Epilepsy drug causes bone loss in young women

ST. PAUL, Minn. – Young women who took the commonly used epilepsy drug phenytoin for one year showed significant bone loss compared to women taking other epilepsy drugs, according to a study published in the April 29, 2008, issue of Neurology®, the medical journal of the American Academy of Neurology.

Researchers tested the bone health of 93 women with epilepsy who were between the ages of 18 and 40 and were taking the epilepsy drugs phenytoin, carbamazepine, lamotrigine or valproate. Bone mineral density was measured at the spine and two areas of the hip, (the femoral neck and total hip) at the beginning of the study and one year later. Researchers also evaluated each woman's nutrition and physical activity, along with other factors that affect bone health.

The study found women taking phenytoin for one year lost 2.6 percent of the bone density in the femoral neck of the hip. Women taking the other epilepsy drugs did not lose any bone density in the femoral neck. There was no bone loss at the spine or the total hip in any group.

"This is a significant amount of bone loss and raises serious concerns about the long-term effects of taking phenytoin in young women with epilepsy," said study author Alison M. Pack, MD, with Columbia University in New York, NY, and member of the American Academy of Neurology. "This is one of the first prospective studies to examine the long-term effects of common epilepsy drugs on rates of bone loss in young women."

"This amount of bone loss, especially it if continues over the long term, could put these women at increased risk of fractures after menopause," Pack said. Femoral neck fractures are tied to a higher risk of death in elderly people. *The study was supported by grants from the National Institutes of Health and GlaxoSmithKline.*

Use of hemoglobin-based blood substitutes associated with increased risk of death, heart attack

An analysis of studies involving the use of hemoglobin-based blood substitutes indicates their use is associated with an increased risk of death and heart attack, according to a JAMA study being released early online, and will appear in print in the May 21 issue of JAMA.

The development of a blood substitute—a liquid that has a long shelf-life, does not need refrigeration and does not cause infection—would provide a potentially lifesaving option for surgical and trauma patients with shock from loss of blood, especially in rural areas and military settings. "To date, a large proportion of blood substitutes in development have been hemoglobin-based products [hemoglobin is the oxygen-carrying protein in the red blood cells]. Yet randomized controlled trials completed as early as 1996 have raised questions about the safety of these products and have failed to demonstrate clinical benefit. Nonetheless, at least 1 of these products is approved for use outside the United States and new clinical trials are being conducted or planned worldwide," the authors write.

Charles Natanson, M.D., of the National Institutes of Health, Bethesda, Md., and colleagues conducted an analysis of previous studies to examine the association between hemoglobin-based blood substitutes (HBBSs) and the risk of heart attack and death in trials using these products in surgical, trauma and stroke patients. The authors searched databases and other sources for randomized controlled trials that included patients age 19 years and older who received HBBSs therapeutically. Sixteen trials that met the authors' criteria were identified, involving five different products and 3,711 patients.

There were a total of 164 deaths among HBBS-treated patients and 123 deaths among patients in the control groups. Overall, the HBBS products were associated with a 30 percent increased risk of death. There were a total of 59 heart attacks among HBBS-treated patients and 16 heart attacks among patients in the control groups. For these studies combined, there was a 2.7 times increased risk of heart attack among patients receiving HBBSs.

Subgroup analysis of these trials indicated the increased risk was not restricted to a particular HBBS or clinical indication. "The pattern of increased risk demonstrated by a variety of HBBSs across an array of clinical settings argues for a policy whereby any new or existing HBBSs should be subjected to pre-clinical studies in animal models that replicate the known toxicities of HBBSs demonstrated in humans before further clinical trials of this class of product are allowed to proceed," the authors write.

The researchers also discussed the regulatory process that permitted repeated trials with these agents despite persistent safety concerns.

"Sponsors are required by law to report their results to the Food and Drug Administration (FDA) in a timely fashion after studies are completed, even if they do not publish their findings. However, the data reported by sponsors to the FDA are not made public by the FDA unless the product is approved or an advisory committee is convened to discuss the product. The cumulative mortality analysis … indicates that prompt meta-analyses of the HBBS trials by the FDA most likely would have demonstrated significant risks by 2000. Had the agency placed a moratorium on trials at that point, product-related deaths and [heart attacks] in subsequent trials

most likely would have been prevented. However, such data were not available to scientists, the public, institutional review boards, or competing HBBS manufacturers," the authors write.

Five trials of HBBSs reportedly are ongoing in eight different countries outside the United States and at least one trial is being planned for the U.S.

"The results of all trials of experimental agents conducted in human beings—from phase 1 to phase 4—should be fully and expeditiously disclosed to the scientific and medical communities. The case study detailed here underscores both the scientific inefficiency and the real risks to patients of the current failure to report data promptly."

(JAMA. 2008;299[19]:doi:10.1001/jama.299.19.jrv80007. Available pre-embargo to the media at www.jamamedia.org)

Editor's Note: Please see the article for additional information, including other authors, author contributions and affiliations, financial disclosures, funding and support, etc.

Editorial: The Future of Clinical Trials Evaluating Blood Substitutes

In an accompanying editorial, Dean A. Fergusson, M.H.A., Ph.D., and Lauralyn McIntyre, M.D., M.Sc., of the Ottawa Health Research Institute and the University of Ottawa Faculty of Medicine, Ottawa, Canada, write that the timely reporting of all evidence independent of positive or negative findings is not only essential but ethical.

"Natanson et al provide evidence that study results were made public well after the trials had stopped enrollment. Thus, it was not possible for ethics boards to properly review proposed studies because they did not have all available information. Additionally, patients or proxy decision makers were not in a position to make well-informed decisions at the time of providing informed consent. Regardless of whether studies are conducted under the auspices of commercial or academic entities, studies need to be centrally registered and their findings duly reported. Not doing so places patients at unnecessary risk."

"Based on the findings of Natanson et al and the consistency of these results with pre-clinical evidence of potential toxicity, further phase 3 trials of hemoglobin-based oxygen carriers (HBOCs) should not be conducted. There has been a tremendous amount of resources expended and knowledge gained from the pursuit of HBOCs. This vast body of knowledge should be reviewed critically and systematically, including theoretical constructs, animal studies, mechanistic studies, and early-phase clinical trials before further phase 3 trials are undertaken," they write. "Until the mechanisms and potential toxicities of HBOC products are better understood, patients cannot be placed at unacceptable risk."

The study and editorial will be published early online Monday. They will appear in the May 21, 2008, print issue of JAMA.

(JAMA. 2008;299[19]:doi:10.1001/jama.299.19.jed80027. Available pre-embargo to the media at www.jamamedia.org)

Osteoporosis drug Fosamax linked to heart problem

Finding from Group Health and University of Washington study

SEATTLE—Women who have used Fosamax are nearly twice as likely to develop the most common kind of chronically irregular heartbeat (atrial fibrillation) than are those who have never used it, according to research from Group Health and the University of Washington published in the April 28 Archives of Internal Medicine.

Merck markets Fosamax, the most widely used drug treatment for the bone-thinning disease osteoporosis, explained study leader Susan Heckbert, MD, PhD, MPH, a professor of epidemiology and scientific investigator in the Cardiovascular Health Research Unit at the University of Washington. The Food and Drug Administration (FDA) approved the first generic versions (called alendronate) in February.

"We studied more than 700 female Group Health patients whose atrial fibrillation was first detected during a three-year period," said Dr. Heckbert. She and her colleagues compared those women to over 900 randomly selected female Group Health members matched on age and high blood pressure to serve as controls.

"Having ever used alendronate was associated with an 86 percent higher risk of newly detected atrial fibrillation compared with never having used the drug," said Dr. Heckbert, who is also an affiliate investigator at the Group Health Center for Health Studies.

Osteoporosis mostly affects older women and can set the stage for fractures that can impair the quality of their lives, said Dr. Heckbert. "Careful judgment is required to weigh the risks and benefits of any medication for any individual patient," she added. "For most women at high risk of fracture, alendronate's benefit of reducing fractures will outweigh the risk of atrial fibrillation."

However, said Dr. Heckbert, "women who are at high risk of fractures but also have risk factors for atrial fibrillation—such as heart failure, diabetes, or coronary disease—might want to discuss alternatives to alendronate with their health care providers." Other medications that can lower the risk of fractures include estrogen, she said. But the Women's Health Initiative, on which she has also served as an investigator, showed other heart risks from hormone therapy combining estrogen with progesterone.

The National Heart, Lung, and Blood Institute funds Dr. Heckbert's Atrial Fibrillation Study, which collects data on all Group Health patients as they are first diagnosed with atrial fibrillation. The study aims to find new factors that raise the risk of developing this quivering of the heart's upper chambers (atria).

About one in 100 people—and nearly nine in 100 people over age 80—have atrial fibrillation, said Dr. Heckbert. In many cases, atrial fibrillation has no symptoms, and it isn't necessarily life threatening. But it can cause palpitations, fainting, fatigue, or congestive heart failure.

Atrial fibrillation can also make blood pool—and sometimes clot—in the atria, said Dr. Heckbert. When parts of clots break off and leave the atria, they can lead to embolic strokes, as happens in over 70,000 Americans a year. That's why atrial fibrillation is often treated with the anticoagulant warfarin. Other results from her study have suggested that maintaining a healthy body weight may help protect people from atrial fibrillation.

"This study will help medical teams better inform their patients about the risks associated with Fosamax, helping us make the best treatment decisions for managing osteoporosis," commented Christine Himes Fordyce, MD, a Group Health family practitioner. "Now with this increased understanding of potential irregular heartbeats, both physicians and their patients should be alert to any problems, report them immediately, and treat them appropriately."

Group Health Center for Health Studies

Founded in 1947, Group Health is a Seattle-based, consumer-governed, nonprofit health care system that coordinates care and coverage. For 25 years, the Group Health Center for Health Studies has conducted research on preventing, diagnosing, and treating major health problems. Government and private research grants provide its main funding.

Spinal cord injury research hampered by animal models, says new study

Scientists say difficulty lies in extrapolating animal data to humans

Washington—Research on traumatic spinal cord injuries is hampered by a reliance on animal experiments that don't accurately predict human outcomes, says a new study in the upcoming edition of the peer-reviewed journal Reviews in the Neurosciences. The review was written by scientists with the Physicians Committee for Responsible Medicine.

"Despite decades of animal experiments, we still don't have a drug to cure spinal cord injury in humans," says Aysha Akhtar, a neurologist with PCRM and the lead author. "According to the Journal of the American Paraplegic Society, at least 22 agents were found to improve spinal cord injury in animals, but not one of these was helpful in humans," says Dr. Akhtar.

The paper outlines the numerous problems with translating animal data into effective human treatments, including the many variations between laboratory-induced injuries in animals and human injuries, the difficulties in interpreting functional outcomes in animals, and the multitude of inter-species differences in physiology and anatomy.

The extrapolation problem, in general, has been widely acknowledged by scientists of many disciplines and affiliations. According to data from the Food and Drug Administration, more than 90 percent of drugs that proved successful in animal tests are not approved for wider use after clinical trials in humans. In February, three U.S. government agencies, including the National Institutes of Health, the Environmental Protection Agency, and the National Toxicology Program announced a major new program aimed at ending the use of animals in safety testing of new chemicals and drugs.

Because of the extrapolation challenge, some fields, such as cancer research and toxicity testing, are moving toward a greater use of alternatives. Unfortunately, spinal cord research, a relatively newer endeavor, is not yet learning from the failure of other fields of inquiry. As Dr. Akhtar warns, "We need to develop new, more effective research techniques."

Although scientists have just begun to develop alternatives to the use of animals in spinal cord injury research, several techniques show great promise. Researchers at the University of Miami, for example, are collaborating on the Human Spinal Cord Injury Model Project which uses imaging techniques, post-mortem analysis, and nerve conduction methods to understand human spinal cords. Other promising directions involve computer modeling, studies on human nerve tissues, and the study of human cadavers.

At least 250,000 Americans are living with spinal cord injuries; an estimated 10,000 Americans are diagnosed each year.

Journalists: For a copy of the paper or an interview with Dr. Akhtar, please contact Ms. Simon Chaitowitz at simonc@pcrm.org or 202-527-7309.

Founded in 1985, the Physicians Committee for Responsible Medicine is a nonprofit health organization that promotes preventive medicine, especially good nutrition. PCRM also conducts clinical research studies, opposes unethical human experimentation, and promotes alternatives to animal research.

RELATED LINKS

** Bios on Reviewers: Aysha Akhtar, M.D. (http://www.pcrm.org/news/bios/aysha_akhtar.html), John Pippin, M.D., (http://www.pcrm.org/news/bios/pippin.html) and Chad Sandusky, Ph.D. (http://www.pcrm.org/news/bios/research.html).*

** Op-ed by John Pippin, M.D., F.A.C.C., on Alternatives to Animal Experiments (http://www.pcrm.org/news/commentary030108.htm)*

** Petition to FDA for Mandatory Use of Non-Animal Methods in Drug Development (http://www.alternatives-petition.org/)*

What does it mean to be alive?

How notions of the natural world unfold- in development and across languages.

Understanding the concept of a "living thing" is a late developmental achievement. Early research by Jean Piaget, showed that kids attribute "life status" to things that move on their own (e.g. clouds or bikes) and even 10-year-olds have difficulty understanding the scope of a living thing.

New research, supported by the National Science Foundation and the National Institutes of Health, proposes that the way in which "alive" and other biological concepts are named within a given language shapes their understanding and acquisition in children. Northwestern University psychologist Florencia Anggoro, with colleagues Sandra Waxman and Doug Medin, compared 4-9-year-old children speaking English and Indonesian, a pair of languages with an intriguing difference. In English, but not Indonesian, the name "animal" is polysemous, or has more than one meaning: one sense includes all animate objects (as in, the animal kingdom); the other excludes humans (as in, 'don't eat like an animal!').

This polysemy, the researchers say, can make it difficult for children to identify with any precision the scope of the names and their underlying concepts. If this is the case, then children learning a language without this polysemy should have less difficulty. Indonesian provides an ideal test: the word "animal" is not ambiguous; it refers exclusively to non-human animals.

To test this theory in the laboratory, Anggoro, who is now at the University of Chicago, and colleagues asked both Indonesian-speaking children and English-speaking children to identify entities that are "alive" in a simple sorting task. Indonesian-speaking children, tested in Jakarta, exhibited little trouble; they selected both plants and animals. But, English-speaking children, tested in Chicago, had trouble settling on the scope of the concept, and even at 9 years of age tended to exclude plants. Thus, the term "alive" poses unique interpretive challenges, especially for English-speaking children.

These results, which appear in the April issue of Psychological Science, a journal of the Association for Psychological Science, offer insights into how knowledge is shaped by language. The results also have strong implications for education, "understanding the conceptual consequences of language differences will serve as an effective tool in our efforts to advance the educational needs of children, including (but not limited to) those from diverse linguistic and cultural backgrounds who are now enrolled in U.S. schools" says Anggoro.

Brookhaven Scientists Explore Brain's Reaction to Potent Hallucinogen

Increasingly popular recreational drug, salvia, shows rapid uptake, short duration in animals

Written by Kendra Snyder

UPTON, NY - Brain-imaging studies performed in animals at the U.S. Department of Energy's (DOE) Brookhaven National Laboratory provide researchers with clues about why an increasingly popular recreational drug that causes hallucinations and motor-function impairment in humans is abused. Using trace amounts of Salvia divinorum - also known as "salvia," a Mexican mint plant that can be smoked in the form of dried leaves or serum - Brookhaven scientists found that the drug's behavior in the brains of primates mimics the extremely fast and brief "high" observed in humans. Their results are now published online in the journal NeuroImage.

Quickly gaining popularity among teenagers and young adults, salvia is legal in most states, but is grabbing the attention of municipal lawmakers. Numerous states have placed controls on salvia or salvinorin A - the plant's active component - and others, including New York, are considering restrictions.

"This is probably one of the most potent hallucinogens known," said Brookhaven chemist Jacob Hooker, the lead author of the study, which is the first to look at how the drug travels through the brain. "It's really important that we study drugs like salvia and how they affect the brain in order to understand why they are abused and to investigate their medicinal relevance, both of which can inform policy makers."

Hooker and fellow researchers used positron emission tomography, or PET scanning, to watch the distribution of salvinorin A in the brains of anesthetized primates. In this technique, the scientists administer a radioactively labeled form of salvinorin A (at concentrations far below pharmacologically active doses) and use the PET scanner to track its site-specific concentrations in various brain regions.

Within 40 seconds of administration, the researchers found a peak concentration of salvinorin A in the brain - nearly 10 times faster than the rate at which cocaine enters the brain. About 16 minutes later, the drug was essentially gone. This pattern parallels the effects described by human users, who experience an almost immediate high that starts fading away within 5 to 10 minutes.

High concentrations of the drug were localized to the cerebellum and visual cortex, which are parts of the brain responsible for motor function and vision, respectively. Based on their results and published data from human use, the scientists estimate that just 10 micrograms of salvia in the brain is needed to cause psychoactive effects in humans.

Salvia doesn't cause the typical euphoric state associated with other hallucinogens like LSD, Hooker said. The drug targets a receptor that is known to modulate pain and could be important for therapies as far reaching as mood disorders.

"Most people don't find this class of drugs very pleasurable," Hooker said. "So perhaps the main draw or reason for its appeal relates to the rapid onset and short duration of its effects, which are incredibly unique. The kinetics are often as important as the abused drug itself."

The Brookhaven team plans to conduct further studies related to salvia's abuse potential. The scientists also hope to develop radioactive tracers that can better probe the brain receptors to which salvia binds. Such studies could possibly lead to therapies for chronic pain and mood disorders.

This research was funded by the National Institutes of Health and the Office of Biological and Environmental Research within DOE's Office of Science. DOE has a long-standing interest in research on brain chemistry gained through brain-imaging studies. Brain-imaging techniques such as PET are a direct outgrowth of DOE's support of basic physics and chemistry research.

All research involving laboratory animals at Brookhaven National Laboratory is conducted under the jurisdiction of the Lab's Institutional Animal Care and Use Committee in compliance with the Public Heath Service (PHS) Policy on Humane Care and Use of Laboratory Animals, the U.S. Department of Agriculture's Animal Welfare Act, and the National Academy of Sciences' Guide for the Care and Use of Laboratory Animals. This research has enhanced understanding of a wide array of human medical conditions including cancer, drug addiction, Alzheimer's and Parkinson's diseases, and normal aging and has led to the development of several promising treatment strategies.

LSD inventor Albert Hofmann dies

Albert Hofmann, the Swiss chemist who discovered the hallucinogenic drug LSD, has died of a heart attack at his home in Basel at the age of 102.

Mr Hofmann first produced LSD in 1938 while researching the medicinal uses of a crop fungus.

He accidentally ingested some of the drug and said later: "Everything I saw was distorted as in a warped mirror."

He argued for decades that LSD could help treat mental illness, but in the 1960s it became a popular street drug.

'Turn on, tune in, drop out'

While working with the drug in the Sandoz pharmaceutical laboratory a few years after first producing it, Mr Hofmann ingested some of the drug through his fingertips.

He went home and experienced what he described as visions of "fantastic pictures, extraordinary shapes with intense, kaleidoscopic play of colours".

The drug was popularised by Harvard professor Timothy Leary who suggested that people "turn on, tune in, drop out".

Rock stars and the counter-culture of the 1960s picked up LSD as a wonder drug but horror stories began to emerge of users suffering permanent psychological damage.

LSD was made illegal in many countries beginning in the late 1960s.

Video: Albert Hofmann on his first LSD experience

Cause and Affect: Emotions can be unconsciously and subliminally evoked

Most people agree that emotions can be caused by a specific event and that the person experiencing it is aware of the cause, such as a child's excitement at the sound of an ice cream truck. But recent research suggests emotions also can be unconsciously evoked and manipulated.

Psychologists Kirsten Ruys and Diedrick Stapel of the Tilburg Institute for Behavioral Economics Research at Tillburg University in The Netherlands have uncovered the first empirical evidence to suggest humans do not need to be aware of the event that caused their mood or feelings in order to be affected by it. The scientists hypothesized that, since humans have evolved to respond quickly and unconsciously to stimuli, they should be able to react to an emotional event without full awareness: "You are likely to live longer if you immediately stop moving at the sight of a growling grizzly bear and do not need full awareness for such a response to be instigated," explained Ruys and Stapel.

The researchers measured people's thoughts, feelings and behavior to determine whether specific emotions were induced without awareness of their cause - a study based on the theory implying that, due to natural selection, humans should be able to detect specific emotion-evoking information automatically. Participants were separated into three groups and were told that very short flashes would appear on a computer screen. They were then instructed to press the 'R' key if it appeared on the right side of the screen or the 'L' key if it appeared on the left.

In actuality, the 'flashes' were subliminal images selected to elicit fear, disgust or no emotion at all. The images flashed at varying speeds making it impossible for the participants to be fully conscious of their

presence. In other words, the participants were unaware that they were viewing images of growling dogs and dirty toilets or even neutral images, such as horses or chairs.

The participants then underwent three tests to measure the effect of the images on their cognition, feelings and behavior. For the cognitive measure, they completed word fragments with a variety of words including those that expressed disgust, fear, anger, generally negative, generally positive and neutral feelings. Next, participants rated the overall positivity or negativity of their mood and the extent to which they felt fearful, disgusted, satisfied, relieved, proud, angry, shameful and joyful on 7-point scales.

During the behavioral measure, participants were asked to take part in either a 'strange food test' or a 'scary movie test,' assuming that, for example, those who were exposed to the disgusting images would want to avoid the possibility of eating something unpleasant. At the end of the study, the researchers asked gradually more specific questions about the subliminal images to gauge the participants' awareness of the study's purpose and intent.

The intriguing results, which appear in the April issue of Psychological Science, a journal of the Association for Psychological Science, strongly support the psychologists' theory. Those participants who viewed only the disgust-inducing subliminal images were more likely to use disgust words in the word-completion task, to describe their feelings with the disgust words and to choose to take the 'scary movie test.' The same held true for those who viewed only the fear-inducing images - they also were more likely to use words related to fear and to take the 'strange food test.'

The psychologists also found that after quick (120ms) speed exposures to emotional stimuli, a general, negative mood developed accompanied by a specific emotion, such as fear after seeing fearful pictures. After the super-quick (40ms) speed exposure, only a general negative mood was induced without a specific emotion involved. These empirical findings are the first to demonstrate that specific emotions can be evoked without awareness of the cause and that a person's global mood can develop into a specific emotion.

And while the study did not investigate how an individual eventually becomes conscious of their emotions, the scientists did pose an additional hypothesis: "When emotions are full-blown, people become aware of their emotions by perceiving their own actions and bodily reactions; likewise, when emotions are weak, people fail to notice their weakly-related actions and bodily reactions."

Before fossil fuels, Earth's minerals kept CO2 in check

Stanford, CA— Over millions of years carbon dioxide levels in the atmosphere have been moderated by a finely-tuned natural feedback system— a system that human emissions have recently overwhelmed. A joint University of Hawaii / Carnegie Institution study published in the advance online edition of Nature Geoscience links the pre-human stability to connections between carbon dioxide in the atmosphere and the breakdown of minerals in the Earth's crust. While the process occurs far too slowly to have halted the historical buildup of carbon dioxide from human sources, the finding gives scientists new insights into the complexities of the carbon cycle.

Ken Caldeira of the Carnegie Institution's Department of Global Ecology and Richard Zeebe of the University of Hawaii studied levels of carbon dioxide in the atmosphere over the past 610,000 years using data from gas bubbles trapped in Antarctic ice cores. They used these records, plus geochemical data from ocean sediments, to model how carbon dioxide released into the atmosphere by volcanoes and other natural sources is ultimately recycled via carbon-bearing minerals back into the crust.

When carbon dioxide levels in the atmosphere rise, the chemical reactions that break down silicate minerals in soils are accelerated. Among the products of these reactions are calcium ions, which dissolve in water and are washed to the ocean by rivers. Marine organisms such as mollusks combine the calcium ions with dissolved carbon dioxide to make their shells (calcium carbonate), which removes both calcium and carbon dioxide from the ocean, restoring the balance.

The researchers found that over hundreds of thousands of years the equilibrium between carbon dioxide input and removal was never more than one to two percent out of balance, a strong indication of a natural feedback system. This natural feedback acts as a thermostat, which is critical for the long-term stability of climate. During Earth's history it has probably helped to prevent runaway greenhouse and icehouse conditions over time scales of millions to billions of years — a prerequisite for sustaining liquid water on Earth's surface.

"The system is finely in tune," says Caldeira. "That one or two percent imbalance works out to an average imbalance in natural carbon dioxide emissions that is thousands of times smaller than our current emissions from industry and the destruction of forests."

Previous researchers had suggested that such a system existed, but Caldeira and Zeebe's study provides the first observational evidence supporting the theory, and confirms its role in stabilizing the carbon cycle. But because it operates over such a long time scale—the time scale over which landscapes are eroded and washed to the sea—this geological feedback system offers little comfort with respect to the current climate crisis.

Carbon dioxide is added naturally to the atmosphere and oceans from volcanoes and hydrothermal vents at a rate of about 0.1 billion tons of carbon each year. Human industrial activity and destruction of forests is adding carbon about 100 times faster, approximately 10 billion tons of carbon each year.

"The imbalance in the carbon cycle that we are creating with our emissions is huge compared to the kinds of imbalances seen over the time of the glacial ice core records," says Caldeira. "We are emitting CO2 far too fast to expect Mother Nature to mop up our mess anytime soon. Continued burning of coal, oil and gas will result in long-term changes to our climate and to ocean chemistry, lasting many thousands of years."

Invention: Plastic red blood cells

* 13:50 28 April 2008
* NewScientist.com news service
*** Justin Mullins**

Plastic red blood cells

Red blood cells travel through the bloodstream delivering vital oxygen to body tissues and taking away unwanted carbon dioxide – and they have to squeeze through blood vessels as thin as 3 micrometres across to do it. But in some diseases, such as malaria and sickle cell disease, red blood cells lose this ability to deform.

Because of the small size of red blood cells and the demanding work they do, nobody has succeeded in making artificial versions to help people with such conditions.

Now though Joseph DeSimone, a chemical engineer at the University of North Carolina at Chapel Hill, US, thinks he knows how.

He has created tiny sacks of the polymer polyethylene glycol just 8 micrometres across – in the range of human red blood cells – that are capable of deforming in a way that allows them to pass through the tiniest capillaries.

Polyethylene glycol is biologically benign, but binds easily with other substances, which makes it ideal for carrying cargo through the blood, says DeSimone.

For example, a haemoglobin-type molecule carried inside the bag could deliver oxygen to the body and carry away carbon dioxide. The bags could also deliver drugs instead, or help as contrast agents for scans such as magnetic resonance imaging, PET or ultrasound.

DeSimone has injected the particles into mice with "no adverse side effects", but there is no news yet of more extensive tests.

Read the full plastic red blood cells patent application.

Microwave rock drill

Tunnelling through soft ground is relatively easy. Set a drilling machine to work in hard rock such as granite or basalt, though, and the rate of progress drops dramatically because of slow cutting speed and the increased rate at which drill bits wear out.

One way to speed up drilling would be to heat up the rock ahead, causing it to crack. Engineers have attempted to do this using gas jets, lasers and even electric heaters, but with little success, says Jacques Ouelett, a mining engineer at McGill University in Montreal, Quebec, Canada.

Instead, he suggests fitting a drilling head with a low energy microwave generator to heat rock just ahead of the drill bit. This fractures the rock efficiently making it much easier to cut.

Read the full microwave rock drill patent application.

Genital herpes vaccine

Vaccination has changed little since the time of Louis Pasteur. The method involves deliberately injecting a dead or inactivate organism into a person to stimulate their immune system to produce cells that fight off the fully fledged organism.

However, many infections have resisted all attempts at producing vaccines.

One of these is the herpes simplex virus type 2 (HSV-2), which is usually the cause of genital herpes.

Now Michal Margalith at Vical, a biopharmaceutical company based in San Diego, says he and colleagues have developed an HSV-2 vaccine using the emerging technology of DNA vaccines.

This involves injecting the patient with a circular piece of DNA called a plasmid that programs their cells to produce HSV-2 proteins that trigger an immune response. That should train the vaccinated person's immune system to fight off the real virus.

The team says that the technique has successfully produced an immune response in mice. However, DNA vaccines are still highly experimental in humans.

Read the full genital herpes vaccine patent application.

Glass chip spins silk just like a spider

* 22:00 28 April 2008
* NewScientist.com news service

*** Mason Inman**

It can't rival Spider-Man yet, but a new micromachine that works like a spider's silk duct might finally lead the way to producing industrial quantities of high-quality artificial spider silk.

Spider silk is super-light, super-strong and elastic too. Existing human materials lack its useful combination of properties, and proposed uses span everything from bulletproof vests to optic fibres.

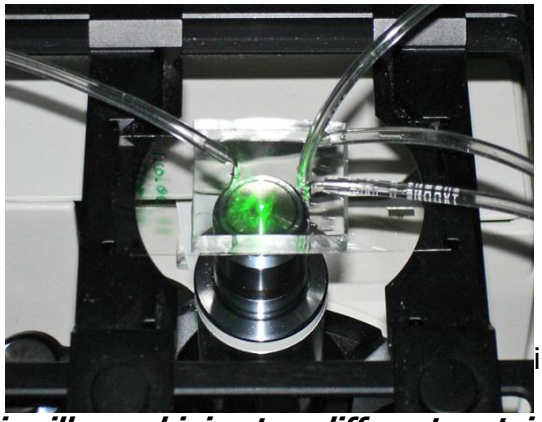
Researchers have struggled for years to find an industrial process to make spider silk, and have tried everything from making it in a lab dish to creating silk-secreting goats.

Now German researchers have demonstrated a new method of production – an artificial version of the ducts spiders use to "spin" the silk.

Mimicking nature

Spiders' silk ducts contain glands that process a gel of simple proteins into long fibres of protein. Different glands alter the chemistry of the gel in different ways, producing silk with different properties.

The artificial duct is a glass chip shot through with tiny tubes that tries to mimic those processes.



This glass chip can recreate the steps used by spiders to spin silk, combining two different proteins into long fibres **(Image: Andreas Bausch)**

"The best thing is to reproduce nature, instead of cutting open spiders," says Andreas Bausch of the Technical University of Munich in Germany, who led the research with Thomas Scheibel of the University of Bayreuth, also Germany.

Bausch and Scheibel are the first to create a device that so accurately recreates the chemical and physical conditions of a real silk duct.

They are also the first to make fibres containing more than one silk protein. The chip uses two – known as ADF3 and ADF4 – found in silk from the European garden spider (Araneus diadematus).

Fine tuning

Inside the chip, the two proteins flow along tiny tubes and are exposed to a phosphate salt solution that makes them aggregate into tiny spheres 1 to 5 micrometres across.

A sudden jump in acidity and phosphate concentration then partially breaks open the spheres, allowing the proteins to latch together into chains. At this point, the flow speed increases and draws out the proteins into long silk fibres.

Creating fibres from two proteins was found to make the silk more chemically stable. The team has not tested the artificial silk's mechanical properties, but its grainy appearance suggests it does not yet rival the quality of the real thing.

Refinements are underway with the goal of making industrial quantities of artificial silk, says Bausch. But the details cannot be revealed because of plans to file patents on the advances.

Kevlar rival

Spider silk has been shown to be able to guide the regrowth of damaged nerves, points out Bausch, and he and Scheibel have previously used spider silk to encapsulate drugs.

Other ideas for the super-strong material include lighter knife- or bullet-proof armour, because spider silk is as strong as fibres like Kevlar, but much lighter.

It will not be surprising if two-protein fibres prove superior to previous man-made silks, considering that the two used in the chip have "been conserved in dragline silk for over 150 million years in all orb and cob weaving spiders," says Randy Lewis, of the University of Wyoming, in Laramie, US.

But until the chip's silk is tested mechanically, "I have to be sceptical about how it will impact manufacturing " he adds.

But Shuguang Zhang at MIT, a microfluidics expert who has worked on spider silk is more optimistic.

"Their findings will for the first time allow industrial development of spinning spider silk with the recombinant spider proteins." *Journal reference: PNAS (DOI: 10.1073/pnas.0709246105)*

Simple brain exercise can boost IQ

* 22:00 28 April 2008
* NewScientist.com news service
*** Alison Motluk**

Can mental training improve your intelligence? No video game or mental puzzle has convincingly been shown to work. But now a group of neuropsychologists claims it has found a task that can add points to a person's IQ – and the harder you train, they say, the more you gain.

So-called "fluid intelligence", or Gf, is the ability to reason, solve new problems and think in the abstract. It correlates with professional and educational success and it appears to be largely genetic.

Past attempts to boost Gf have suggested that, although by training you can achieve great gains on the specific training task itself, those gains don't transfer to other tasks.

Now Susanne Jaeggi at the University of Michigan at Ann Arbor, US, and her colleagues say that is not true.

They invited 70 healthy adults to participate in a challenging training exercise known as the "dual n-back" task.

Daily training

The exercise involves tracking small squares on a screen that pop into a new location every three seconds. Volunteers have to press a button when the current location is a duplicate of two views earlier.

At the same time, consonants are played through headphones and a button is pressed if the letter is the same as that heard two "plays" earlier.

If participants perform well, the interval to be tracked (n) increases to three or more stages earlier.

Jaeggi's volunteers were trained daily for about 20 minutes for either 8, 12, 17 or 19 days (with weekends off). They were given IQ tests both before and after the training.

The researchers found that the IQ of trained individuals increased significantly more than controls – and that the more training people got, the higher the score.

Small study

"It definitely challenges the old opinions," says Jaeggi. She thinks their training regimen succeeded where others failed largely because it remained challenging. Also, because it was tailor-made to the individual, people were never able to go on autopilot.

Not everyone is impressed. Robert Plomin, at the Institute of Psychiatry in London, says that no serious intelligence researchers consider Gf "immutable", as the paper suggests.

"There is no contradiction at all between substantial heritability and improvement of performance," he says. "What is school about?"

Plomin says what is more interesting is how much an individual can profit from training. He complains, however, that the researchers did not really address this in the research, and that the study, with nine subjects in each of four training conditions, is much too small to detect it.

Journal reference: Proceedings of the National Academy of Sciences (DOI: 10.1073/pnas.0801268105)

Aspirin-like compounds increase insulin secretion in otherwise healthy obese people

Aspirin-like compounds (salicylates) can claim another health benefit: increasing the amount of insulin produced by otherwise healthy obese people. Obesity is associated with insulin resistance, the first step toward type 2 diabetes.

Aspirin and other salicylates are known to reduce blood glucose in diabetic patients. New research accepted for publication in the Journal of Clinical Endocrinology & Metabolism reveals a similar beneficial effect among obese individuals by increasing the amount of insulin secreted into the bloodstream.

"The administration of a salicylate led to the lowering of serum glucose concentrations," said Jose-Manuel Fernandez-Real of the Institut d'Investigacio Biomedica de Girona and CIBEROBN Fisiopatologia de la Obesidad, Spain, and lead author of the study. "These findings highlight the importance of further research on the possible therapeutic benefit of aspirin in the fight against type 2 diabetes."

For their study, Fernandez-Real and his colleagues evaluated the effects of triflusal (a derivative of salicylate) on 28 subjects (nine men and 29 women). The average age of the participants was 48 years old and their average Body Mass Index (BMI) was 33.9. A BMI of over 30 is considered obese. During three, four-week treatment periods, the study participants received a 600 mg dose, a 900 mg dose, or a placebo once per day.

The researchers found that administration of triflusal led to decreased fasting serum glucose. Contrary to their expectations, insulin sensitivity did not significantly change during the trial. Insulin secretion, however, significantly increased in relation to the dose size.

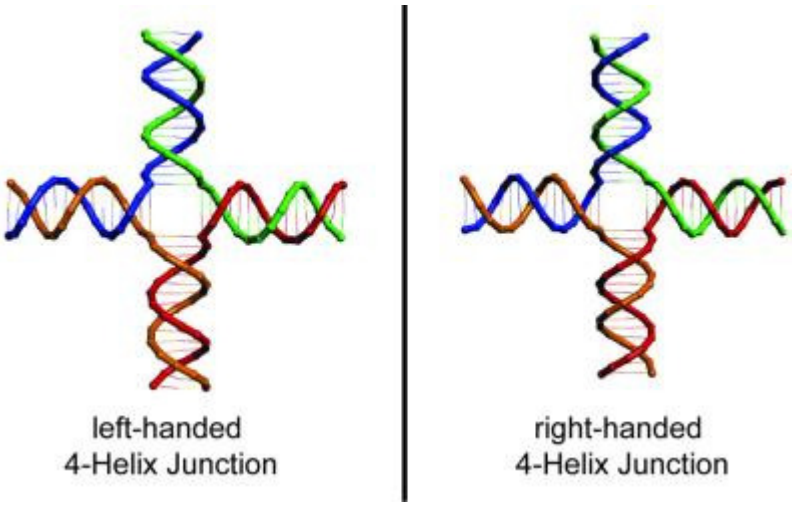
In conjunction with the human studies, the researchers also conducted laboratory studies on insulin-producing cells (known as islets of Langerhans) from mice and humans. The researchers observed that triflusal significantly increased the insulin secreted by these cells.

"Aspirin therapy has been recognized to improve glucose tolerance and to reduce insulin requirements in diabetic subjects," said Fernandez-Real. "To our knowledge, this is the first study to show that salicylates lowered serum glucose in non-diabetic obese subjects. We believe that this effect was due to a previously unsuspected increase in insulin secretion rather than enhanced insulin sensitivity."

Scientists make chemical cousin of DNA for use as new nanotechnology building block

In the rapid and fast-growing world of nanotechnology, researchers are continually on the lookout for new building blocks to push innovation and discovery to scales much smaller than the tiniest speck of dust.

In the Biodesign Institute at Arizona State University, researchers are using DNA to make intricate nano-sized objects. Working at this scale holds great potential for advancing medical and electronic applications. DNA, often thought of as the molecule of life, is an ideal building block for nanotechnology because they self-assemble, snapping together into shapes based on natural chemical rules of attraction. This is a major advantage for Biodesign researchers like Hao Yan who rely on the unique chemical and physical properties of DNA to make their complex nanostructures.



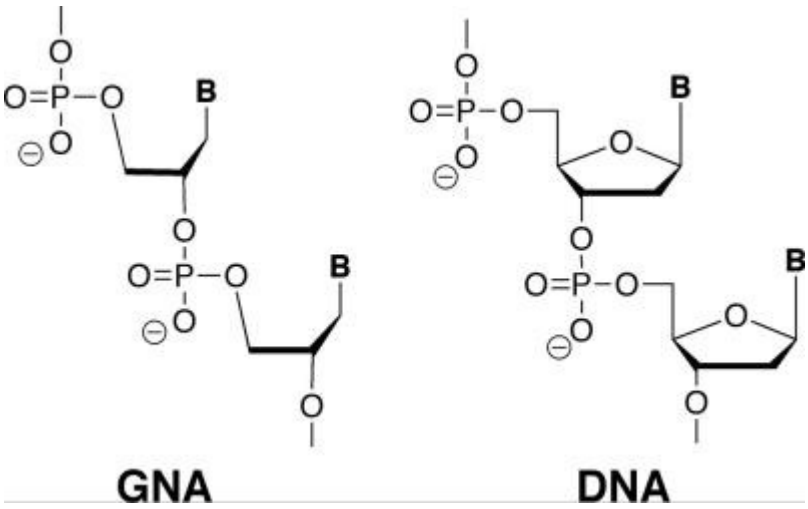
***Biodesign Institute scientist John Chaput and his research team have made the first self-assembled nanostructures composed entirely of glycerol nucleic acid -- a synthetic analog of DNA. The nanostructures contain additional properties not found in natural DNA, including the ability to form mirror image structures. The ability to make mirror image structures opens up new possibilities for nanotechnology*.** **Biodesign Institute at Arizona State University**

While scientists are fully exploring the promise of DNA nanotechnology, Biodesign Institute colleague John Chaput is working to give researchers brand new materials to aid their designs. In an article recently published in the Journal of the American Chemical Society, Chaput and his research team have made the first self-assembled nanostructures composed entirely of glycerol nucleic acid (GNA)—a synthetic analog of DNA.

"Everyone in DNA nanotechnology is essentially limited by what they can buy off the shelf," said Chaput, who is also an ASU assistant professor in the Department of Chemistry and Biochemistry. "We wanted to build synthetic molecules that assembled like DNA, but had additional properties not found in natural DNA."

The DNA helix is made up of just three simple parts: a sugar and a phosphate molecule that form the backbone of the DNA ladder, and one of four nitrogenous bases that make up the rungs. The nitrogenous base pairing rules in the DNA chemical alphabet fold DNA into a variety of useful shapes for nanotechnology, given that "A" can only form a zipper-like chemical bond with "T" and "G" only pair with "C."

In the case of GNA, the sugar is the only difference with DNA. The five carbon sugar commonly found in DNA, called deoxyribose, is substituted by glycerol, which contains just three carbon atoms.



The only chemical difference between DNA and a synthetic cousin, GNA, is in the sugar molecule. GNA uses a three-carbon sugar called glycerol rather than the five-carbon deoxyribose used in DNA. The sugar provides the chemical backbone for nucleic acid polymers, anchoring a phosphate molecule and nitrogenous base (B). **Biodesign Institute at Arizona State University**

Chaput has had a long-standing interest in tinkering with chemical building blocks used to make molecules like proteins and nucleic acids that do not exist in nature. When it came time to synthesize the first self-assembled GNA nanostructures, Chaput had to go back to basics. "The idea behind the research was what to start with a simple DNA nanostructure that we could just mimic."

The first self-assembled DNA nanostructure was made by Ned Seeman's lab at Columbia University in 1998, the very same laboratory where ASU professor Hao Yan received his Ph.D. Chaput's team, which includes graduate students Richard Zhang and Elizabeth McCullum were not only able to duplicate these structures, but, unique to GNA, found they could make mirror image nanostructures.

In nature, many molecules important to life like DNA and proteins have evolved to exist only as right-handed. The GNA structures, unlike DNA, turned out to be 'enantiomeric' molecules, which in chemical terms means both left and right-handed.

"Making GNA is not tricky, it's just three steps, and with three carbon atoms, only one stereo center," said Chaput. "It allows us to make these right and left-handed biomolecules. People have actually made left-handed DNA, but it is a synthetic nightmare. To use it for DNA nanotechnology could never work. It's too high of a cost to make, so one could never get enough material."

The ability to make mirror image structures opens up new possibilities for making nanostructures. The research team also found a number of physical and chemical properties that were unique to GNA, including having a higher tolerance to heat than DNA nanostructures. Now, with a new material in hand, which Chaput dubs 'unnatural nucleic acid nanostructures,' the group hopes to explore the limits on the topology and types of structure they can make.

"We think we can take this as a basic building block and begin to build more elaborate structures in 2-D and see them in atomic force microscopy images," said Chaput. "I think it will be interesting to see where it will all go. Researchers come up with all of these clever designs now."

To read the online publication, go to: http://pubs.acs.org/cgi-bin/abstract.cgi/jacsat/asap/abs/ja800079j.html

Ancient Sunflower Fuels Debate About Agriculture in the Americas

Researchers at the University of Cincinnati and Florida State University have confirmed evidence of domesticated sunflower in Mexico — 4,000 years before what had been previously believed.

Date: 4/29/2008 **By: Wendy Beckman** Phone: (513) 556-1826

Photos By: David Lentz

"People sometimes ask "What is the big deal about sunflower?" says David Lentz, professor of biological sciences and executive director of the Center for Field Studies in the McMicken College of Arts & Sciences at the University of Cincinnati (UC). Lentz worked with Mary Pohl from Florida State University, José Luis Alvarado from Mexico's Institute of Anthropology and History, and Robert Bye from the Independent National University of Mexico.

Wild sunflowers in Nuevo Leon in the foothills of the Sierra Madre Oriental mountains.

"First of all, sunflower is one of the world's major oil seed crops and understanding its ancestry is important for modern crop-breeding purposes," Lentz says. "For a long time, we thought that sunflower was domesticated only in eastern North America, in the middle Mississippi valley — Arkansas, Missouri, Tennessee, Illinois. This is what traditional textbooks say. Now it appears that sunflower was domesticated independently in Mexico."

"The Mexican sunflower discovery suggests that there may have been some cultural exchange between eastern North America and Mesoamerica at a very early time," Lentz adds. "Now the textbooks need to be rewritten."

More than just a matter of pride over which part of America can claim a flower, the debate centers on when sunflower was domesticated and which civilization first cultivated it. Now there is solid evidence that two similar events took place thousands of years and hundreds of miles apart.

Lentz and his fellow researchers have documented archaeological, linguistic, ethnographic and ethnohistoric data demonstrating that the sunflower had entered the repertoire of Mexican domesticates by 2600 B.C., that its cultivation was widespread in Mexico and extended as far south as El Salvador by the first millennium B.C., that it was well known to the Aztecs, and that it is still in use by traditional Mesoamerican cultures today. (People of the Americas made huge contributions to today's society in terms of agriculture, including the development of a number of valuable crops such as corn, peppers, beans, cotton, squash, chocolate, tomatoes and avocadoes, as well as sunflower.)

But it is unknown if the Mexican domestication and North American domestication are related. So is it coincidence? Did one cause the other? Or did they both happen because of some other common outside factor?

"Whatever conclusions we draw, the evidence clearly shows that sunflower as a Mexican crop goes back far into antiquity," says Lentz.

In addition to the biogeographic study of sunflower, the researchers conducted archaeological, linguistic, ethnographic and ethnohistorical research, collecting data from many fields of study.

Archaeological evidence of sunflower in Mexico has been rare, probably for a number of reasons. First, the way it was used may not have been conducive to deposition in archaeological sites. Second, climatic conditions, especially in the Neotropics, have bad properties of preservation for plant parts so most things just rot away. Finally, archaeological research strategies in many areas of Mesoamerica focus more on monumental architecture and less on agricultural developments. That is, you are unlikely to find something if you are not looking for it.

Nevertheless, sunflower achenes (this is what most of us call the seed, but it is actually the fruit of the sunflower, containing the seed) were found in Mexico in situations where the preservation was especially good. Cueva del Gallo was a dry cave and the sunflower achenes there were in pristine condition. San Andrés was a waterlogged site and the sunflower remains from that site were also well preserved. Using accelerator mass spectrometry, the sunflowers at San Andrés were found to be older than 2600 B.C.

The researchers also asked indigenous people in Mexico what terms they used for the sunflower.

From The Florentine Codex: Aztec ceremony where guest is presented with a tobacco tube (representing a spear) and a sunflower (representing a shield).

"They described how they used sunflower and told us the name in their native language," says Lentz. "The names they used for sunflower were all unique, not related to Spanish. That tells us the use of sunflower is older than the Spanish expeditions of the 15th and 16th centuries."

The Otomi, one of the Mexican indigenous groups interviewed, use the name "dä nukhä," which translates to "big flower that looks at the sun god," a reference to pre-Columbian solar worship. The sunflower is commonly still used as an ornament in their churches.

"When asked about sunflowers, people of the Nahua culture in Mexico, descendants of the Aztecs gave us a clue to help interpret early historic texts," describes Lentz. "The modern Nahua use two words for sunflower: 'chimalxochitl,' which means 'shield flower,' or 'chimalacatl,' which means 'shield reed,' which is also a reference to its hollow stem and large, disk-like head (that resembles an Aztec shield). These terms led us to sunflower references to listed in early chronicles of 16th century Aztec society, including 'The Florentine Codex,' written by Fray Bernardino de Sahagun. In the Florentine Codex, the sunflower is described as part of an offering to the Sun God, 'Huitzilopochtli.'"

The researchers point out, the sunflower's association with solar worship and warfare in Mexico may have led to its suppression after the Spanish Conquest.

"Sunflower was believed to be a powerful aphrodisiac, which could have also contributed to its being banned by the Spanish priests," Lentz says with a smile. "Of course, it is not but this belief was probably part of the case against sunflowers."

"Mesoamerica had a thriving culture, a grand civilization," Lentz notes. "They had irrigation systems, monumental construction, agriculture and a complex society.

The group's research is published in the Proceedings of the National Academy of Science (PNAS) as "Sunflower (Helianthus annuus L.) as a Pre-Columbian Domesticate in Mexico" with UC's David Lentz as lead author and co-authors Mary Pohl from Florida State, José Luis Alvarado from Mexico's Institute of Anthropology and History and Robert Bye from the Independent National University of Mexico. (Lentz's student, Somayeh Tarighat, is also a co-author on the paper.)

"The discovery of ancient sunflower in Mexico refines our knowledge of domesticated Mesoamerican plants and adds complexity to our understanding of cultural evolution," the authors state in the paper.

Lentz's research on the biogeography of sunflower is also being published at the same time as the cover story for the International Journal of Plant Sciences, "Ecological Niche Modeling and Distribution of Wild Sunflower (Helianthus annuus L.) in Mexico," with co-authors Robert Bye and Victor Sánchez-Cordero from the Independent National University of Mexico (UNAM).

Wild sunflower in Mexico, possible ancestral population to domesticated version

"Beyond the recognition of the great cultures due these early peoples, there are very real lessons that we can learn from them. As we deal with our modern-day issues of global warming and as we evaluate and

examine what crops will survive and thrive in warmer climates, the ancient Aztecs might have some valuable lessons to teach us — and the descendants of the Aztecs may have valuable sunflower seed stocks to help improve our modern agricultural capability."

This research was funded by grants from the National Science Foundation and the National Geographic Society.

Immune system kick-started in moist nasal lining in sinusitis, asthma and colds

Study explains why steroid therapy loses its punch over time

Scientists at Johns Hopkins have outlined a new path for potential therapies to combat inflammation associated with sinusitis and asthma based on a new understanding of the body's earliest immune response in the nose and sinus cavities.

Researchers say their findings, to be published in the May edition of the Journal of Allergy and Clinical Immunology, are the first evidence describing how viral agents, such as the rhinovirus responsible for the common cold, can kick start the body's mobilization of immune white blood cells in the moist, mucous membrane lining of the nasal passages.

While such responses are key to maintain health in the face of pathogens, they can also become a source of illness due to resulting inflammation. This can lead to potentially life-long problems, including tissue swelling, nasal polyp formation, sneezing, stuffy and runny nose, sore throat, cough, headache, chills, fever and difficulty breathing.

Thus, blocking these reactions, the researchers point out, could interrupt the cascade of feel-awful symptoms that ensue.

The focus of the study is B7-related proteins, called B7 homologs, which trip white blood cell response in a pathogen attack.

Using purified cold virus and its genetic material as bait, the scientists found that production of two B7 homologs spiked in response: Levels of B7-H1 jumped almost ninefold and levels of B7-DC tripled.

Until now, says senior study investigator Jean Kim, M.D., Ph.D., viruses were known to reside in and infect the physical epithelium, invading surface membrane cells and revving up the immune system's main blood cell defenses, "but no one knew the major steps involved in or precisely how this immune response was triggered."

"The inside surface of our nose and sinuses is much more than a protective cover, and we have good scientific evidence to show that epithelial cells on these mucosal membranes are very powerful mediators - middlemen - in diseases that result in inflammation," adds Kim. An assistant professor at the Johns Hopkins University School of Medicine and an expert in the molecular origins of inflammation, Kim is also an authority on nasal and sinus infections.

Moreover, Kim notes, study results demonstrate how the body's immune system is interconnected, where one key part, the physical lining that filters out and captures invading viruses and environmental allergens, can trigger the other key part, which leads to targeted white blood cell action.

"Now that we have a better understanding of the immune pathway, we can start to develop therapies that could potentially block the triggering reactions for sinusitis and asthma, which are both made worse when people are infected with the common cold virus," she says.

Sinusitis is the most common respiratory complaint in the United States. The condition is often linked with asthma, which affects more than 30 million, including 9 million children. Each year, 62 million Americans catch a cold.

The study also explains a common failure in current therapy.

According to Kim, nasal and oral steroids are frequently prescribed for many of the 15 percent of the American adult population who suffer from sinusitis, nasal polyps or asthma. Steroids complement drugs taken for symptomatic relief, such as decongestants and pain relievers.

But corticosteroid drugs, she says, do not work for everyone and their effectiveness often wanes over time.

This may be related to the B7 homolog triggers in the mucous membranes, Kim says, as study results showed that corticosteroid therapy does not fully shut down or prevent their overproduction.

In the study's first set of experiments, researchers found that levels of two of five key proteins tested, B7-H1 and B7-DC, rose sharply after samples of nasal cell concentrate were exposed to genetic material from cold viruses. Spiked production was detected using antibodies chemically tagged to glow when bonded to a specific B7 homolog.

However, when researchers pretreated the cell scrapings with a well-known anti-inflammatory corticosteroid, called flucticasone propionate, the drug failed to stop overproduction of either B7-H1 or B7-DC.

In the final set of study experiments, six adult volunteers were infected with the cold virus and monitored for variations in their immune response during infection, which typically lasts a week to 10 days.

Analysis of daily scrapings of surface cells lining the nose showed that production of B7-H1 and B7-DC peaked on the second and third days, when cold symptoms were also at their worst. These protein levels, as a

measure of severity of the immune response, dropped quickly afterwards, and at the same time as scores of symptom severity went down. It was this evidence that verified the triggering connection between the cold virus and the immune white cell response inside the nose and sinuses, says Kim.

Kim says that researchers' next steps are to analyze the biological control mechanisms for producing the B7 homologs in the nasal lining, and to map out any chemical interactions that result, to look for ways of breaking the cycle of inflammation involved in sinusitis, asthma and colds.

The study, which ran from 2003 to 2007, was funded by the National Institutes of Health and the Flight Attendant Medical Research Institute. Sinusitis afflicts thousands of fight attendants who were exposed to secondhand smoke before the habit was banned on airlines in the late 1980s.

Besides Kim, other Hopkins investigators involved in this research were Lowella Heinecke, B.A.; and Scherer Sanders, Ph.D. Further assistance was provided by David Proud, Ph.D., at the University of Calgary, in Canada; and Robert Schleimer, Ph.D., at Northwestern University's Feinberg School of Medicine, in Chicago, Ill.

Absinthe uncorked: The 'Green Fairy' was boozy -- but not psychedelic

A new study may end the century-old controversy over what ingredient in absinthe caused the exotic green aperitif's supposed mind-altering effects and toxic side-effects when consumed to excess. In the most comprehensive analysis of old bottles of original absinthe — once quaffed by the likes of van Gogh, Degas, Toulouse-Lautrec and Picasso to enhance their creativity — a team of scientists from Europe and the United States have concluded the culprit was plain and simple:

Albert Maignan's painting of "Green Muse " (1895) shows a poet succumbing to absinthe's mind-altering effects.

A high alcohol content, rather than thujone, the compound widely believed responsible for absinthe's effects. Although consumed diluted with water, absinthe contained about 70 percent alcohol, giving it a 140-proof wallop. Most gin, vodka, and whiskey are 80 – 100-proof and contain 40-50 percent alcohol or ethanol.

The study is scheduled for the May 14, 2008 issue of the American Chemical Society's bi-weekly Journal of Agricultural and Food Chemistry, where the full text of the article can be downloaded now without charge.

Absinthe took on legendary status in late 19th-Century Paris among bohemian artists and writers. They believed it expanded consciousness with psychedelic effects and called it "the Green Fairy" and "the Green Muse." The drink's popularity spread through Europe and to the United States. However, illness and violent episodes among drinkers gave absinthe the reputation as a dangerous drug, and it was banned in Europe and elsewhere.

In the new study, Dirk W. Lachenmeier and colleagues point out that scientists know very little about the composition of the original absinthe produced in France before that country banned the drink in 1915. Only a single study had analyzed one sample of preban absinthe. The researchers analyzed 13 samples of preban absinthe from sealed bottles — "the first time that such a wide ranging analysis of absinthe from the preban era has been attempted," they say.

The analysis included thujone, widely regarded as the "active" ingredient in absinthe. "It is certainly at the root of absinthe's reputation as being more drug than drink," according to Lachenmeier. Thujone was blamed for "absinthe madness" and "absinthism," a collection of symptoms including hallucinations, facial contractions, numbness, and dementia.

However, the study found relatively small concentrations of thujone, amounts less than previously estimated and not sufficient to explain absinthism. Thujone levels in preban absinthe actually were about the same as those in modern absinthe, produced since 1988, when the European Union (EU) lifted its ban on absinthe production. Laboratory tests found no other compound that could explain absinthe's effects. "All things considered, nothing besides ethanol was found in the absinthes that was able to explain the syndrome of absinthism," according to Lachenmeier.

He says that scientific data cannot explain preban absinthe's reputation as a psychedelic substance. Recent historical research on absinthism concluded that the condition probably was alcoholism, Lachenmeier indicates.

"Today it seems a substantial minority of consumers want these myths to be true, even if there is no empirical evidence that they are," says Lachenmeier. "It is hoped that this paper will go some way to refute at least the first of these myths, conclusively demonstrating that the thujone content of a representative selection of preban absinthe... fell within the modern EU limit."

The American Chemical Society — the world's largest scientific society — is a nonprofit organization chartered by the U.S. Congress and a global leader in providing access to chemistry-related research through its multiple databases, peer-reviewed journals and scientific conferences. Its main offices are in Washington, D.C., and Columbus, Ohio.

**The research in this press release is from a copyrighted publication, and stories must credit the journal by name or the American Chemical Society.*

News media may obtain a full text of this report ("Chemical Composition of vintage Preban Absinthe with Special Reference to Thujone, Fenchone, Pinocamphone, Methanol, Copper, and Antimony Concentrations") in ACS' Journal of Agricultural and Food Chemistry by contacting Michael Bernstein.

TAU Researchers Examine "Great Expectations" in the Workplace

A study finds that managers who expect more from their employees get more from them, too

Researchers at Tel Aviv University have found that employee performance in the workplace, like students' grades at school, is greatly influenced by managers' expectations of that performance.

An analysis of results from twenty-five years' worth of experimental research conducted at banks, schools, the Israel Defense Forces -- and even summer camp -- shows unequivocal results: when a leader expects subordinates to perform well, they do.

"A self-fulfilling prophecy goes into effect," says Prof. Dov Eden from Tel Aviv University's Faculty of Management, who conducts and directs the experiments. "Managers and leaders would be well-advised to expect a lot, and let people know they expect a lot. The message should be genuine and consistent."

Expectations Feed Performance

In one of Prof. Eden's experiments, he divided bank branch managers into two groups. One group of managers was told that their employees were exceptional; the other group was told nothing about their employees' performance potential.

When Prof. Eden analyzed performance results, he found a significant difference between the branches. There had been no pre-existing differences between employees, but the branch managers who were led to expect more, got more -- their branches scored higher in terms of profitability and overall economic success.

This effect has been found in dozens of organizations: high expectations have a positive effect in business and in many other social arenas, Prof. Eden says.

A "Pygmalion" Effect

His findings confirm beyond any reasonable doubt that the "Pygmalion Effect" can be created among leaders and subordinates. Subordinates get a 3-to-1 boost in their performance success rate if a leader expects more from them, says Prof. Eden. "Success" is determined by any number of relevant factors, such as completing a course, a performance rating on the job, or grades in a training program.

But "if a leader has high expectations, it doesn't mean that a subordinate will perform three times as well," Prof. Eden says. "It means that he or she will have a three times greater chance of being above-average."

A Boost of Confidence

Study results indicate that when a manager expects a lot from an employee, the manager's leadership style changes and subsequently boosts the employee's self-confidence. "If your boss believes you can excel, you are more likely to believe in your own capacity to succeed," says Prof. Eden.

The result holds true for any supervisory position, adds Prof. Eden, who has studied this phenomenon at banks, in schools among principals and teachers, at summer camps among counsellors and campers, in university-based tutorial programs and in the military among commanders and their subordinates.

The Pygmalion research expands on studies of the "experimenter effect" in the 1960s, the notion that an investigator can unintentionally influence the outcome of an experiment in significant ways.

The recipe for success, says Prof. Eden, is to "expect a lot from people. You'll get more. Have high expectations and reinforce them with positive messages to the employee, even if it requires being a good actor."

Common Ground for Barack Obama, Bill Clinton Suggested by Rutgers-Camden Sociologist

CAMDEN -- The Democratic primary contest may have placed them on opposing sides, but presidential hopeful Sen. Barack Obama and former President Bill Clinton have more in common than their voter party registration cards.

According to Ted Goertzel, a professor of sociology at Rutgers University-Camden, both men may owe their current success to their past upbringing by single mothers during many of their critical childhood years. Moreover, the two frequently sided with their mothers during conflicts with fathers or step-fathers.

In a recent essay comparing Clinton, Obama, and Brazilian President Luiz Inacio Lula de Silva, Goertzel found that "all are leaders with exceptional ability to share feelings and communicate empathy to large publics. All three charted their own course in life instead of following a family history or tradition. And all were raised by single mothers who did not have time to smother their children or dominate their lives."

The author of the book "Cradles of Eminence: Childhoods of More Than 700 Famous Men and Women (Second Edition)" (Great Potential Press), Goertzel studies the impact of parental influence on the evolution of prominent figures. In studying Obama, Clinton, and da Silva, the Rutgers—Camden researcher found that each leader lost their father at a very early age.

"Obama's father left him and his mother to pursue a doctorate in economics at Harvard, and then returned to his native Kenya without either of them. Bill Clinton's biological father was killed in an automobile accident before Bill was born; his mother later remarried, but his stepfather had a drinking problem and abused his mother. Lula da Silva's father ran off to Sao Paulo to start another large family before da Silva was born into a family of eight children," says Goertzel.

While the mothers were busy raising their children, they also strongly encouraged their sons to get a good education.

"All three leaders felt anger or resentment with their father and stepfathers, and all three had close and warm relationships with their mothers," continues the Rutgers-Camden educator. "But none of them became overly dependent on their mothers or remained in their mothers' homes after reaching adulthood.

"None of these leaders modeled their lives or their careers on their fathers. Modeling themselves on their mothers may have helped these leaders develop skills in human relations and practical problem solving," concludes Goertzel. "Not having to compete with their fathers for their mothers' attention may have helped them build self-confidence. Not having to compete with their fathers, or being expected to realize their fathers' ambitions, may have helped them to move quickly through adolescence into a career path that suited their own talents and ambitions."

Goertzel regularly teaches such courses as "Introduction to Latin American Studies," "Methods of Research," and "Communications" to undergraduate students at Rutgers-Camden. He is the author of numerous books, including "Turncoats and True Believers: The Dynamics of Political Belief and Disillusionment" (Prometheus Press).

He is a resident of Medford Lakes.

Dog's bark means more than its bite

* 15:08 29 April 2008

* NewScientist.com news service

*** Ewen Callaway**

Timmy is not the only one who can translate Lassie's bark – dogs themselves also seem to discriminate between the yaps of other pooches.

That's the conclusion of a team of Hungarian researchers who have measured the heart-rate fluctuations of pet dogs while playing them recordings of dogs barking at strangers and dogs barking to get attention.

"If we find that dogs can discriminate between barks, it might be that they also understand," says Péter Pongrácz, an ethologist at Eötvös Loránd University in Budapest, who led the study.

It's no secret that animals talk to one another. Prairie dogs, for instance, use an elaborate communication system that can distinguish between coyotes and humans. But researchers know far less about barking, a call unique to dogs, says Pongrácz.

Dogs' heart rates reveal that they can tell a "stranger" alert bark from an "I'm lonely" bark

Watch the full-size video

Racing hearts

In 2005, Pongrácz's team showed that humans can tell between a dog barking at a stranger (hear audio) and one when they are alone (hear audio). They even created a computer program to decipher barks.

To see if dogs could make the same distinction, Pongrácz played the two types of barks to 14 dogs hooked up to heart monitors. The hounds included German shepherds, golden retrievers, and several other breeds. All heard the barks of a Hungarian herding dog called a Mudi.

With a pup sitting in a room with its owner, Pongrácz's team played several dog barks, each a minute apart.

When the dogs first heard the "stranger" bark their hearts raced. As the researchers played the same sound over and over, a dog's heart rate tended to rise slightly then quickly return to normal.

Each successive "stranger" bark provoked less and less of a reaction, on average. However, when the dogs were played the "alone" bark, their hearts started racing again.

Alert call

Pongrácz interprets the heart-rate changes as evidence that the dogs understand the difference between the two kinds of barks. He also noticed that the animals tended to turn their heads toward the speaker only when they heard a new kind of bark.

Hearing certain barks might put a dog on alert, Pongrácz says. "We thought the 'stranger' bark has some kind of relevance for other dogs, because it's quite interesting to them that somebody came," he says.

Clive Wynne, a behavioural psychologist at the University of Florida in Gainesville, US, says that the heart-range changes suggest that dogs notice a difference in barks, but he would like to see more behavioural data to make the case even stronger.

Still, Pongrácz's conclusion seems likely: "If we can hear a difference, it seems to me, surely other dogs can pick it up," he says.

Journal reference: Applied Animal Behaviour Science (DOI: 10.1016/japplanim.2008.01.022)

Are you looking at me?

Birds can tell if you are watching them -- because they are watching you

In humans, the eyes are said to be the 'window to the soul', conveying much about a person's emotions and intentions. New research demonstrates for the first time that birds also respond to a human's gaze.

Predators tend to look at their prey when they attack, so direct eye-gaze can predict imminent danger. Julia Carter, a PhD student at the University of Bristol, and her colleagues, set up experiments that showed starlings will keep away from their food dish if a human is looking at it. However, if the person is just as close, but their eyes are turned away, the birds resumed feeding earlier and consumed more food overall.

Carter said "This is a great example of how animals can pick up on very subtle signals and use them to their own advantage". Her results are published online today (30 April) in Proceedings of the Royal Society B.

Wild starlings are highly social and will quickly join others at a productive foraging patch. This leads to foraging situations that are highly competitive. An individual starling that assesses a relatively low predation risk, and responds by returning more quickly to a foraging patch (as in the study), will gain valuable feeding time before others join the patch.

Responses to obvious indicators of risk – a predator looming overhead or the fleeing of other animals – are well documented, but Carter argued that a predator's head orientation and eye-gaze direction are more subtle indicators of risk, and useful since many predators orient their head and eyes towards their prey as they attack.

This research describes the first explicit demonstration of a bird responding to a live predator's eye-gaze direction. Carter added: "By responding to these subtle eye-gaze cues, starlings would gain a competitive advantage over individuals that are not so observant. This work highlights the importance of considering even very subtle signals that might be used in an animal's decision-making process."

Do these birds understand that a human is looking at them, and that they might pose some risk? As yet, this question has not been answered. But whether or not the responses involve some sort of theory of mind, and whether or not they are innate or acquired, the result is that starlings are able to discriminate the very subtle eye-gaze cues of a nearby live predator and adjust their anti-predator responses in a beneficial manner.

An Unlikely Way to Save a Species: Serve It for Dinner

By KIM SEVERSON

SOME people would just as soon ignore the culinary potential of the Carolina flying squirrel or the Waldoboro green neck rutabaga. To them, the creamy Hutterite soup bean is too obscure and the Tennessee fainting goat, which keels over when startled, sounds more like a sideshow act than the centerpiece of a barbecue.

But not Gary Paul Nabhan. He has spent most of the past four years compiling a list of endangered plants and animals that were once fairly commonplace in American kitchens but are now threatened, endangered or essentially extinct in the marketplace. He has set out to save them, which often involves urging people to eat them.

Mr. Nabhan's list, 1,080 items and growing, forms the basis of his new book, an engaging journey through the nooks and crannies of American culinary history titled "Renewing America's Food Traditions: Saving and Savoring the Continent's Most Endangered Foods" (Chelsea Green Publishing, $35).

The book tells the stories of 93 ingredients both obscure (Ny'pa, a type of salt grass) and beloved (the Black Sphinx date), along with recipes that range from the accessible (Centennial pecan pie) to the challenging (whole pit-roasted Plains pronghorn antelope).

Saving rare breeds and varieties saves cultural traditions, too. Among American plants and animals being catalogued are the Tennessee fainting goat. **Jeannette Beranger/American Livestock Breeds Conservancy**

To make the list, an animal or plant — whether American eels, pre-Civil War peanuts or Seneca hominy flint corn — has to be more than simply edible. It must meet a set of criteria that define it as a part of American

culture, too. Mr. Nabhan's book is part of a larger effort to bring foods back from the brink by engaging nursery owners, farmers, breeders and chefs to grow and use them.

"This is not just about the genetics of the seeds and breeds," said Mr. Nabhan, an ethnobotanist and an expert on Native American foods who raises Navajo churro sheep and heritage crops in Arizona. "If we save a vegetable but we don't save the recipes and the farmers don't benefit because no one eats it, then we haven't done our work."

He organized his list into 13 culinary regions that he calls nations, borrowing from Native American and other groups. The Pacific Coast from California to northern Mexico is acorn nation. Its counterpart on the mid-Atlantic coast is crab cake nation. Moose nation covers most of Canada. New Yorkers, for the record, live in clambake nation.

His work is based on extensive trips around the country, where he listened to old-timers and cataloged hundreds of hard-to-find plants and animals, like the finicky Datil chili pepper (originally from Cuba), the Bronx grape and the long-stemmed Harrison cider apple from New Jersey.

"The daunting thing is that so much about American traditional foods comes out of people's heads and isn't in any book," he said. He had little trouble getting people to share their knowledge. "This to them is like a baseball fan talking about the Yankees. They just know all the details."

Mr. Nabhan engaged seven culinary, environmental and conservation groups to help him identify items for the list and return them to culinary rotation.

He acted like a broker for the groups, some of which had been trying to save traditional food for decades. Organizations including the Seed Savers Exchange and the American Livestock Breeds Conservancy contributed suggestions for the list. Then, leveraging the rising interest in regional food, he engaged hundreds of chefs, farmers and curious eaters to grow and cook some of the lost breeds and varieties.

Disappearing Foods: Encouraging a Comeback

Leading the way are members of the gastronomic group Slow Food U.S.A., which assesses whether foods on Mr. Nabhan's list are delicious and meaningful enough in the communities where they originated to be worth reviving and promoting. Foods that do become part of what the group calls its Ark of Taste.

The Chefs Collaborative, a group of more than 1,000 professional cooks and others dedicated to sustainable cuisine, willingly signed on, too. Several members incorporated traditional ingredients into modern restaurant dishes, holding a series of picnics last year to show off their work.

And everyone in Mr. Nabhan's alliance tried to encourage farmers and ranchers to grow the seeds and the breeds, promising to deliver buyers if they did.

That is the most complicated part of reviving traditional food, said Makalé Faber Cullen, a cultural anthropologist with Slow Food U.S.A. who contributed to the book. Farmers are often more concerned with innovating and crossbreeding than in preserving cultural traditions or encouraging biological diversity.

"That's where the tension lies in this project," she said. "A lot of times products fall into disuse because farmers themselves decide they are not worthy of the marketplace. A farmer will say, I don't want to grow out that tomato anymore. I want something with thicker skin."

Some of the items on the list, like Ojai pixie tangerines and Sonoma County Gravenstein apples, were well on their way back before Mr. Nabhan came along. But other foods are enjoying a renaissance largely as a result of the coalition's work.

The Makah ozette potato, a nutty fingerling with such a rich, creamy texture that it needs only a whisper of oil, is one of the success stories. It is named after the Makah Indians, who live at the northwest tip of Washington state and have been growing the potatoes for more than 200 years.

The Seattle chapters of Slow Food and the Chefs Collaborative adopted the rare potato. In 2006, Slow Food passed out seed potatoes to a handful of local farmers and gardeners, and chefs like Seth Caswell at the Stumbling Goat Bistro in Seattle began putting them on the menu.

Mr. Caswell says they are delicious roasted with a little hazelnut oil for salads or cut into wedges to go with burgers made with wagyu beef and Washington State black truffle oil.

There have been other revivals, the moon and stars watermelon and the tepary bean among them. The effort to reintroduce heritage turkeys to the American table was a precursor to the work of Mr. Nabhan and his collaborators.

The meaty Buckeye chicken, with its long legs suitable for ranging around, is considered one of five most endangered chicken breeds. Last year over 1,000 chicks were hatched and delivered to breeders, Mr. Nabhan said.

Justin Pitts, whose family has raised Pineywoods cattle in southern Mississippi for generations, credits the coalition with saving those animals. The small, lean cattle that provide milk, meat and labor spent centuries

adapting to the pine barrens of the deep south, raised by families who can trace their herds back as far as anyone can remember. There are less than a dozen of those families left, and at one point the number of pure Pineywoods breeding animals fell to under 200. In the past few years, it has grown to nearly 1,000.

Mr. Pitts, who has "90 head if I can find them all," sells New York strips and other cuts at the New Orleans farmers' market and to chefs.

"I can't raise cattle fast as they eat them," he said.

He supports the notion that you've got to eat something to save it.

"If you're keeping them for a museum piece," he said, "you've just signed their death warrant."

But Mr. Nabhan doesn't want people to eat everything on his list. The idea of eater-based conservation, which holds that to save something, one has to eat it, works well for agricultural products and some wild foods like clams that benefit from regular harvesting. For some wild species, however, like the foot-long, pink-fleshed Carolina flying squirrel, a harvest would create too much pressure on a tiny population.

The squirrels used to make regular appearances in Appalachian game-meat stews. But as their forests declined, so did the squirrel population; they are now on state and federal endangered species lists. Even if catching them were legal, Mr. Nabhan says a trapper would be hard-pressed to bag more than half a dozen a season.

Because the squirrel was once so important to the diets of North Carolina and east Tennessee, Mr. Nabhan included it on his list, along with a recipe for the thick vegetable stew called Kentucky burgoo.

It calls for corn, lima beans, spring water and two pounds of cubed and fried squirrel meat. Just don't use flying squirrel. At least not yet.

Some Athletes' Genes Help Outwit Doping Test

By GINA KOLATA

Correction Appended

The 55 men in a drug doping study in Sweden were normal and healthy. And all agreed, for the sake of science, to be injected with testosterone and then undergo the standard urine test to screen for doping with the hormone.

The results were unambiguous: the test worked for most of the men, showing that they had taken the drug. But 17 of the men tested negative. Their urine seemed fine, with no excess testosterone even though the men clearly had taken the drug.

It was, researchers say, a striking demonstration of a genetic discovery. Those 17 men can build muscles with testosterone, they respond normally to the hormone, but they are missing both copies of a gene used to convert the testosterone into a form that dissolves in urine. The result is that they may be able to take testosterone with impunity.

The gene deletion is especially common in Asian men, notes Jenny Jakobsson Schulze, a molecular geneticist at the Karolinska University Hospital in Stockholm. Dr. Schulze is the first author of the testosterone study, published recently in The Journal of Clinical Endocrinology and Metabolism.

Dr. Schulze learned from an earlier study that about two-thirds of Asian men are missing both copies of the gene, as are nearly 10 percent of Caucasians. The prevalence in other groups is not known.

Doping researchers said the study raised questions about what to do next.

"It's disturbing," said Dr. Don Catlin, the chief executive of Anti-Doping Research, a nonprofit group in Los Angeles. "Basically, you have a license to cheat."

Should athletes give DNA samples for scientists to analyze as genes like the testosterone-metabolizing one are found to be important? Or would another approach, the so-called athlete's passport, be sufficient? The passport, favored by the World Anti-Doping Agency, is a record of all of an athlete's screening tests and would detect results that vary from the athlete's baseline values — but it would not include gene testing and therefore may not detect those athletes lacking this gene.

But nothing will happen soon, and certainly not in time for the Beijing Olympics in August.

Testosterone and substances that act like it are the most frequently detected drugs in screening tests of athletes. The antidoping agency reported that these drugs have been implicated in 43 percent of its positive doping tests.

Researchers have long known that some men, Asians in particular, seemed to be able to take the drugs without getting caught, although no one had identified the cause of the phenomenon. Without gene testing, there is no way to know whether any athletes have exploited this doping loophole, but Dr. Catlin says he suspects some athletes discovered their invulnerability by accident and took advantage of it.

Men with the gene deletion still metabolize testosterone, Dr. Schulze says. But, she adds, she does not know where the hormone goes. "We have no idea," she said. "That's what we're trying to find out."

The gene in question adds a chemical, glucuronide, to testosterone. That converts it from a substance that dissolves in oil into one that dissolves in water and urine.

The testosterone screening test looks for testosterone and another substance, epitestosterone, that is produced in parallel to testosterone but does not have testosterone's effects. The antidoping agency considers a testosterone to epitestosterone, or T to E, ratio of four or greater a positive test and follows it with a more expensive and definitive test that asks whether the excess testosterone is of human origin or whether it is from plants. The testosterone used in doping usually comes from plants.

When they conceived of their study, Dr. Anders Rane and Dr. Mats Garle, head of the Doping Control Laboratory at the Karolinska University Hospital, applied for and received a grant from the antidoping agency. Then, to test their hypothesis, the Karolinska scientists injected the men with 500 milligrams of testosterone and looked at T to E ratios over the next 15 days as the testosterone was metabolized.

The men with two normal copies of the gene had T to E ratios that soared to 100; those with one copy of the gene had ratios that reached 50; those with no copies had almost no rise in their ratios and 40 percent of them had a ratio that never reached 4.

Dr. Schulze and her colleagues suggest that athletes be tested to see if they have the testosterone-metabolizing gene. Others said the testing of athletes for this and other genes may be coming soon.

"The specter of doing this is out there," says Dr. Alvin Matsumoto, a testosterone expert at the University of Washington in Seattle and the Veterans Affairs Puget Sound Health Care System.

The World Anti-Doping Agency is studying instead the athlete's passport. It hopes to keep track of each athlete's drug tests to see if any results suddenly change compared to before.

"You are in a situation where you monitor the athlete and you can see right away if there are modifications" in test results, said Olivier Rabin, the science director of the agency.

Dr. Rabin is less enthusiastic about genetic testing because, he said, it raises ethical questions.

But in either case, it is not clear what to do if an athlete has a genetic feature that makes doping tests turn out negative when the athlete is using drugs. The testosterone follow-up test is technically complex and expensive, raising questions about whether it is feasible to use it for as many as two-thirds of Asians and 10 percent of Caucasians.

"The analytical facilities and costs required preclude any routine use of this methodology for screening in antidoping testing," Dr. Schulze and her colleagues wrote.

And the newly discovered gene deletion may be just one reason the T to E ratio test may fail in some men.

There may be more than a dozen testosterone-metabolizing enzymes, said Dr. Shalender Bhasin, a testosterone researcher at Boston University School of Medicine, and it may be necessary to examine all of them to see if gene variations affect test results. He added that there may be differences in the way men and women metabolize testosterone, so a separate study on women would be necessary to determine whether the gene deletion affects their testosterone tests the same way.

Still Dr. Catlin said, the work by the Karolinska scientists offers hope for the future, showing that the doping world is entering a new era.

"To me it's inevitable that we are going to learn more and more about how genes are influencing the outcome of tests," he said. "It's here," he added. "We might as well get used to it."

An earlier version of this article misspelled Dr. Anders Rane's surname.

This article has been revised to reflect the following correction:

Correction: May 1, 2008

An article on Wednesday about a genetic drug doping study in Sweden misspelled the surname of one of the researchers. He is Dr. Anders Rane, not Rhane.

Incubator electromagnetic fields alter newborns' heart rates

The electromagnetic fields produced by incubators alter newborns' heart rates, reveals a small study published ahead of print in the Fetal and Neonatal Edition of Archives of Disease in Childhood.

It is not clear what the long term effects might be, but this could have implications for babies born prematurely, who may spend several weeks or months in incubators, say the authors.

The research team assessed the variability in the heart rate of 43 newborn babies, none of whom was critically ill or premature.

The heart rates of 27 of these babies were assessed over three periods of five minutes each, during which the incubator motor was left running, then switched off, then left running again.

To see if noise might be a factor, because incubators are noisy, 16 newborns were exposed to "background noise," by placing a tape beside the baby's head, while the incubator motor was switched off.

The tape recording, which reproduced the sound of the incubator fan, was played for five minutes, paused for five minutes, and then played again for five minutes.

There were no differences in heart rate variability in the tape recorded babies. But there were significant differences in the heart rate variability of babies in the incubators.

The heart rate variability fell significantly during the periods when the incubator was switched on.

Decreased heart rate variability is a strong predictor of a poor prognosis in adult patients with heart disease and the general population, the evidence shows.

Heart rate variability is made up of low and high frequency components, and the ratio between the two is higher in premature babies than it is in adults.

The authors suggest that this may be influenced by the powerful electromagnetic fields created by incubators.

They conclude that modifications to the design of incubators could help, but they add that as yet it is unclear what long term consequences there may be of exposure to electromagnetic fields at such a tender age.

"International recommendations and laws set levels to safeguard the health of workers exposed to electromagnetic fields: newborns should be worthy of similar protection," they say.

Alzheimer's disease risks are gender specific

The risks of developing Alzheimer's disease differ between the sexes, with stroke in men, and depression in women, critical factors, suggests research published ahead of print in the Journal of Neurology Neurosurgery and Psychiatry.

The French researchers base their findings on almost 7000 people over the age of 65, drawn from the general population in three French cities.

None had dementia, but around four out of 10 were deemed to have mildly impaired mental agility (mild cognitive impairment) at the start of the study.

Their progress was assessed two and four years later.

In all, just over 6.5% of those deemed to be cognitively impaired developed dementia over the next four years. In just over half, no change was seen.

Just over one in three reverted to normal levels of cognitive agility.

Progression from mild cognitive impairment to dementia was more likely among those who were depressed and who were taking anticholinergic drugs, which influence chemical signalling in the brain.

A variation in the ApoE gene, a known risk factor for dementia, was also more common among those whose mild cognitive impairment progressed.

But risk factors also differed between the sexes, the results showed.

Men with mild cognitive impairment were more likely to be overweight, diabetic, and to have had a stroke. Men who had had a stroke were almost three times as likely to progress.

Women with mild cognitive impairment were more likely to be in poorer general health, disabled, suffering from insomnia and to have a poor support network.

Women unable to perform routine daily tasks, which would allow them to live without assistance, were 3.5 times as likely to progress. And those who were depressed were twice as likely to do so.

Stroke was not a risk factor for women, despite a similar rate of occurrence in both sexes.

Ancient "Nutcracker Man" Challenges Ideas on Evolution of Human Diet

Human ancestor's teeth yields new clues

Tiny marks on the teeth of an ancient human ancestor known as the "Nutcracker Man" may upset current evolutionary understanding of early hominid diet.

Using high-powered microscopes, researchers looked at rough geometric shapes on the teeth of several Nutcracker Man specimens and determined that their structure alone was not enough to predict diet.

Peter Ungar, professor of anthropology at the University of Arkansas in Fayetteville, contends the finding shows evolutionary adaptation for eating may have been based on scarcity rather than on an animal's regular diet.

"These findings totally run counter to what people have been saying for the last half a century," says Ungar. "We have to sit back and re-evaluate what we once thought."

Ungar and his colleagues, Frederick E. Grine of State University of New York at Stony Brook and Mark F. Teaford of Johns Hopkins University, Baltimore, Md., reported their findings last week in the Public Library of Science One, a peer-reviewed, international, online journal. The research was funded in part by the National Science Foundation.

The researchers examined the teeth of Paranthropus boisei, an ancient hominin that lived between 2.3 and 1.2 million years ago and is known popularly as the "Nutcracker Man" because it has the biggest, flattest cheek teeth and the thickest enamel of any known human ancestor.

"Ungar and colleagues' work on Paranthropus boisei diet is extremely important," says Joanna Lambert, physical anthropology program director at NSF. "Understanding what and how early hominins ate sheds light not only onto the feeding biology of our fossil ancestors, but also onto the very evolution of our own species."

Scientists long have believed that P. boisei fed on nuts and seeds or roots and tubers found in the savannas throughout eastern Africa because the teeth, cranium and mandible appear to be built for chewing and crunching hard objects.

But Ungar points out that the teeth only suggest "what P. boisei could eat, but not necessarily what it did eat."

Anthropologists have traditionally inferred the diet of ancient human ancestors by looking at the size and shape of the teeth and jaws. However, by using powerful microscopes to look at the patterns of wear on a tooth, scientists can get direct evidence of what the species actually ate.

Since food interacts with teeth, it leaves behind telltale signs that can be measured. Hard foods like nuts and seeds, for instance, lead to more complex tooth profiles, while tough foods like leaves lead to more parallel scratches.

Researchers compared dental microwear profiles of P. boisei to modern-day primates that eat different types of foods. P. boisei teeth were compared to those of the Old World Monkey species grey-cheeked mangabeys, and the New World Monkey species brown capuchin monkeys--both of these species consume mostly soft items but fall back on hard nuts or palm fronds.

Researchers examined the teeth of Paranthropus boisei, also called the "Nutcracker Man," an ancient hominin that lived between 2.3 and 1.2 million years ago. The "Nutcracker Man" had the biggest, flattest cheek teeth and the thickest enamel of any known human ancestor and was thought to have a regular diet of nuts and seeds or roots and tubers. But analysis of scratches on the teeth and other tooth wear reveal the pattern of eating for the "Nutcracker Man" was more consistent with modern-day fruit-eating animals. **Credit: Nicolle Rager Fuller, National Science Foundation**

Old World monkeys are found today in South and East Asia, the Middle East, Africa and Gibraltar at the southern tip of Spain. New World monkeys are found in tropical forest environments in southern Mexico, Central and South America.

P. boisei dental profiles also were compared to the New World mantled howling monkey and Old World silvered leaf monkey, which eat mostly leaves. Researchers also compared them to some of P. boisei's more contemporary counterparts--Australopithecus africanus, which lived between 3.3 million and 2.3 million years ago, and Paranthropus robustus, which lived between 2 million and 1.5 million years ago.

The findings showed that P. boisei teeth had light wear, suggesting that none of the individuals ate extremely hard or tough foods in the days leading up to death. The pattern was more consistent with modern-day fruit-eating animals than with most modern-day primates.

"It looks more like they were eating Jell-O," Ungar said.

This finding, while contradictory to previous speculation on the diet of P. boisei, is in line with a paradox documented in fish. Liem's Paradox states that animals may actively avoid eating the very foods they have developed adaptations for when they can find other food sources.

It appears the paradox may hold true for P. boisei and for some modern-day primates as well.

"If you give a gorilla a choice of eating fruit or a leaf, it will take the fruit every time," Ungar says. "But if you look at a gorilla's skull, its sharp teeth are adapted to consuming tough leaves. They don't eat the leaves unless they have to."

Accordingly, the finding represents a fundamental shift in the way researchers look at the diets of early human ancestors.

"For many years, the perspective has been that the very large teeth and thick dental enamel of P. boisei were adaptations to consuming very hard food types year-round," says Lambert. "Such specialization has historically been viewed as a potential cause for this fossil species' extinction. The research team demonstrated that such generalizations require careful re-thinking, and that P. boisei was a more flexible feeder than has classically been viewed."

"This challenges the fundamental assumptions of why such specializations occur in nature," Ungar says. "It shows that animals can develop an extreme degree of specialization without the specialized object becoming a preferred resource." **-NSF-**

Decoding the dictionary: Study suggests lexicon evolved to fit in the brain

Troy, N.Y. – The latest edition of the Oxford English Dictionary boasts 22,000 pages of definitions. While that may seem far from succinct, new research suggests the reference manual is meticulously organized to be as concise as possible — a format that mirrors the way our brains make sense of and categorize the countless words in our vast vocabulary.

"Dictionaries have often been thought of as a frustratingly tangled web of words where the definition of word A refers users to word B, which is defined using word C, which ends up referring users back to word A,"

said Mark Changizi, assistant professor of cognitive science at Rensselaer Polytechnic Institute. "But this research suggests that all words are grounded in a small set of atomic words — and it's likely that the dictionary's large-scale organization has been driven over time by the way humans mentally systematize words and their meanings."

Dictionaries are built like an inverted pyramid. The most complex words (e.g., "albacore" and "antelope") sit at the top and are defined by words that are more basic, and thus lower on the pyramid. Eventually all words are linked to a small number of words — called "atomic words," (such as "act" and "group") — that are so fundamental they cannot be defined by simpler terms. The number of levels of definition it takes to get from a word to an atomic word is called the "hierarchical level" of the word.

Changizi's research, which was published online this week and will appear in the June print edition of the Journal of Cognitive Systems Research, indicates that the dictionaries we use every day utilize approximately the optimal number of hierarchical levels — and provide a visual roadmap of how the lexicon itself has culturally evolved over tens of thousands of years to help lower the overall "brain space" required to encode it, according to Changizi.

Many other human inventions — such as writing and other human visual signs — have been designed either explicitly or via cultural selection over time so as to minimize their demands on the brain, Changizi said.

By conducting a series of calculations based on the estimation that the most complex words in the dictionary total around 100,000 different terms, and that the number of atomic words range from 10 to 60, Changizi was able to devise three signature features present in the most efficient dictionaries — as well as in their human counterpart, the brain.

Most importantly, he discovered that the total number of words across all the definitions in the dictionary (and thus the size of the dictionary) changes in relation to the total number of hierarchical levels present. Optimal dictionaries should have approximately seven hierarchical levels, according to Changizi.

"The presence of around seven levels of definition will reduce the overall size of the dictionary, so that it is about 30 percent of the size it would be if there were only two hierarchical levels," Changizi said.

Additionally, users will find that there are progressively more words at each successive hierarchical level, and that each hierarchical level contributes mostly to the definitions of the words just one level above their own, according to Changizi, who put his three predictions to the test by studying actual dictionaries.

The Oxford English Dictionary and WordNet — a large, online lexical database of English, developed at Princeton University — were found to possess all three signatures of an economically organized dictionary, and thus were organized in such a way as to economize the amount of dictionary space required to define the lexicon, according to Changizi.

"Somehow, over centuries, these revered reference books have achieved near-optimal organization," Changizi said. "That optimality can likely be attributed to the fact that cultural selection pressures over time have shaped the organization of our lexicon so as to require as little mental space and energy as possible."

Changizi believes his research has potential applications in the study of childhood learning, where scientists could analyze how students learn vocabulary words and possibly develop ways to optimize that learning process.

Research Team Is First to Model Photochemical Compass for Bird Navigation

International study elucidates the relationship between migratory birds, light and Earth's magnetic field

A team of researchers at Arizona State University and the University of Oxford are the first to model a photochemical compass that may simulate how migrating birds use light and Earth's weak magnetic field to navigate. The team reports in the April 30, 2008, online issue of Nature that the photochemical model becomes sensitive to the magnitude and direction of weak magnetic fields similar to Earth's when exposed to light. The research funded by the National Science Foundation (NSF) demonstrates that this phenomenon, known as chemical magnetoreception, is feasible and gives insight into the structural and dynamic design features of a photochemical compass.

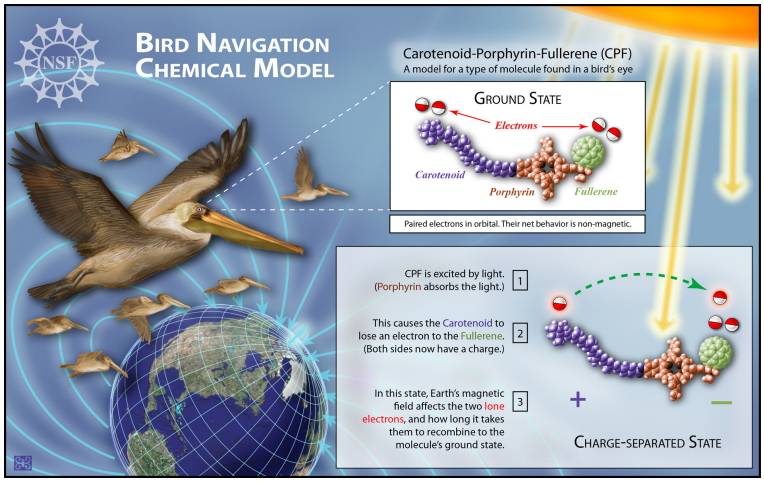
The most common bird migration pattern in the northern hemisphere is to fly north in the summer to breed in the Artic and to fly south to warmer regions for the winter.

Regardless of which way they are flying, migrating birds are important ecologically as a food source for other animals. They also transport plankton, materials involved in plant reproduction and hitchhikers such as ticks and lice, which can carry micro-organisms harmful to human health.

About 50 animal species, ranging from birds and mammals to reptiles and insects, use Earth's weak magnetic field for navigation. Earth's magnetic field ranges from approximately 30 to 60 millionths of one tesla. By comparison, magnetic resonance imaging, or MRI, uses magnetic fields from 1.5 to 3.0 tesla.

Weak magnetic fields are also produced by widely used technologies such as power lines and communications equipment. Because these man-made magnetic fields can disrupt animal navigation, "it is essential for humans to understand how animals navigate using Earth's weak magnetic field and the effects of human activity on animal navigation," according to Devens Gust, foundation professor of chemistry and biochemistry at Arizona State University.

Even though the mechanisms of a bird's internal compass have been studied intensively, they are not completely understood.



One existing theory is that photoreceptors in a bird's retina absorb light, which causes a chemical reaction that, in turn, produces a short-lived photochemical species whose lifetime is sensitive to the magnitude and direction of a weak magnetic field.

An international team of researchers are the first to demonstrate that a synthesized photochemical molecule composed of linked carotenoid (C), porphyrin (P) and fullerene (F) units can act as a magnetic compass. When excited with light, CPF forms a short-lived charge-separated state with a negative charge on the ball-like fullerene unit and a positive charge on the rod-like carotenoid unit. The lifetime of the charge-separated state before it returns to its lowest energy or ground state is sensitive to the magnitude and direction of a weak magnetic field similar to Earth's. **Credit: Zina Deretsky, National Science Foundation**

The photoreceptor theory is supported by the fact that blue light photoreceptors have been detected in retinas of migratory birds when they perform magnetic orientation. However, it has not been confirmed in the field or the lab that a magnetic field as weak as Earth's can produce detectable changes within a photochemical molecule; nor, has a photochemical molecule been shown to respond to the direction of such a magnetic field until now.

The U.S. and U.K. researchers have demonstrated that a synthesized photochemical molecule composed of linked carotenoid, porphyrin and fullerene units can act as a magnetic compass. Carotenoid is an organic pigment that occurs naturally in plants and other photosynthetic organisms. Porphyrin is similar to a chlorophyll molecule and exists in green leaves and red blood cells. Fullerene is composed entirely of carbon, and a spherical fullerene is known as a "buckyball."

Under normal conditions, each of the outer electron orbitals of the linked carotenoid (C), porphyrin (P) and fullerene (F) units contain two paired electrons. In the pair, the magnetic "north" pole of one electron is matched with the magnetic "south" pole of the other, causing it to be non-magnetic. As all of its electrons are paired, the CPF molecule has a neutral charge and exists in its lowest energy or ground state. Alternatively, when a CPF molecule is exposed to light, porphyrin absorbs the light energy and moves into a higher energy or excited state.

Porphyrin's excited state induces a carotenoid electron to leave its partner electron and move to fullerene's outer orbital. Since the transfer of the single electron causes the outer orbital of fullerene to gain an electron and be negatively charged and the outer orbital of carotenoid to be short one electron and positively charged, the newly formed molecule, C•+PF•-, exists in a charge-separated state.

Given that the single, or radical, electrons located in the outer orbitals of the carotenoid and fullerene units are no longer paired with their partner electrons, and are located on opposite ends of the C•+PF•- molecule, they can respond to the direction and magnitude of weak external magnetic forces of approximately 50 millionths of a tesla. After a brief moment, the lone radical electron on the fullerene returns to the carotenoid and the absorbed light energy is converted to heat.

"These results provide a clear proof-of-principle that the magnetic compass sense of migratory birds is based on a magnetically sensitive chemical reaction whose lifetime depends on the orientation of its molecules to Earth's magnetic field," said Peter Hore, professor of chemistry at Oxford University and head of the U.K. team.

Gust and Arizona State University collaborators Thomas Moore and Ana Moore originally synthesized photochemical molecules related to the CPF molecule for use in artificial photosynthetic reaction centers. These centers mimic the mechanisms by which photosynthetic organisms convert sunlight into useful forms of energy. They are now looking at developing their molecules for solar production of electricity or fuels such as hydrogen.

"The research completed by Gust and his collaborators is an excellent example of how basic research can lead to new knowledge and applications in many different fields of science and technology," said Tyrone Mitchell, director of NSF's Organic and Macromolecular Chemistry Program.

Co-authors of the Nature paper are Kiminori Maeda, Kevin Henbest, Filippo Cintolesi, Ilya Kuprov, Christopher Rodgers and Christiane Timmel of Oxford University and Paul A. Liddell of Arizona State University.

The research was supported by NSF Division of Chemistry award number 0352599. ***-NSF-***

UIC scientists discover how some bacteria survive antibiotics

Researchers at the University of Illinois at Chicago have discovered how some bacteria can survive antibiotic treatment by turning on resistance mechanisms when exposed to the drugs. The findings, published in the April 24 issue of the journal Molecular Cell, could lead to more effective antibiotics to treat a variety of infections.

"When patients are treated with antibiotics some pathogenic microbes can turn on the genes that protect them from the action of the drug," said Alexander Mankin, professor and associate director of the University of Illinois at Chicago's Center for Pharmaceutical Biotechnology and lead investigator of the study. "We studied how bacteria can feel the presence of erythromycin and activate production of the resistance genes."

Erythromycin and newer macrolide antibiotics azithromycin and clarithromycin are often used to treat respiratory tract infections, as well as outbreaks of syphilis, acne and gonorrhea. The drugs can be used by patients allergic to penicillin.

Macrolide antibiotics act upon the ribosomes, the protein-synthesizing factories of the cell. A newly-made protein exits the ribosome through a tunnel that spans the ribosome body. Antibiotics can ward off an infection by attaching to the ribosome and preventing proteins the bacterium needs from moving through the tunnel.

Some bacteria have learned how to sense the presence of the antibiotic in the ribosomal tunnel, and in response, switch on genes that make them resistant to the drug, Mankin said. The phenomenon of inducible antibiotic expression was known decades ago, but the molecular mechanism was unknown.

Mankin and his team of researchers -- Nora Vazquez-Laslop, assistant professor in the Center for Pharmaceutical Biotechnology, and undergraduate student Celine Thum -- used new biochemical and genetic techniques to work out the details of its operation.

"Combining biochemical data with the knowledge of the structure of the ribosome tunnel, we were able to identify some of the key molecular players involved in the induction mechanism," said Vazquez-Laslop.

"We only researched response to erythromycin-like drugs because the majority of the genetics were already known," she said. "There may be other antibiotics and resistance genes in pathogenic bacteria regulated by this same mechanism. This is just the beginning."

The man who grew a finger

By Matthew Price BBC News, Ohio

In every town in every part of this sprawling country you can find a faceless sprawling strip mall in which to do the shopping.

Rarely though would you expect to find a medical miracle working behind the counter of the mall's hobby shop.

That however is what Lee Spievak considers himself to be.

"I put my finger in," Mr Spievak says, pointing towards the propeller of a model airplane, "and that's when I sliced my finger off."

It took the end right off, down to the bone, about half an inch.

"We don't know where the piece went."

The photos of his severed finger tip are pretty graphic. You can understand why doctors said he'd lost it for good.

Today though, you wouldn't know it. Mr Spievak, who is 69 years old, shows off his finger, and it's all there, tissue, nerves, nail, skin, even his finger print.

'Pixie dust'

How? Well that's the truly remarkable part. It wasn't a transplant. Mr Spievak re-grew his finger tip. He used a powder - or pixie dust as he sometimes refers to it while telling his story.

Mr Speivak's brother Alan - who was working in the field of regenerative medicine - sent him the powder.

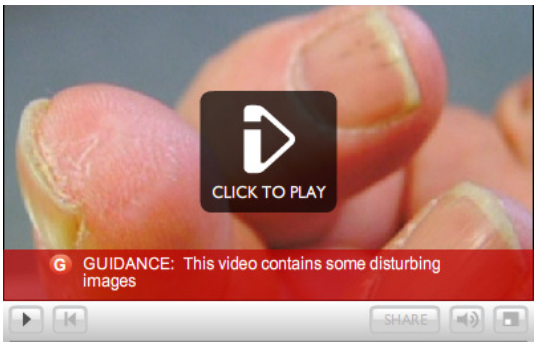
For ten days Mr Spievak put a little on his finger.

"The second time I put it on I already could see growth. Each day it was up further. Finally it closed up and was a finger.

"It took about four weeks before it was sealed."

Now he says he has "complete feeling, complete movement."

The "pixie dust" comes from the University of Pittsburgh, though in the lab Dr Stephen Badylak prefers to call it extra cellular matrix.



The man who grew a finger Video here

Pig's bladder

The process he has been pioneering over the last few years involves scraping the cells from the lining of a pig's bladder.

The remaining tissue is then placed into acid, "cleaned" of all cells, and dried out.

It can be turned into sheets, or a powder.

How it works in detail

It looks like a simple process, but of course the science is complex.

"There are all sorts of signals in the body," explains Dr Badylak.

"We have got signals that are good for forming scar, and others that are good for regenerating tissues.

"One way to think about these matrices is that we have taken out many of the stimuli for scar tissue formation and left those signals that were always there anyway for constructive remodelling."

In other words when the extra cellular matrix is put on a wound, scientists believe it stimulates cells in the tissue to grow rather than scar.

If they can perfect the technique, it might mean one day they could repair not just a severed finger, but severely burnt skin, or even damaged organs.

Clinical trial

They hope soon to start a clinical trial in Buenos Aires on a woman who has cancer of the oesophagus.

The normal procedure in such cases is often deadly. Doctors remove the cancerous portion and try to stretch the stomach lining up to meet the shortened oesophagus.

In the trial they will place the extra cellular matrix inside the body from where the portion of oesophagus has been removed, and hope to stimulate the cells around it to re-grow the missing portion.

So could limbs be re-grown? Dr Badylak is cautious, but believes the technology is potentially revolutionary.

"I think that within ten years that we will have strategies that will re-grow the bones, and promote the growth of functional tissue around those bones. And that is a major step towards eventually doing the entire limb."

That kind of talk has got the US military interested.

They are just about to start trials to re-grow parts of the fingers of injured soldiers.

Skin burns

They also hope the matrix might help veterans like Robert Henline re-grow burnt skin.

He was almost killed in an explosion while serving in Iraq. His four colleagues travelling with him in the army Humvee were all killed.

He suffered 35% burns to his head and upper body. His ears are almost totally gone, the skin on his head has been burnt to the bone, his face is a swollen raw mess.

So far he has undergone surgery 25 times. He reckons he has got another 30 to go.

Anything that could be done in terms of regeneration would be great he says.

"Life changing! I think I'm more scared of hospitals than I am of going back to Iraq again."

Like any developing technology there are many unknowns. There are worries about encouraging cancerous growths by using the matrix.

Doctors though believe that within the so called pixie dust lies an amazing medical discovery.

Story from BBC NEWS: http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/7354458.stm

H.P. Unveils New Memory Technology

By JOHN MARKOFF

A team of Hewlett-Packard scientists reported Wednesday in the science journal Nature that they have designed a simple circuit element they believe will enable tiny powerful computers that could imitate biological functions.

The device, called a memristor, could make it possible to build extremely dense computer memory chips that use far less power than today's DRAM memory chips, which are rapidly reaching the limit in how much smaller they can be made.

The memristor, an electrical resistor with memory properties, may also make it possible to fashion advanced logic circuits, like a class of reprogrammable chips known as field programmable gate arrays, that are today widely used for rapid prototyping of new circuits and for custom-made chips that need to be manufactured quickly.

Potentially even more tantalizing is the memristors' ability to store and retrieve a vast array of intermediate values, not just the binary 1s and 0s as conventional chips do. This makes them function like biological

synapses, which would be ideal for many artificial intelligence applications ranging from machine vision to understanding speech.

The H.P. researchers said that the discovery of the memory properties in tiny, extremely thin spots of titanium dioxide, came from a frustrating, decade-long hunt for a new class of organic molecules to serve as nano-sized switches. Researchers in both industry and academia have hoped they would be able to fashion switches as small as the size of a single molecule to someday replace transistors once the semiconductor industry's shrinking of electronic circuits made with photolithographic techniques reached a technological limit.

Independent researchers said that it seemed likely that the memristor might relatively quickly be applied in computer memories, but that other applications might be more challenging. Typically, technology advances are not adopted unless they offer dramatic cost or performance advantages over the technologies they are replacing.

"Whether it will be useful for other large scale applications is unclear at this point," said Wolfgang Porod, director for the Center of Nano Science and Technology at the University of Notre Dame.

The material offers a new approach that is radically different than another type of solid state storage called "phase-change memory" that is now being pursued by I.B.M., Intel and other companies. In a phase-change memory heat is used to shift a glassy material from an amorphous to a crystalline state and back again. The switching speed of these systems is both slower and requires more power, according to the H.P. scientists.

The memristor technology should be fairly quickly commercialized, said R. Stanley Williams, director of the quantum science research group at H.P. "This is on a fast track," he said.

The memristor was predicted in 1971 by a Berkeley electrical engineer, Leon Chua. There have been hints of an unexplained behavior in the literature for some time, Mr. Chua said in a phone interview on Tuesday.

However, he noted that he had not worked on his idea for several decades and that he was taken by surprise when he was contacted by the H.P. researchers several months ago. The advance clearly points the way to a prediction made in 1959 by the physicist, Richard Feynman, that "there's plenty of room at the bottom," referring to the possibility of building atomic-scale systems.

"I can see all kinds of new technologies and I'm thrilled," he said.

The original theoretical work done by Mr. Chua was laid out in a 1971 paper titled "Memristor — The Missing Circuit Element." The paper argued that basic electronic theory required that in addition to the three basic circuit elements — resistors, capacitors, and inductors — a fourth element should exist.

The H.P. research team titled their paper, "The Missing Memristor Found."

The H.P. team has successfully created working circuits based on memristors that are as small as 15 nanometers (the diameter of an atom is roughly about a tenth of a nanometer.) Ultimately, it will be possible to make memristors as small as about four nanometers, Mr. Williams said. In contrast the smallest components in today's semiconductors are 45 nanometers, and the industry currently does not see away to shrink those devices below about 20 nanometers.

Because the idea of a memristor was invented almost 40 years ago by Mr. Chua, it is in the public domain, however the H.P. scientists have applied for patents covering their successful implementation of a working version of the device.

One of the most exciting aspects of the new devices is that they may consume dramatically less power compared with today's microprocessors and memory devices, which must be continually refreshed electrically to maintain their state. In contrast, circuits made from memristors will require power only to switch and will hold their state for at least several years once they have been set in a particular state. Moreover, they can be made in the same kinds of semiconductor factories that the chip industry now uses without specialized equipment.

The most significant limitation that the H.P. researchers said the new technology faces is that the memristors function about 10 times more slowly than today's DRAM memory cells.

The discovery was made when the H.P. researchers and a cooperating team of scientists at U.C.L.A. got widely different results in a technical experiment involving organic materials. Ultimately the H.P. team was able to prove that the dramatic changes in resistance they were seeing were coming from a contaminant, and not from the organic molecules.

"I'll take serendipity, but it took us a long time to figure this out," Mr. Williams said.

The researchers were eventually able to determine that the change in resistance came from the movement of oxygen atoms in the material in response to an electrical charge. Moreover, the changes were so significant that it was simple to detect the state of the device even at near-atomic scale.

After beginning to explore the properties of titanium dioxide, Mr. Williams said his group was at first baffled by the effect and were unable to produce it reliably. However, through experimentation they gained a solid theoretical understanding of the phenomenon. Currently they are building the devices from a sandwich of a pure layer of titanium dioxide and a second layer of the same material doped with a proprietary material.

In a New Climate Model, Short-Term Cooling in a Warmer World

By ANDREW C. REVKIN

After decades of research that sought, and found, evidence of a human influence on the earth's climate, climatologists are beginning to shift to a new and similarly daunting enterprise: creating decade-long forecasts for climate, just as meteorologists routinely generate weeklong forecasts for weather.

One of the first attempts to look ahead a decade, using computer simulations and measurements of ocean temperatures, predicts a slight cooling of Europe and North America, probably related to shifting currents and patterns in the oceans.

The team that generated the forecast, whose members come from two German ocean and climate research centers, acknowledged that it was a preliminary effort. But in a short paper published in the May 1 issue of the journal Nature, they said their modeling method was able to reasonably replicate climate patterns in those regions in recent decades, providing some confidence in their prediction for the next one.

The authors stressed that the pause in warming represented only a temporary blunting of the centuries of rising temperatures that scientists have projected if carbon dioxide and other heat-trapping gases continue accumulating in the atmosphere.

"We're learning that internal climate variability is important and can mask the effects of human-induced global change," said the paper's lead author, Noel Keenlyside of the Leibniz Institute of Marine Sciences in Kiel, Germany. "In the end this gives more confidence in the long-term projections."

The new study focused on relationships between short-term climate trends and a system of currents in the Atlantic Ocean, called the meridional overturning circulation, which undergo periodic changes. The predictions were made by repeatedly running a simulation of the global climate and adjusting conditions in the simulated oceans to match temperature measurements.

To get a computer-generated simulation of the climate for the 1990s, for example, the model ran from the 1950s through the 1980s, with sea temperatures adjusted to reflect the real world, then ran without further inputs for 10 more years.

The model is a rough replica of conditions, the scientists said. While it reliably reproduced climate patterns in Europe and North America, the model could not replicate patterns over central Africa, for example.

In e-mail exchanges, several climate experts not associated with the study expressed a variety of views on the new cooling forecast. But they agreed that the work served the important function of at least trying to chart what will assuredly be a winding climatic journey toward a generally warmer world.

Other researchers, including NASA scientists at the Jet Propulsion Laboratory in Pasadena, Calif., reported separately on April 21 that a slowly fluctuating oscillation in Pacific Ocean temperatures had shifted into its cool phase, a condition that is also thought to exert an overall temporary cooling of the climate.

These natural variations can also amplify warming, and that is likely to happen in future decades on and off as well, experts say.

The global climate will continue to be influenced in any particular decade by a mix of natural variability and the building greenhouse effect, said Kevin Trenberth, a climate scientist at the National Center for Atmospheric Research in Boulder, Colo. He said efforts to build forecasts by mixing modeling and measurements were vital in a world with rising populations in places where poverty leads to vulnerability from climate-related threats like flooding and famine.

It should also help the public and policy makers understand that a cool phase does not mean the overall theory of human-driven warming is flawed, Dr. Trenberth said.

"Too many think global warming means monotonic relentless warming everywhere year after year," Dr. Trenberth said. "It does not happen that way."

A consistent, worldwide association between short sleep duration and obesity

WESTCHESTER, Ill. – A study published in the May 1 issue of the journal SLEEP is the first attempt to quantify the strength of the cross-sectional relationships between duration of sleep and obesity in both children and adults. Cross-sectional studies from around the world show a consistent increased risk of obesity among short sleepers in children and adults, the study found.

Francesco P. Cappuccio, MD, of Warwick Medical School in the United Kingdom, and colleagues performed a systematic search of publications on the relationship between short sleep duration and obesity risk. Criteria for inclusion were: report of duration of sleep as exposure, body mass index (BMI) as continuous outcome and prevalence of obesity as categorical outcome, number of participants, age and gender.

Of the 696 studies identified from the search, 12 studies on children and 17 studies on adults met the inclusion criteria.

For the children, 13 population samples from the 12 studies were included in the pool analysis, for a total of 30,002 participants from around the world. The subjects' age ranged from two to 20 years. Seven of 11 studies reported a significant association between short sleep duration and obesity.

For the adults, 22 population samples from the 17 studies were included in the pool analysis, for a total of 604,509 worldwide participants. The subjects' age ranged from 15-102 years. Seventeen population samples showed a significant association between short duration of sleep and obesity. Unlike studies in children, all studies in adults showed a consistent and significant negative association between hours of sleep and BMI.

According to Dr. Cappuccio, this study showed a consistent pattern of increased odds of being a short sleeper if you are obese, both in childhood and adulthood.

"By appraising the world literature, we were able to show some heterogeneity amongst studies in the world. However, there is a striking consistent overall association, in that both obese children and adults had a significantly increased risk of being short sleepers compared to normal weight individuals. The size of the association was comparable (1.89-fold increase in children and 1.55-fold increase in adults). This study is important as it confirms that this association is strong and might be of public health relevance. However, it also raises the unanswered question yet of whether this is a cause-effect association. Only prospective longitudinal studies will be able to address the outstanding question," said Dr. Cappuccio.

While an increasing number of adults are considered overweight, the number of overweight children is also on the rise. According to the National Heart, Lung and Blood Institute, the percentage of overweight children and teens has more than doubled in the past 30 years. Today, about 17 percent of American children aged two to 19 are overweight. An estimated 61 percent of U.S. adults aged 20-74 years are either overweight or obese. About 34 percent of these people are overweight and 27 percent or 50 million people are obese. While eating healthy and exercising regularly are important precautions to take to reduce one's chances of being overweight, getting enough sleep is equally as important.

Being overweight can lead to cardiovascular disease and type two diabetes, and can also increase the risk for developing obstructive sleep apnea (OSA), a sleep-related breathing disorder that causes your body to stop breathing during sleep. OSA, which can disturb your sleep numerous times on any given night, can result in daytime sleepiness, as well as elevate the risk for stroke, diabetes and heart disease. OSA is a serious sleep disorder that can be harmful, or even fatal, if left untreated. OSA occurs in about two percent of young children, four percent of men and two percent of women.

Snoring is a sound made in the upper airway of your throat as you sleep. It normally occurs as you breathe in air. It is a sign that your airway is being partially blocked. About one-half of people who snore loudly have OSA. OSA happens when the tissue in the back of the throat collapses to block the entire airway. This keeps air from getting in to the lungs. Almost everyone is likely to snore at one time or another. It has been found in all age groups. Estimates of snoring vary widely based on how it is defined. The rate of snoring in children is reported to be 10 to 12 percent, and in about 24 percent of adult women and 40 percent of adult men.

It is recommended that infants (three to 11 months) get 14 to 15 hours of nightly sleep, while toddlers get 12 to 14 hours, children in pre-school 11-13 hours and school-aged children between 10-11 hours. Adolescents are advised to get nine hours of nightly sleep and adults seven to eight hours.

The American Academy of Sleep Medicine (AASM) offers some tips to help your child sleep better:

* Follow a consistent bedtime routine. Set aside 10 to 30 minutes to get your child ready to go to sleep each night.
* Establish a relaxing setting at bedtime.
* Interact with your child at bedtime. Don't let the TV, computer or video games take your place.
* Keep your children from TV programs, movies, and video games that are not right for their age.
* Do not let your child fall asleep while being held, rocked, fed a bottle, or while nursing.
* At bedtime, do not allow your child to have foods or drinks that contain caffeine. This includes chocolate and sodas. Try not to give him or her any medicine that has a stimulant at bedtime. This includes cough medicines and decongestants.

The AASM offers the following tips for adults and adolescents on how to get a good night's sleep:

* Follow a consistent bedtime routine.
* Establish a relaxing setting at bedtime.
* Get a full night's sleep every night.
* Avoid foods or drinks that contain caffeine, as well as any medicine that has a stimulant, prior to bedtime.
* Do not stay up all hours of the night to "cram" for an exam, do homework, etc. If after-school activities are proving to be too time-consuming, consider cutting back on these activities.
* Do not bring your worries to bed with you.
* Keep computers and TVs out of the bedroom.
* Do not go to bed hungry, but don't eat a big meal before bedtime either.
* Avoid any rigorous exercise within six hours of your bedtime.
* Make your bedroom quiet, dark and a little bit cool.
* Get up at the same time every morning.

It is important to make sure that your child gets enough sleep and sleeps well. The value of sleep can be measured by your child's smiling face, happy nature and natural energy. A tired child may have development or behavior problems. A child's sleep problems can also cause unnecessary stress for you and the other members of your family.

Parents who suspect that their child might be suffering from a sleep disorder are encouraged to consult with their child's pediatrician or a sleep specialist. Adults and adolescents are encouraged to consult with their primary care physician or a sleep specialist.

SLEEP is the official journal of the Associated Professional Sleep Societies, LLC, a joint venture of the AASM and the Sleep Research Society.

More information about "children and sleep" is available from the AASM at http://www.SleepEducation.com/Topic.aspx?id=8, OSA at http://www.SleepEducation.com/Disorder.aspx?id=7, child OSA at http://www.SleepEducation.com/Disorder.aspx?id=71, snoring at http://www.SleepEducation.com/Disorder.aspx?id=26, and "teens and sleep", including a new questionnaire that assesses the level of sleepiness in adolescents, at http://www.SleepEducation.com/Topic.aspx?id=71.

Biomarker predicts malignancy potential of HG-PIN lesions in the prostate

PHILADELPHIA – Men whose prostate cancer screenings show high grade prostatic intraepithelial neoplasia (HG-PIN) may find themselves in limbo, "stuck" between diagnoses – they are told prostate cancer has not yet developed, but it might, and they are advised to undergo repeated needle biopsies as a precaution.

Investigators from Spain have found a means of distinguishing between HG-PIN lesions destined to become cancerous and those which will remain benign. Their findings, reported in the May 1 issue of Clinical Cancer Research, a journal of the American Association for Cancer Research, could spare patients the discomfort and inconvenience of unnecessary needle biopsies.

The Spanish team found that expression of the PTOV1 gene in HG-PIN lesions is linked to prostate cancer development, and that the higher the expression, the more likely it is that subsequent biopsies will find cancer. The reverse is also true—lack of PTOV1 reduces the risk of prostate cancer.

"This is the first HG-PIN biomarker to be associated with prostate cancer development," said the study's lead author, Rosanna Paciucci, Ph.D., a researcher at the Vall d´Hebrón Hospital Research Institute in Barcelona. She says that when the results of this study are validated, the PTOV1 gene marker could be used to determine which men with HG-PIN are at substantial risk of developing prostate cancer.

"Those patients with a high PTOV1 score should undergo an immediate repeat biopsy," Paciucci said. On the flip side, men who test low for PTOVI may not need to receive future "annoying and useless" biopsies, she said. "We estimate that we can save 40 percent of unnecessary biopsies - those that are repetitively negative and contain HG-PIN lesions that do not develop into cancer."

While the researchers do not know the precise biochemical function of PTOV1, they say they have found this protein promotes the proliferation of cancer cells when it is over-expressed, as it occurs in prostate cancer cells.

HG-PIN is defined as a pre-malignant lesion present in most cancerous prostates. Although a pre-malignant lesion shows many of the typical cellular changes observed in cancer, the lesion has not yet progressed fully to disease. Since HG-PIN lesions are also associated with the presence of cancer in many patients, men whose biopsies show HG-PIN are often re-biopsied until cancer is detected, Paciucci says.

In most recent studies, the average risk of cancer following a diagnosis of isolated HG-PIN in biopsy ranged from 20 percent to 30 percent, the researchers say. And while other researchers have found markers in HG-PIN lesions, none have been able to discriminate between lesions that will progress to cancer, the researchers say.

In this study, the research team analyzed HG-PIN lesions from 140 patients: the positive control group comprised 79 patients diagnosed with prostate cancer who had their prostate glands surgically removed and who had been earlier diagnosed with HG-PIN; the negative control group included 11 patients with bladder cancer who had both their diseased bladder and healthy prostate removed; and the study group comprised 50 patients diagnosed with HG-PIN but not prostate cancer. The study group had an average of 2.5 biopsies each between 2000 and 2004.

Finding that PTOV1 gene expression was elevated in HG-PIN associated with cancer, the investigators used tissue microarray and immunohistochemical analyses to see whether PTOV1 protein levels could discriminate these pre-malignant lesions from HG-PIN that did not develop into prostate cancer.

They considered both the number of cells that express the protein and the intensity of the expression, and derived a quantitative score (Hscore) that ranged from 0 to 300. From this, they calculated that an Hscore of 100 represented a highly sensitive malignancy threshold. "This means that when PTOV1 Hscore is equal or above 100 the possibility to find cancer in the subsequent biopsy is 90 percent," Paciucci said. "Currently, the diagnosis of cancer is made only when the cancer lesion is seen in the biopsy."

By adding the analysis of PTOV1, the positive predictive value (the chance that the HG-PIN lesion will become cancerous) of all samples, including those with a score of less than 100, is 34 percent, and the negative predictive value (the chance that the HG-PIN lesion will not become cancerous) is more than 95 percent, Paciucci says.

Paciucci cautions that the study results need to be confirmed among a larger study group. "From this validation we can expect to improve the current rate of early detection of cancer," she said.

Early treatment of stomach infection may prevent cancer

PHILADELPHIA – Based on research using a new mouse model of gastritis and stomach cancer, researchers from the Massachusetts Institute of Technology (MIT) say that prompt treatment of Helicobacter pylori (H. pylori) infections reverses damage to the lining of the stomach that can lead to cancer.

In the May 1 issue of Cancer Research, a journal of the American Association for Cancer Research, researchers say their study results should lay to rest any question about whether – and when - antibiotic treatment of H. pylori can eliminate or reduce risk of developing gastric, or stomach cancer.

"We concluded that H. pylori eradication prevented gastric cancer to the greatest extent when antibiotics were given at an early point of infection, but that eradication therapy given at a later time point also delayed the development of severe lesions that can lead to cancer," said the study's lead author, James G. Fox, D.V.M., professor and director of the Division of Comparative Medicine at MIT.

The findings are important, Fox says, because stomach cancer is the second leading cause of cancer death worldwide, and approximately half of the world's population is infected with H. pylori. Although H. pylori infection is now recognized as the major cause of both peptic ulcers and gastric cancer, and has been classified as a group I carcinogen by the World Health Organization, physicians are not sure whom to screen and treat with costly antibiotics, aside from first degree relatives of gastric cancer patients and those with peptic ulcer disease, he adds.

Since it typically takes several decades for gastric cancer to develop in those who are susceptible – which is estimated to be up to three percent of infected people – researchers also do not know when to treat the infection for maximum benefit. Human studies that tested treatment in patients who had already developed tumors had mixed results, but one previous study showed that giving antibiotics before premalignant lesions develop was successful in preventing cancer, Fox says.

The current study examined the effects of treating and eliminating H. pylori at different stages of progression from gastritis, an inflammation of the mucous membrane layer of the stomach, to development of gastric cancer. To do this, Fox and colleagues from MIT and Columbia University developed transgenic "INS-GAS" mice that over-expressed gastrin, a hormone that controls secretion of gastric acid by the stomach's parietal cells.

"If you lose these cells over time, they stop secreting gastric acid, and this is, in and of itself, a risk factor for development of cancer, but gastric acid also helps protect against commensal bacterial colonization of the stomach," Fox said.

With increasing age, parietal cells in INS-GAS mice stopped producing gastric acid and underwent precancerous changes. By 20 months of age, the mice spontaneously developed invasive gastric cancer. Infection by H. pylori and progression to gastric cancer was accelerated in these mice, researchers discovered.

Researchers then treated the mice with antibiotics and looked for cellular changes. They found that, at every stage of advancing infection, mice that were treated with antibiotics had less severe disease. . Treating mice that were eight weeks post-infection reduced risk of developing cancer to the same level seen in uninfected mice. But using antibiotics at 12 and 22 weeks post-infection did not reverse the damaging changes, such as inflammation and development of precancerous lesions, to the levels seen in uninfected mice.

"Our mouse model mimics the progressive process we know occurs in development of human gastric cancer," Fox said. "This shows early intervention provides the maximum benefit."

Of added benefit, Fox says, is the associated finding that antibiotic treatment also reduces the level of other bacterial species that have invaded the stomach. "Gastric acid is a barrier to bacteria, and if there is no barrier, bacteria can move into the stomach from the lower bowel and colonize it, producing inflammation and progression to cancer," he said. . "Findings in humans and mice now suggest that antibiotic treatment potentially changes gastric microbiota and may impact gastric carcinogenesis.'"

'Sexy' voice gives fertile women away

*** Colin Barras**

A woman's voice becomes more attractive when she is most fertile. That's according to Nathan Pipitone and Gordon Gallup of the State University of New York at Albany.

The pair recorded women counting from 1 to 10 at four occasions during their menstrual cycle. They then replayed the recordings at random to male and female students and asked them to rate the attractiveness of the voices. Both males and females judged the women's voices to be most attractive if they were recorded

during the peak fertility period of the menstrual cycle, and less attractive if they were recorded during non-fertile periods (Evolution and Human Behavior, DOI: 10.1016/j.evolhumbehav.2008.02.001).

The results are in line with evidence that the female voice box, or larynx, is under the influence of sex hormones, says Gallup. He says the changes in the female voice during peak fertility support the view that women are "different" at that point in the menstrual cycle - in other words, that they experience oestrus.

The theory of human oestrus remains controversial because its effects are subtle; human females show none of the distinct genital swellings seen in other female mammals "in heat". But there is increasing evidence of more subtle changes. "Other differences include changes in sexual receptivity and odour sensitivity," Gallup says.

Martie Haselton and Greg Bryant at the University of California, Los Angeles, say that vocal pitch plays an important role in judging fertility. "We have found that voices are higher in pitch on high-fertility days of the cycle," says Haselton.

The fact that men notice the differences in vocal attractiveness suggests that there is a subtle evolutionary battle of the sexes going on, says Gallup: as women evolve ever more efficient ways to conceal fertility - to avoid unwanted attention - men become increasingly sensitive to the tiny changes that do occur. Other women also pick up on the changes, perhaps to keep an eye on the competition, he suggests.

Geoffrey Miller at the University of New Mexico, Albuquerque, showed last year that women lap dancers earn more tips during their fertile days. "The voice changes might explain some of the shift in lap dancer tip earnings," he says. "Dancers certainly chat with their customers." But Miller points out that there is also evidence that visual attractiveness changes during the menstrual cycle. "Voice quality is unlikely to be the whole story," he says.

DNA Tests Confirm the Deaths of the Last Missing Romanovs

By THE ASSOCIATED PRESS

MOSCOW (AP) — For nine decades after Bolshevik executioners shot Czar Nicholas II and his family, there were no traces of the remains of Crown Prince Aleksei, the hemophiliac heir to Russia's throne.

Some said the prince, a delicate 13-year-old, had somehow survived and escaped; others believed he was buried in secret as the country lurched into civil war.

Now an official says DNA tests have solved the mystery by identifying bone shards found in a forest as those of Aleksei and his sister Grand Duchess Maria.

The remains of their parents, Nicholas II and Empress Alexandra, and three siblings, including the czar's youngest daughter, Anastasia, were unearthed in 1991 and reburied in the imperial resting place in St. Petersburg. The Russian Orthodox Church made all seven of them saints in 2000.

Researchers unearthed the bone shards last summer in a forest near Yekaterinburg, where the royal family was killed, and enlisted laboratories in Russia and the United States to conduct DNA tests.

Eduard Rossel, governor of the region 900 miles east of Moscow, said Wednesday that tests done by an American laboratory had identified the shards as those of Aleksei and Maria.

"This has confirmed that indeed it is the children," he said. "We have now found the entire family."

Mr. Rossel did not specify the laboratory, but a genetic research team working at the University of Massachusetts Medical School has been involved in the process. Evgeny Rogaev, who headed the team that tested the remains in Moscow and at the medical school in Worcester, Mass., was called into the case by the Russian Federation Prosecutor's Office.

He said Wednesday that he had delivered the results to the Russian authorities, but that it was up to the prosecutor's office to disclose the findings.

"The most difficult work is done, and we have delivered to them our expert analysis, but we are still working," he said. "Scientifically, we want to make the most complete investigation possible." Despite the earlier discoveries and ceremonies, the absence of Aleksei's and Maria's remains gnawed at descendants of the Romanovs, history buffs and royalists. Even if the announcement is confirmed and widely accepted, many descendants of the royal family are unlikely to be fully assuaged; they seek formal rehabilitation by the government.

"The tragedy of the czar's family will only end when the family is declared victims of political repression," said German Lukyanov, a lawyer for royal descendants.

Nicholas abdicated in 1917 as revolutionary fervor swept Russia, and he and his family were detained. They were shot by a firing squad on July 17, 1918, in the basement of a house in Yekaterinburg.

Flower power may bring ray of sunshine to cancer sufferers

A mini-protein found in sunflower seeds could be the key to stopping tumors spreading in prostate cancer patients, according to QUT researchers

The grants came from Queensland Cancer Research, the Prostate Cancer Foundation, and the National Health and Medical Research Council.

"We are interested in this miniprotein as a potential treatment of prostate cancer, in particular for those patients who relapse," said Dr Harris.

"The best thing to do in those cases is block the disease spreading to other organs, particularly the spine, which is very debilitating; it is not the prostate tumour that kills you, it is when the cancer cells escape from the prostate so we want to prevent that."

Another QUT researcher, Professor Judith Clements, had previously shown that the action of enzymes called proteases was a key event in tumour spread, and Dr Harris said that the sunflower mini-protein, known as the protease inhibitor, was able to block these enzymes in test tube-based assays.

"However, it also inhibits a whole range of proteases, some of which control important processes in the body, so we have re-engineered the molecule so it should just block the proteases produced in prostate cancer and hence stop tumour spreading, whilst leaving other processes intact," he said.

The National Health and Medical Research Council grant will allow Dr Harris and his team to perform tests on the re-engineered inhibitor in animals over the next months.

"It feels like we have been covered in a shower of gold at the moment, it is very exciting for us because we are a small team but we have been working very hard on this for a long time," he said.

"We are extremely happy because now we can carry out trials in mouse-models of prostate cancer and if we have positive results, we could get a pharmaceutical industry partner interested in the work.

"Currently bluebox, QUT's commercialisation company, is helping us towards that goal."

"The dream end-product is having a drug which could be produced in sunflower seeds and given as a simple dietary supplement for people with prostate cancer."

FSU geochemist challenges key theory regarding Earth's formation

TALLAHASSEE, Fla. -- Working with colleagues from NASA, a Florida State University researcher has published a paper that calls into question three decades of conventional wisdom regarding some of the physical processes that helped shape the Earth as we know it today.

Munir Humayun, an associate professor in FSU's Department of Geological Sciences and a researcher at the National High Magnetic Field Laboratory, co-authored a paper, "Partitioning of Palladium at High Pressures and Temperatures During Core Formation," that was recently published in the peer-reviewed science journal Nature Geoscience. The paper provides a direct challenge to the popular "late veneer hypothesis," a theory which suggests that all of our water, as well as several so-called "iron-loving" elements, were added to the Earth late in its formation by impacts with icy comets, meteorites and other passing objects.

"For 30 years, the late-veneer hypothesis has been the dominant paradigm for understanding Earth's early history, and our ultimate origins," Humayun said. "Now, with our latest research, we're suggesting that the late-veneer hypothesis may not be the only way of explaining the presence of certain elements in the Earth's crust and mantle."

To illustrate his point, Humayun points to what is known about the Earth's composition.

"We know that the Earth has an iron-rich core that accounts for about one-third of its total mass," he said. "Surrounding this core is a rocky mantle that accounts for most of the remaining two-thirds," with the thin crust of the Earth's surface making up the rest.

"According to the late-veneer hypothesis, most of the original iron-loving, or siderophile, elements" -- those elements such as gold, platinum, palladium and iridium that bond most readily with iron -- "would have been drawn down to the core over tens of millions of years and thereby removed from the Earth's crust and mantle. The amounts of siderophile elements that we see today, then, would have been supplied after the core was formed by later meteorite bombardment. This bombardment also would have brought in water, carbon and other materials essential for life, the oceans and the atmosphere."

To test the hypothesis, Humayun and his NASA colleagues -- Kevin Righter and Lisa Danielson -- conducted experiments at Johnson Space Center in Houston and the National High Magnetic Field Laboratory in Tallahassee. At the Johnson Space Center, Righter and Danielson used a massive 880-ton press to expose samples of rock containing palladium -- a metal commonly used in catalytic converters -- to extremes of heat and temperature equal to those found more than 300 miles inside the Earth. The samples were then brought to the magnet lab, where Humayun used a highly sensitive analytical tool known as an inductively coupled plasma mass spectrometer, or ICP-MS, to measure the distribution of palladium within the sample.

"At the highest pressures and temperatures, our experiments found palladium in the same relative proportions between rock and metal as is observed in the natural world," Humayun said. "Put another way, the distribution of palladium and other siderophile elements in the Earth's mantle can be explained by means other than millions of years of meteorite bombardment."

The potential ramifications of his team's research are significant, Humayun said.

"This work will have important consequences for geologists' thinking about core formation, the core's present relation to the mantle, and the bombardment history of the early Earth," he said. "It also could lead us to rethink the origins of life on our planet."

Wakame waste

Composting polluted seaweed

Bacteria that feed on seaweed could help in the disposal of pollutants in the world's oceans, according to a new study by researchers in China and Japan. The discovery is reported in the International Journal of Biotechnology, an Inderscience publication.

Shinichi Nagata of the Environmental Biochemistry Group, at Kobe University, Japan, working with colleagues at Shimane University and at Nankai University, China, explain that as marine pollution is on the increase novel approaches to removing toxic contaminants is becoming an increasingly pressing issue. They point out that various species of seaweed are able to extract toxic compounds from seawater and point to the brown seaweed, Undaria pinnatifida, known as wakame in Japan as having been the focus of research in this area for almost a decade.

Wakame can thrive evening the presence of carbon, ammonium, nitrate and phosphate in seawater that would otherwise be lifeless. However, there remains the problem of how to dispose of planted wakame, once it has feasted on organic and inorganic pollutants in seawater.

Organic pollutants are absorbed by cultured wakame and so cultivated wakame must be treated as a kind of toxic waste rather than a useful byproduct of marine bioremediation. The researchers point out that there may be a simple solution to the disposal problem. Natural wakame has been used as a fertilizer since ancient times, they explain, so the composting process could be an effective means of degrading wakame into a useful form and so recycling organic substances containing C, N and P from coastal waters.

The team has now found a highly efficient way to accelerate the composting process in the form of a novel marine bacterium, identified as a Halomonas species and given the label AW4.

Partial DNA analysis helped identify the active species isolated from the seaweeds in Awaji Island, Japan. The researchers explain that strain AW4 grows well even at high salt (sodium chloride) concentrations and can reduce the total organic components, including pollutant content, of the seaweed significantly within a week.

"Disposal of seaweed wakame (Undaria pinnatifida) in composting process by marine bacterium Halomonas sp. AW4" by Nagata et al in International Journal of Biotechnology, 2008, 10, 73-85
http://www.inderscience.com/offer.php?id=17970

World first: researchers develop completely automated anesthesia system

'McSleepy' hopes to revolutionize anesthesia practice

Researchers at McGill University and the McGill University Health Centre (MUHC) have performed the world's first totally automated administration of an anesthetic. Nicknamed "McSleepy," the new system developed by the researchers administers drugs for general anesthesia and monitors their separate effects completely automatically, with no manual intervention.

"We have been working on closed-loop systems, where drugs are administered, their effects continuously monitored, and the doses are adjusted accordingly, for the last 5 years," said Dr. Thomas M. Hemmerling of McGill's Department of Anesthesia and the Montreal General Hospital, who heads ITAG (Intelligent Technology in Anesthesia research group), a team of anesthesiologists, biomedical scientists and engineers. "Think of "McSleepy" as a sort of humanoid anesthesiologist that thinks like an anesthesiologist, analyses biological information and constantly adapts its own behavior, even recognizing monitoring malfunction."

The anesthetic technique was used on a patient who underwent a partial nephrectomy, a procedure that removes a kidney tumor while leaving the non-cancerous part of the kidney intact, over a period of 3 hours and 30 minutes. To manipulate the various components of general anesthesia, the automated system measures three separate parameters displayed on a new Integrated monitor of anesthesia (IMATM): depth of hypnosis via EEG analysis, pain via a new pain score, called AnalgoscoreTM, and muscle relaxation via phonomyographyTM, all developed by ITAG. The system then administers the appropriate drugs using conventional infusion pumps, controlled by a laptop computer on which "McSleepy" is installed. Using these three separate parameters and complex algorithms, the automated system calculates faster and more precisely than a human can the appropriate drug doses for any given moment of anesthesia. "McSleepy" assists the anesthesiologist in the same way an automatic transmission assists people when driving. As such, anesthesiologists can focus more on other aspects of direct patient care. An additional feature is that the system can communicate with personal digital assistants (PDAs), making distant monitoring and anesthetic control possible. In addition, this technology can be easily incorporated into modern medical teaching programs such as simulation centers and web-based learning platforms.

Anesthesia care is characterized by many biological and pharmacological parameters to monitor record and analyze. "It will probably take two years to perfect the system," Dr. Hemmerling said. "Many people are reluctant to rely on automated systems, especially when they are not visible – it is not clear what they are actually doing or how - , the fear of a 'black box' which suddenly takes over". In designing "McSleepy", we put in considerable research on the design of an interface which is clear, easy to read, resembles displays of our everyday practice but still provides a detailed clinical picture of what is going on and what has happened.

Dr. Hemmerling hopes that a commercial system might be available within the next 5 years.

$45 billion a year is spent by public on health costs for full-time workers and families

19 million full-time workers and dependents are uninsured and 11 million members of working families are on public programs

May 2, 2008, New York, NY—Health insurance coverage and unpaid health care for full-time workers and their family members without employer coverage costs the U.S. public $45 billion a year, according to a report from The Commonwealth Fund released today. This includes $33 billion in the cost of public coverage such as Medicaid and the State Children's Health Insurance Program, and $12 billion in uncompensated care expenses—which are paid by Federal, state and local governments and shifted to other payers—provided to uninsured workers and dependents.

The report, "Who Pays for Health Care When Workers Are Uninsured?, by Sherry Glied and Bisundev Mahato at Columbia University, found that 19 million full-time workers and their dependents were uninsured in 2004, compared to 16 million in 1999. Eleven million workers and their dependents are enrolled in public programs in 2004, up from 6 million in 1999, a 70 percent increase over the five-year period.

The cost borne by the public for workers not covered by their own employers is largely a result of fewer workers and worker family members obtaining health insurance coverage through their employers, even among those employed by firms with more than 100 employees. While the proportion of workers and family members enrolled in public health insurance programs increased for all size firms between 1999 and 2004, public insurance enrollment increased most rapidly for those with family members employed by large firms. In 2004, about 3 million workers in large firms were enrolled in public heath insurance, more than double the 1.4 million enrolled in 1999.

The costs of publicly paid health care for full-time workers and families increased from $31 billion in 1999 to $45 billion in 2004. (All costs are reported in 2004 dollars.) This includes an increase in public insurance costs from $21.2 billion to $32.5 billion, and an increase in uncompensated care costs from $9.4 billion to $12 billion.

Workers without coverage from their employers are disproportionately concentrated in smaller firms. Nonetheless, significant increases in uninsured or publicly insured workers in firms with 100 or more employees occurred over the five-year period from 1999 to 2004. For example, 1.6 million people working for employers with more than 100 employees were uninsured in 2004, compared with 1.2 million in 1999, a 33 percent increase. Including family members, nearly 5 million household members in working families associated with large firms were uninsured in 2004, compared with nearly 4 million in 1999.

A related study by Glied and Mahato, also released today, found that in 2003 one-third of full-time workers earning less than the 20th percentile of wages—$9.80 or less per hour in 2003—were uninsured for the full year, an increase of 9 percentage points since 1996. That study, The Widening Health Care Gap Between High- and Low-Wage Workers, found that in addition to being less likely to have health insurance through their jobs than higher-wage workers, low-wage workers were less likely to have a regular doctor, to go to the doctor when they are sick, or to get preventive care like blood pressure checks.

The study reveals a growing divide in the health system between low-wage and higher-wage earners between 1996-2003. While higher-wage workers made substantial gains in their use of preventive care services over the period of the study, lower-wage workers made only modest gains or suffered declines in preventive care. They were also less likely to be using the latest generation of prescription drugs. Consequently, the health care spending gap between high- and low-wage workers has widened considerably.

"Without insurance coverage, people don't get the care they need when they are sick, and the preventive care they need to keep them from getting sick in the first place," said lead author Sherry Glied, Professor and Chair of the Department of Health Policy and Management of Columbia University's Mailman School of Public Health. "When private employer-sponsored coverage declines, public health insurance and uncompensated care only fill part of the gap. We need expanded health insurance coverage to ensure that everyone has access to the benefits of health care."

Additional Findings from Health Insurance, Health, and Low-Wage Workers:

* There is a widening gap in insurance coverage between low- and higher-wage workers: in 1996, 22 percent of low-wage workers were uninsured compared to 6 percent of higher-wage workers; by 2003 nearly a third of low-wage workers were uninsured with no change in the share of uninsured higher-wage workers.

* The gap in insurance coverage mirrors a growing gap in access to health care between low- and higher-wage workers. In 2003, 81 percent of higher-wage workers had their blood pressure checked in the last year, up from 77 percent in 1996. In contrast, only 66 percent of lower-wage workers had had their blood pressure checked in the last year, down from 70 percent in 1996.

* Similarly, in 1996, low-wage workers reporting a routine check-up was just 5 percentage points lower than similar reports by high-wage workers. By 2003, however, lower-wage workers lagged higher-wage workers in reports of routine check-ups by 15 percentage points.

"While these studies underscore the crucial role of public programs in filling gaps in employer coverage, many workers are falling further behind in access to critical health care services," said Sara Collins, assistant vice president for the Future of Health Insurance at The Commonwealth Fund. "This points to the need for universal health insurance to ensure that everyone has access to needed care."

Both studies concluded that the growing lack of employer provided health care is placing a larger burden on taxpayers, working families, especially lower-wage workers, and public health insurance programs.

"If we want to move the United States toward the high performance health care system Americans want and deserve, the first step is to get all Americans insured," says Commonwealth Fund President Karen Davis. "In order to do that, the public and private sectors must work together to share responsibility for providing health care coverage."

Ancient bird is missing link to Archaeopteryx

* 11:27 02 May 2008
* NewScientist.com news service

*** Jeff Hecht**

A spectacularly preserved new Chinese fossil reveals a previously unseen stage in the early evolution of flight.

Called Eoconfuciusornis, it is a missing link between the oldest known bird, Archaeopteryx, and more advanced birds that have been discovered in the Yixian geological formation in China.

The Yixian deposits have yielded remarkably diverse fauna that have revolutionised avian palaeontology, but they are limited to a period from 125 to 120 million years ago – too narrow a time span to show much evidence of evolution within bird lineages.

A huge interval separates the Yixian birds from Archaeopteryx, which lived about 150 million years ago, leaving a gap in scientists' knowledge of bird evolution over this period.

Eoconfuciusornis is a missing link between the oldest known bird, Archaeopteryx, and more advanced birds **(Image: University of Bristol)**

Toothless beak

But Eoconfuciusornis, was found in different deposits, known as the Dabeigou formation, and falls within the gap – radiometric dating shows it lived 131 million years ago.

The new find is closely related to Confuciusornis – the most abundant Yixian fossil bird, with thousands of examples known. The two share skeletal features, as well as toothless horny bills and distinctive long paired tail feathers.

"The new discovery gives us a span of 11 million years of history" for the Confuciusornis family, long enough to show patterns of evolution, says Mike Benton of the University of Bristol, UK, co-author of a description of Eoconfuciusornis with palaeontologists from the Institute of Vertebrate Paleontology and Paleoanthropology (IVPP) in Beijing.

Less developed

Avian evolution made important advances between Archaeopteryx and the Yixian birds. "Archaeopteryx was an efficient powered flapping flyer, but lacked many of the adaptations of the skeleton seen in modern birds – especially fusions of bones that support flight muscle and reduce length of the tail," Benton told New Scientist.

Confuciusornis was a strong flyer, with flight muscles anchored on the wing by a large ridge of bone known as the deltopectoral crest, and on the body by a large fused sternum.

With a pair of separate sternal plates and a smaller deltopectoral crest, Eoconfuciusornis is more advanced then Archaeopteryx, and the most primitive, as well as the earliest, member of the Confuciusornis family.

Temporary success

"I think they are dead-on, absolutely correct," in placing the new fossil in the crucial gap, says Larry Martin, a palaeontologist at the University of Kansas, Lawrence, US, who was not involved in this study.

Martin originally described Confuciusornis 12 years ago with Zhou ZhongHe from the IVPP, a co-author of the Eoconfuciusornis paper.

Although the Confuciusornis family were the first and most primitive birds to evolve toothless bills and dominated the Yixian landscape, they vanished from the fossil record without leaving descendants.

The ancestors of modern birds lost their teeth independently. Exactly how is another mystery – palaeontologists hope the solution is waiting for them in other rocks.

Journal reference: Science in China Series D: Earth Sciences, vol 51, p 625 (pdf)

Bees Disease - One Step Closer To Finding A Cure

Scientists in Germany have discovered a new mechanism of infection for the most fatal bee disease. American Foulbrood (AFB) is the only infectious disease which can kill entire colonies of bees. Every year, this notifiable disease is causing considerable economic loss to beekeepers all over the world. The only control measure is to destroy the infected hive.

The mechanism of infection (pathogenic mechanism) was originally thought to be through the growth of a bacterium called Paenibacillus larvae in the organ cavity of honey bee larvae. The accepted view was that the bacteria germinate preferentially at either end of the gut of honey bee larvae then make holes in the gut wall and enter the larval organ cavity, the presumed primary place of bacterial proliferation.

In a paper published in Environmental Microbiology, Professor Elke Genersch and colleagues in Berlin explain that they have discovered that these bacteria cause infection in a completely different way. They colonize the larval midgut, do most of their multiplying in the mid-gut - living from the food ingested by the larvae - until eventually the honey bee larvae gut contains nothing but these disease-causing (pathogenic) bacteria. It isn't until then that the bacteria 'burst' out of the gut into the organ cavity thereby killing the larvae. These findings are a major breakthrough in honeybee pathology.

"Now that we fully understand the way in which this disease works, we can start to look at ways of preventing the spread of infection" said Professor Genersch.

Honeybees are important pollinators of crops, fruit and wild flowers. Therefore, they are indispensable for a sustainable and profitable agriculture but also for the maintenance of the non-agricultural ecosystem. Honeybees are attacked by numerous pathogens including viruses, bacteria, fungi and parasites. For most, if not all of these diseases, the molecular pathogenesis is poorly understood hampering the development of new ideas about how to prevent and combat honeybee diseases.

Professor Genersch added: "Molecular understanding of pathogen-host interactions is vital for the development of effective measures against infectious diseases. Therefore, in the long run, our findings will help to save large numbers of bees all over the world."

Notes to Editors:

1. The article referred to is: Fluorescence in situ hybridization (FISH) analysis of the interactions between honeybee larvae and Paenibacillus larvae, the causative agent of American foulbrood of honeybees (Apis mellifera). Dominique Yue, Marcel Nordhoff, Lothar H. Wieler and Elke Genersch. Environmental Microbiology, Online Early, doi:10.1111/j.1462-2920.2008.01579.x.

Commonly used medications associated with impaired physical function in older adults

WINSTON-SALEM, N.C. – Older adults who take drugs designed to block the neurotransmitter acetylcholine – including common medications for incontinence, high blood pressure and allergies – are more likely to be dependent in one or more activities of daily living and to walk slower, according to new findings from researchers at Wake Forest University School of Medicine and colleagues.

The findings, which involve a class of drugs known as anticholinergic medications, are from the Ginkgo Evaluation of Memory Study (GEMS) and will be presented at the American Geriatrics Society Meeting in Washington, D.C., on May 3.

"These results were true even in older adults who have normal memory and thinking abilities," said Kaycee M. Sink, M.D., M.A.S., lead author. "For older adults taking a moderately anticholinergic medication, or two or more mildly anticholinergic medications, their function was similar to that of someone three to four years older."

In a separate study reported this month in the Journal of the American Geriatrics Society, Sink found that older nursing home residents who took medications for dementia and anticholingeric medications for incontinence at the same time had a 50 percent faster decline in function than those who were being treated only for dementia.

Over a year's time, the decline would represent a resident going from requiring only limited assistance in an activity to being completely dependent, or from requiring only supervision to requiring extensive assistance in an activity.

Sink said that the two studies together suggest that physicians should carefully consider the implications when prescribing anticholingeric medications to older adults.

"Because these medications are so commonly prescribed, older adults who take multiple medications are at increased risk of taking one or more anticholinergic-containing medications," said Sink. "The potential effects on physical function represent a significant public health problem."

Many medications have anticholinergic properties including some for high blood pressure, some antidepressants, most allergy medicines and incontinence medicines. Some of the most common anticholinergics in the GEMS participants include the blood pressure medication nifedipine (Adalat® or Procardia®), which has mild anticholinergic properties, the stomach antacid ranitidine (Zantac®), which has moderate anticholinergic properties, and the incontinence medication tolterodine (Detrol®), which is highly anticholinergic.

In the GEMS study, the researchers sought to determine the effects of taking multiple anticholinergic drugs on walking speed and the ability to independently perform activities of daily living such as dressing, personal hygiene, toileting, transferring, bed mobility and eating as well as higher order activities including shopping, cooking, managing money, doing light housework and using a telephone.

The findings are from more than 3,000 people with an average age of 78 years. Almost half (40 percent) of participants were taking more than one anticholinergic drug. The researchers found that higher anticholinergic burden is associated with worse physical function, both self-reported and performance-based.

Sink is supported by the Hartford Geriatrics Health Outcomes Research Scholars, the Wake Forest University Pepper Center and the Kulynych Center for Research in Cognition. GEMS was funded by the National Institutes of Health and the National Center for Complementary and Alternative Medicine.

Co-researchers were James Lovato, M.S., Jeff Williamson, M.D., Hal Atkinson, M.D., and David Goff, M.D., all with Wake Forest, Michelle Carlson, Ph.D., with Johns Hopkins University, Oscar Lopez, M.D., and Steve DeKosky, M.D., with the University of Pittsburgh, and Richard Nahin, Ph.D., with the National Center for Complementary and Alternative Medicine.

Nearly one-third of US parents don't know what to expect of infants

Lack of parenting savvy leads to unrealistic expectations, poorer interactions

Almost one-third of U.S. parents have a surprisingly low-level knowledge of typical infant development and unrealistic expectations for their child's physical, social and emotional growth, according research from the University of Rochester. The new findings, which suggest that such false parenting assumptions can not only impair parent-child interactions, but also rob kids of much-needed cognitive stimulation, will be presented Sunday, May 4, at the Pediatric Academic Society meeting in Honolulu, Hawaii.

"There are numerous parenting books telling people what to expect when they're pregnant," said Heather Paradis, M.D., a pediatric fellow at the University of Rochester Medical Center. "But once a baby is born, an astonishing number of parents are not only unsure of what to anticipate as their child develops, but are also uncertain of when, how or how much they are to help their babies reach various milestones, such as talking, grabbing, discerning right from wrong, or even potty-training."

Moms and dads often misinterpret behaviors – some parents expect too much of babies too soon and grow frustrated; others underestimate their child's abilities, preventing them from learning on their own.

Using data from the Early Childhood Longitudinal Study's Birth Cohort (ECLS-B), Paradis and her colleagues analyzed the average parenting knowledge of a nationally-representative sample of parents of more than 10,000 9-month-old babies. These parents first answered an 11-point survey designed to distinguish informed parents from less-informed parents (asking questions such as "Should a 1-year-old child be able to tell between right from wrong"" and "Should a 1-year-old child be ready to begin toilet-training""). Those who scored 4 or fewer correct answers were considered to have low-level knowledge of typical infant development.

Paradis and colleagues then compared these knowledge scores to both scores from (1) a 73-point videotape analysis of the same families' parent-child interactions while teaching a new task, and (2) from these parents' self-reports of how often they engaged their child in enrichment activities (e.g. reading books, telling stories, or singing songs).

The analysis revealed that 31.2 percent of parents of infants had low-level knowledge of infant development, and that this low-level knowledge correlated with lower parental education level and income. Still, even when controlling for maternal age, education, income and mental state (e.g., depression), low-level knowledge of infant development still significantly and independently predicted parents being both less likely to enjoy healthy interactions with their infants during learning tasks and less likely to engage their children in regular enrichment activities

"This is a wake-up call for pediatricians," Paradis said. "At office visits, we have a prime opportunity to intervene and help realign parents' expectations for their infants, and in turn, promote healthy physical, social, and emotional development for these children. On the other hand, we still have more work cut out for us – additional research is needed to explore how these unrealistic expectations form in the first place."

Turning fungus into fuel

Organism with a taste for olive drab shows promise for greener energy

LOS ALAMOS, New Mexico, May 4, 2008—A spidery fungus with a voracious appetite for military uniforms and canvas tents could hold the key to improvements in the production of biofuels, a team of government, academic and industry researchers has announced.

In a paper published today in Nature Biotechnology, researchers led by Los Alamos National Laboratory and the U.S. Department of Energy Joint Genome Institute announced that the genetic sequence of the fungus Tricoderma reesei has uncovered important clues about how the organism breaks down plant fibers into simple sugars. The finding could unlock possibilities for industrial processes that can more efficiently and cost effectively convert corn, switchgrass and even cellulose-based municipal waste into ethanol. Ethanol from waste products is a more-carbon-neutral alternative to gasoline.

The fungus T. reesei rose to dubious fame during World War II when military leaders discovered it was responsible for rapid deterioration of clothing and tents in the South Pacific. Named after Dr. Elwyn T. Reese, who, with colleagues, originally isolated the hungry fungus, T. reesei was later identified as a source of industrial enzymes and a role model for the conversion of cellulose and hemicellulose—plant fibers—into simple sugars.

The organism uses enzymes it creates to break down human-indigestible fibers of plants into the simplest form of sugar, known as a monosaccharide. The fungus then digests the sugars as food.

Researchers decoded the genetic sequence of T. reesei in an attempt to discover why the deep green fungus was so darned good at digesting plant cells. The sequence results were somewhat surprising. Contrary to what one might predict about the gene content of a fungus that can eat holes in tents, T. reesei had fewer genes dedicated to the production of cellulose-eating enzymes than its counterparts.

"We were aware of T. reesei's reputation as producer of massive quantities of degrading enzymes, however we were surprised by how few enzyme types it produces, which suggested to us that its protein secretion system is exceptionally efficient," said Los Alamos bioscientist Diego Martinez (also at the University of New Mexico), the study's lead author. The researchers believe that T. reesei's genome includes "clusters" of enzyme-producing genes, a strategy that may account for the organism's efficiency at breaking down cellulose.

On an industrial scale, T. reesei could be employed to secrete enzymes that can be purified and added into an aqueous mixture of cellulose pulp and other materials to produce sugar. The sugar can then be fermented by yeast to produce ethanol.

"The sequencing of the Trichoderma reesei genome is a major step towards using renewable feedstocks for the production of fuels and chemicals," said Joel Cherry, director of research activities in second-generation biofuels for Novozymes, a collaborating institution in the study. "The information contained in its genome will allow us to better understand how this organism degrades cellulose so efficiently and to understand how it produces the required enzymes so prodigiously. Using this information, it may be possible to improve both of these properties, decreasing the cost of converting cellulosic biomass to fuels and chemicals."

Other authors of the paper include: From JGI-LANL (at Los Alamos National Laboratory) Thomas Brettin, David Bruce, Chris Detter, Cheryl Kuske, Olga Chertkov, Melissa Jackson, Cliff Han, Monica Misra, Nina Thayer, Ravi Barbote, and Gary Xie; from the JGI-PGF (Production Genomics Facility in Walnut Creek, CA): Jarrod Chapman, Igor Grigoriev, Isaac Ho, Susan Lucas, Nicolas Putnam, Paul Richardson, Daniel Rokhsar, Eddy Rubin, Asaf Salamov and Astrid Terry; and Pacific Northwest National Laboratory's Scott Baker and Jon Magnuson.

Other collaborating institutions include the United States Department of Agriculture Forest Products Lab, Oregon State University, University of New Mexico, TU-Vienna, Catholic University of Chile, VTT Finland, and Universités d'Aix-Marseille I & II.