu cemetery in Duurlig Nars show genetic links to people who live in northeastern Asia, according to Kim's team. Other team members include Kijeong Kim of Chung-Ang University, Eregzen Gelegdorj of the National Museum of Mongolia in Ulaanbaatar and Eun-Jeong Chang of the National Museum of Korea in Seoul.

The Duurlig Nars man's genetic signature supports the idea that Indo-European migrations to northeastern Asia started before 2,000 years ago. This notion is plausible, but not confirmed, says geneticist Peter Underhill of Stanford University. Further investigations of Y chromosome mutation frequencies in modern populations will allow for a more precise tracing of the Duurlig Nars man's geographic roots, Underhill predicts.

Scholars have long sought to trace the origin and spread of related languages now found in Europe, India and other parts of Asia. One hypothesis holds that Indo-European languages proliferated via several waves of expansion and conquest by nomads known as Kurgans who had domesticated horses and thus could travel long distances. In this scenario, Kurgans left a homeland north of the Black Sea, in what's now Russia, around 6,400 years ago.

Another view holds that farmers from ancient Turkey spread Indo-European tongues as they swallowed up one parcel of land after another, beginning around 9,000 years ago.

Since 1978, discoveries of 2,400- to 4,000-year-old mummified corpses with European features in northwestern China, not far from Mongolia, have fueled the Kurgan hypothesis (SN: 2/25/95, p. 120). Remains of large wheels found with these blond-haired individuals raise the controversial possibility that these foreigners introduced carts and chariots to the Chinese.

Add to those discoveries a report in the September 2009 Human Genetics. Geneticist Christine Keyser of the University of Strasbourg in France and her colleagues found that nine of 26 skeletons previously excavated at 11 Kurgan sites in northeastern Russia possess a Y chromosome mutation pattern thought to mark the eastward expansion of early Indo-Europeans. That same genetic signature characterizes the Duurlig Nars man.

By 2,000 years ago, the easternmost Indo-European languages were probably spoken in northwestern China, Anthony holds. So an Indo-European speaker could have aligned himself with Xiongnu political big shots and earned an eternal resting place in an elite Xiongnu cemetery, in his opinion.

Kim agrees. The Duurlig Nars man's tomb lies close to the tomb of an especially high-ranking Xiongnu man whom he may have served in some way, he suggests.

Kim's group plans to extract and study DNA from additional Duurlig Nars skeletons. For now, Anthony remarks, "this new study from Mongolia is important because it adds one more point of light to a largely dark prehistoric sky."